Drought Plan 2019
Annex 12: Strategic Environmental Assessment Environmental Report

July 1, 2019
Version 1

from Southern Water

Contents

Appendices (published as separate documents)

1 Introduction

1.1 Background and Purpose of Report

This Strategic Environmental Assessment (SEA) Environmental Report has been prepared in support of the development of the Southern Water Services (Southern Water) final Drought Plan. Habitats Regulations Assessment (HRA) has also been carried out in parallel.

SEA is a statutory requirement for plans or programmes which could have significant environmental implications, and helps to identify where there are potential impacts and how any negative impacts might be mitigated. More information about SEA, and its role in supporting the development of the Drought Plan, is provided in Section 1.2.

This Environmental Report is the second output of the SEA process. In November 2016, the SEA Scoping Report was issued for consultation which summarised the environmental baseline and set out the proposed assessment framework. Comments and issues raised by consultees were considered in preparing the Environmental Report of the draft Drought Plan (see Appendix A). Following public consultation on the draft Drought Plan and the SEA Environmental Report in March to April 2018, this SEA Environmental Report was updated to take account of the representations made on the SEA of the draft plan as part of preparing the revised draft Drought Plan. This included updates to take account of the Hampshire Abstraction Licences Public Inquiry held in March 2018 and the agreement reached between Southern Water and the Environment Agency as part of the inquiry process and formalised in an operating agreement under Section 20 of the Water Resources Act 1991 (S20 Agreement). Further updates have been made to the SEA Environmental Report during 2019 in light of further comments received from Defra and Natural England as part of the process of preparing the final Drought Plan 2019.

The Environmental Report presents the review of relevant policies and plans (Section 2) and the baseline environment information (Section 3) that set the context for the assessment that has been carried out in accordance with the assessment methodology (Section 4). The potential effects of alternative drought plan measures are described in Section 5, with assessment of the cumulative, or in-combination, effects between drought plan measures and other activities, programmes and plans set out in Section 6. Section 7 explains how the SEA findings have been used to inform the development of the Drought Plan. Information regarding mitigation and monitoring is provided in Section 8. A quality assurance checklist is provided in Section 9.

1.2 Application of SEA to Drought Planning

1.2.1 Overview of Strategic Environmental Assessment

SEA became a statutory requirement in the UK following the adoption of Directive 2001/42/EC (the SEA Directive) on the assessment of effects of certain plans and programmes on the environment. The Directive was transposed into national legislation by The Environmental Assessment of Plans and Programmes Regulations 2004 (referred to as the SEA Regulations)[1].

The objectives of SEA are set out in Article 1 of the SEA Directive as follows:

> *'to provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans with a view to promoting sustainable development'.*

The SEA Directive requires preparation of an Environmental Report in which the likely significant effects on the environment of implementing the plan or programme, and reasonable alternatives

1 The Environmental Assessment of Plans and Programmes Regulations 2004 (Statutory Instrument 2004 No. 1633) apply to any plan or programme which relates solely or in part to England.

taking into account the objectives and geographical scope of the plan or programme, are identified, described and evaluated. It should be noted that, as stated in the Office of the Deputy Prime Minister (ODPM) SEA Guidelines[2], "it is not the purpose of the SEA to decide the alternative to be chosen for the plan or programme. This is the role of the decision-makers who have to make choices on the plan or programme to be adopted. The SEA simply provides information on the relative environmental performance of alternatives, and can make the decision-making process more transparent." The SEA process has therefore been used to help inform decisions making, including the selection of options, and the timing and implementation of drought plan measures within the plan, as well as the consideration of appropriate monitoring and mitigation of identified environmental and social effects.

The range of environmental and social issues to be included in an SEA is set out in the SEA regulations, and includes biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage, and landscape.

As identified above, the Government has produced SEA guidance which sets out the stages of the SEA process[3]. This, together with water industry guidance on undertaking SEA of Drought Plans[4], has been used to inform the assessment methodology for the SEA.

A Drought Plan Guideline was published by the Environment Agency in 2011[5] and included recommendations for the application of SEA to water company drought plans. A revised guideline was published by the Environment Agency in December 2015[6] with extra information on Environmental Assessment for Water Company Drought Plans[7] and the Defra Drought Plan (England) Direction issued to water companies in 2016. These guidance documents and regulations have all informed Southern Water's Drought Plan 2019 and the SEA.

1.2.2 Requirement for SEA and HRA of Southern Water's Drought Plan

The SEA Scoping Report issued in 2016 set out the reasons why an SEA of the Southern Water Drought Plan was required. The conclusion was that SEA is required taking into account a precautionary approach and uncertainties associated with whether the plan is likely to set a framework for future development consent and the risk that the Habitats Regulations Assessment (HRA) would identify the potential for likely significant effects on certain Natura 2000 sites. A HRA has since been undertaken which accompanies the Drought Plan and which has informed the SEA.

Undertaking a SEA of the Drought Plan has aided its development and Southern Water's decision-making on the measures to be included in the plan, their timing and phasing taking account the assessed environmental and social effects (adverse and beneficial). As every drought is different in terms of severity, location, duration and hence impact, the output of the SEA (and parallel HRA and Water Framework Directive assessments) has helped to guide the selection of options specific to the characteristics of any potential drought. The application of the SEA (and HRA) have helped ensure strategic decisions affecting the environment were made early on in the Drought Planning process.

2 Office of the Deputy Prime Minister (2005) A Practical Guide to the Strategic Environmental Assessment Directive.
3 Office of the Deputy Prime Minister (2005). A Practical Guide to the Strategic Environmental Assessment Directive.
4 UKWIR (2012) Strategic Environmental Assessment and Habitats Regulation Assessment – Guidance for Water Resources Management Plans & Drought Plans (12/WR/02/A).
5 Environment Agency (2011) Water Company Drought Plan Guideline.
6 Environment Agency (2015) How to write and publish a Drought Plan, December 2015. Available at https://www.gov.uk/guidance/drought-plans-environmental-assessment-and-monitoring#carry-out-an-environmental-assessment. Accessed 1 March 2016.
7 Environment Agency (2016) Drought Plan Guideline Extra Information: Environmental Assessment for Water Company Drought Plans (May 2016)

1.3 Southern Water Supply Area and Drought Planning

1.3.1 Introduction

In the event of a drought, Southern Water will need to implement a range of management measures to ensure the continued provision of essential water supplies to all of its customers. The Southern Water Drought Plan sets out the options that the company will consider implementing in dealing with drought conditions, taking account of statutory legislation and regulatory requirements. A number of changes to Drought Planning legislation have been introduced during the past decade. Statutory demand management options available to water companies during drought were extended through provisions in the Flood and Water Management Act 2010. Section 36 of this Act amended the Water Industry Act 1991 provisions relating to hosepipe bans and allows water companies to introduce Temporary Use Bans to restrict a wider range of non-essential water uses than previously permitted. The Drought Direction 2011 sets out those non-essential water uses that still require a Drought Order to be obtained before they can be restricted during a drought.

The Drought Plan (England) Direction 2016 contains revised timeframes for submission of updated drought plans to the Secretary of State. Once approved by the Secretary of State and published, the Drought Plan 2019 will replace the existing Southern Water Drought Plan published in February 2013.

1.3.2 Southern Water's Supply Area

Southern Water provides water supplies to just over 2.4 million customers across an area of 4,450km^2, extending from East Kent, through parts of Sussex, to Hampshire and the Isle of Wight in the west.

Water supplies are predominantly reliant on the transmission and storage of groundwater from the widespread chalk aquifer that underlies much of the region. This extends throughout parts of Kent, Sussex, Hampshire and the Isle of Wight; and makes up 70% of the total water supply. River abstractions account for 23% of the water supplies, most notably the Eastern Yar and Medina on the Isle of Wight, the Rivers Test and Itchen in Hampshire, the Western Rother and Arun in West Sussex, the River Eastern Rother and River Brede in East Sussex, and the River Teise, River Medway and Great Stour in Kent. Four surface water impounding reservoirs provide the remaining 7% of water supplies: Bewl Water, Darwell, Powdermill and Weir Wood. The total storage capacity of these four reservoirs amounts to 42,390Ml. South East Water is entitled to 25% of the available supplies from the River Medway Scheme, which incorporates Bewl Water Reservoir.

Although the South East is one of the driest regions in the UK, rainfall is still integral to the maintenance of water supplies. During winter, when most of the effective rainfall occurs, groundwater reserves are recharged naturally through infiltration processes. Rain infiltrates through the soil to recharge the natural storage in the underlying groundwater to support river baseflows for the following year. Annual rainfall averages 730mm across the Southern Water region. Rainfall experienced outside of winter is of less value to groundwater recharge as it is mostly lost to evaporation, plant transpiration or runs off directly into rivers from the land.

The Southern Water region is divided into fourteen Water Resource Zones (WRZs) which are geographically separate and amalgamated into three larger, sub-regional areas (see **Figure 1.1**):

Western Area – comprising the following seven WRZs:

- Hants Kingsclere (HK)
- Hants Andover (HA)
- Isle of Wight (IW)
- Hants Rural
- Hants Winchester
- Hants Southampton East
- Hants Southampton West

Central Area – comprising the following three WRZs:

- Sussex North (SN)
- Sussex Worthing (SW)
- Sussex Brighton (SB)

Eastern Area – comprising the following four WRZs:

- Kent Medway East
- Kent Medway West
- Kent Thanet (KT)
- Sussex Hastings (SH)

These areas contain a number of separate WRZs, but they are managed as semi-integrated blocks because there is significant bulk water transfer capability between the WRZs. This means that an area-wide perspective is required when drought management measures are being considered.

A number of bulk water supplies are made between Southern Water and several adjacent water companies. Southern Water's supply area is bounded by eight other water companies:

- Thames Water
- Wessex Water
- Cholderton and District Water
- South East Water
- Affinity Water
- SES Water
- Bournemouth Water
- Portsmouth Water

The geographical area under consideration for the SEA covers all of Southern Water's WRZs as well as the river and/or groundwater catchments of those water sources and sources of bulk water supply imports that serve these WRZs but which lie outside their boundaries (see map at **Figure 1-2**).

Figure 1-1 Southern Water's Supply Area

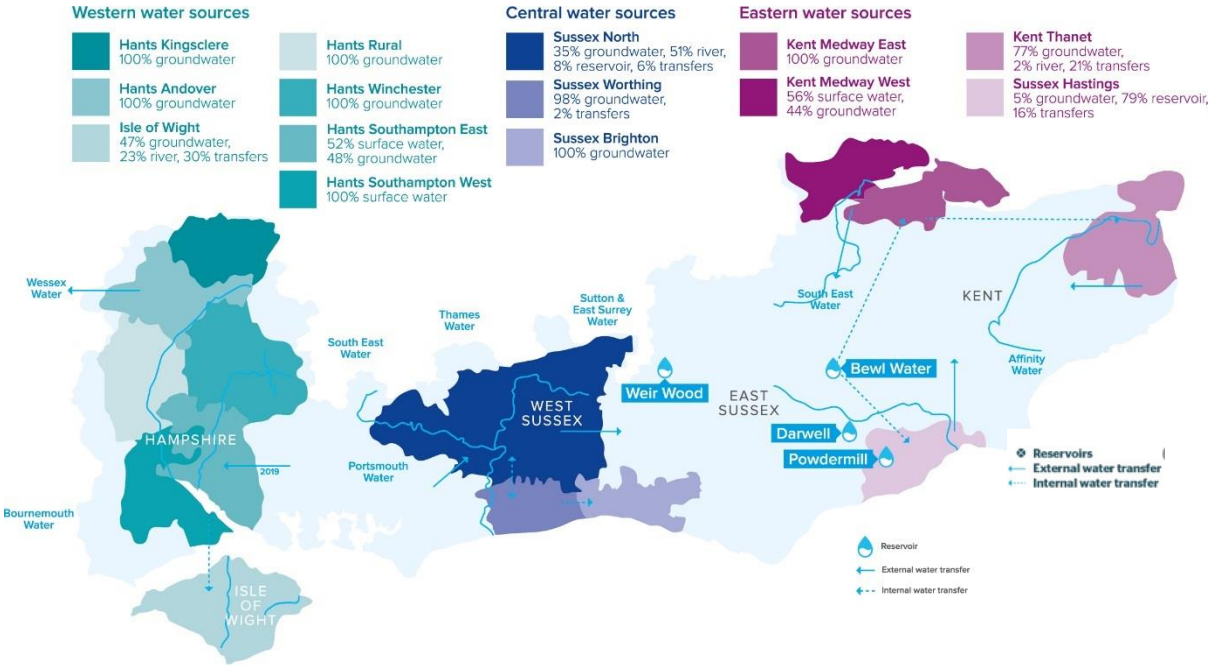
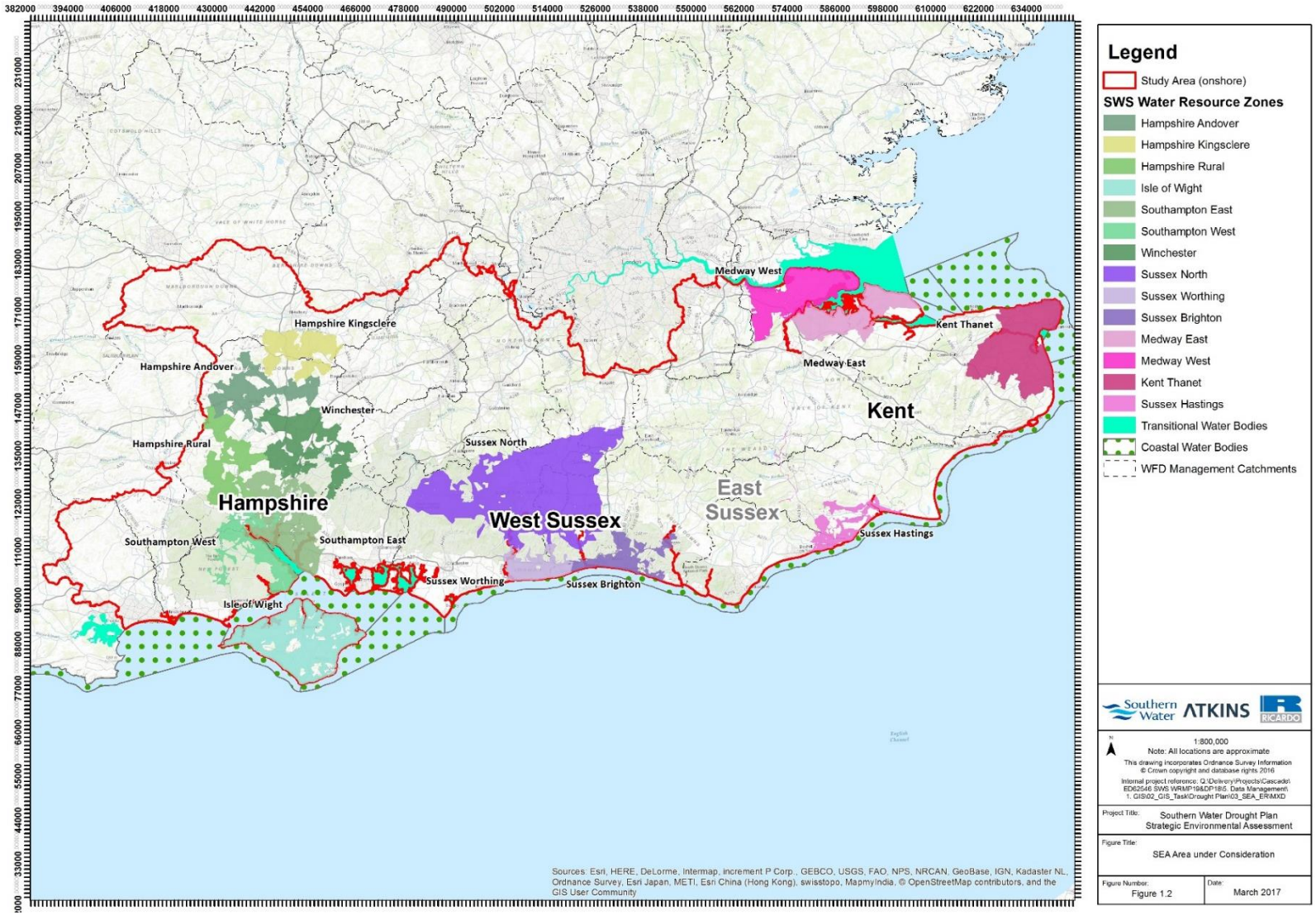


Figure 1-2 SEA Area under Consideration



1.4 Southern Water's Drought Planning Process

1.4.1 Overview and Timetable

Southern Water published its last Drought Plan in February 2013. In accordance with the Drought Direction (England) 2016, Southern Water submitted an updated draft Drought Plan and issued it for public consultation along with this SEA Environmental Report during March to April 2018. Following feedback from the public consultation process, the plan (and associated SEA) has been revised as appropriate for re-submission to the Secretary of State. A final Drought Plan is expected to be published during 2019, subject to approval by the Secretary of State. The updated plan will guide Southern Water's response to any drought events that may arise in the subsequent five-year period.

Only those drought management measures that are relevant to the period encompassed by the Drought Plan 2019 are considered in the SEA (i.e. the years 2019 to 2022). In this regard, environmental effects of the potential drought plan measures are considered within the context of the company's existing abstraction licence conditions (except where stated) and operating arrangements. Additionally, only those plans, projects and programmes that are likely to be effective during the five-year period of the Drought Plan are considered in the SEA. The closely allied, but separate statutory process, of developing a long-term Water Resources Management Plan (WRMP) is also being undertaken by Southern Water, with the draft plan published for consultation between March-May 2018. This identifies several new permanent measures to improve future water supply resilience in drought conditions beyond the period of the Drought Plan 2019. This includes measures to reduce the frequency of requiring Drought Permits or Orders across the company's supply area. In particular the WRMP sets out the short to medium term strategy for substantially reducing the need for the Test Surface Water Drought Permit and reducing the frequency of Drought Orders on the River Test and River Itchen to 1 in 200-year drought events or worse, only after 2027.

1.4.2 Drought Plan Development

Under sections 39B and 39C of the Water Industry Act 1991 (as amended), water companies are required to prepare and maintain statutory drought plans. The Drought Plan sets out the operational steps a water company will take before, during and after a drought to maintain essential water supplies to customers. A Drought Plan is defined in the Water Industry Act 1991 (as amended) as 'a plan for how the water undertaker will continue, during a period of drought, to discharge its duties to supply adequate quantities of wholesome water, with as little recourse as reasonably possible to Drought Orders or Drought Permits'. The Drought Plan identifies triggers that act as decision points for implementing a range of drought management actions. The nature of the triggers varies for each Water Resource Zone, and the nature of the drought management actions that will be considered also varies depending on the prevailing drought conditions.

1.4.3 Drought Management Measures

There are two broad categories of drought management measures: demand-side measures and supply-side measures, as described below.

Demand-side measures

Demand-side measures are designed to reduce the demand for water during drought and the various potential options that have been considered in developing the Drought Plan are set out in **Table 1.1.**

Table 1-1 Potential demand-side drought management options

Measure	Description of Measure
Media campaigns to influence water use	Wide-scale media activity and advertising to encourage voluntary reduction in water usage
Water efficiency promotion to partner organisations	Engage with partner organisations to ensure co-ordinated approach to interventions
Water efficiency promotion with local authorities	Initiate discussions with local authorities regarding watering regimes for public parks and gardens
Leakage reduction	Increase leakage monitoring and repair activity
Pressure management	Mains pressure reduction
Enhanced media campaign with customers	Enhanced media campaign to publicise restrictions and encourage water savings
Temporary Use Ban	Temporary ban on certain categories of water use under water company powers set out in the Water Industry Act 1991 (WIA 1991) as amended by Flood and Water Management Act 2010
Drought Order to ban non-essential water use	Application to Secretary of State for a Drought Order to prohibit certain prescribed non-essential water uses as set out in the Drought Direction 2011
Emergency Drought Order to ration water supplies by use of rota cuts or standpipes	Application to Secretary of State for an Emergency Drought Order to authorise water supply via temporary rota cuts or standpipes

Supply-side measures

Supply side measures relate to actions that can temporarily increase the amount of water available for supply. Potential supply-side drought measures that have been considered in developing the Drought Plan and which do not require a Drought Permit or Drought Order are listed in **Table 1-2**. Options that require Drought Permits or Drought Orders are summarised in **Table 1-3**.

Table 1-2 Potential supply-side drought management options

Drought Measure	WRZ	Description
Tankering of water	All	Tankering water from adjacent WRZs or other water companies
Rest groundwater sources	Sussex Worthing	Use any spare winter/spring surface water available to supply customers in Worthing and Brighton during the early stages of a drought. This allows groundwater sources in the Worthing area to be rested in key 'storage' sources, which can improve their drought resilience as drought conditions intensify.
Littlehampton emergency desalination	Sussex Worthing	Installation of a temporary desalination plant adjacent to Wastewater Treatment Works site near Littlehampton supplying up to 10Ml/d.
Sheerness (Isle of Sheppey) emergency desalination	Kent Medway East	Installation of a temporary desalination plant at the Sheerness site supplying up to 10Ml/d.
Rest groundwater sources	Isle of Wight	Maximise any spare surface water sources available on the Isle of Wight and the cross-Solent supply from Hampshire during the early stages of a drought. This

Drought Measure	WRZ	Description
		allows groundwater sources in the Isle of Wight to be rested to improve their drought resilience as drought conditions intensify.
Sandown emergency desalination	Isle of Wight	Installation of a temporary desalination plant adjacent to the Wastewater Treatment Works site on the Isle of Wight supplying up to 10Ml/d.
Additional import from Portsmouth Water	Hampshire Southampton East	Increase the bulk import from Portsmouth Water from existing sources
Increase bulk imports Reduce bulk water exports	Various	In the event of a severe drought, the Company would investigate the possibility of receiving additional bulk supplies from other water companies and/or reducing existing bulk water exports to other water companies
Rest Weir Wood Reservoir source during early stages of drought	Sussex North	Maximise pumping from the Pulborough source in order to reduce abstraction from Weir Wood Reservoir to conserve reservoir for increased use in the later stages of a drought.
Additional import from Portsmouth Water	Sussex North	Increase import from Portsmouth Water to the Sussex North Water Resource Zone by up to 15Ml/d
Reduce industrial supply to commercial customer	Hampshire Southampton West	In the event of a drought the Company would hold discussions with a commercial customer with regards to the possibility of reducing their water supply temporarily.
Reduce supplies to other large commercial customers	Various	In the event of a drought the Company would hold discussions with other large commercial customers as to the possibility of reducing their water supply temporarily.

Table 1-3 Supply side Drought Permit / Order measures

Measure Name	WRZ	Description
Lukely Brook WSW Groundwater source	Isle of Wight	Remove requirement for Minimum Residual Flow condition at the Sheep Dip Weir on the Lukely Brook. Provision of a temporary compensation flow release of 0.4 Ml/d to the Lukely Brook from the Lukely Brook groundwater source via a temporary pipeline.
Caul Bourne WSW Groundwater source	Isle of Wight	Reduce the Minimum Residual Flow in the Caul Bourne from 4l/s (0.3Ml/d) to 2 l/s (0.15Ml/d) Remove the constraint that limits abstraction to 40 Ml (1.3 Ml/d) within a 30-day period when the flow drops beneath 20 l/s (1.7Ml/d)
Shalcombe WSW Groundwater source	Isle of Wight	Remove abstraction licence constraint that limits abstraction to 0.35Ml/d when groundwater levels at Chessel observation borehole are equal to or less than 70mAOD. This would allow abstraction up to the 1.0Ml/d daily peak abstraction licence limit.
Eastern Yar Augmentation Scheme Surface water source	Isle of Wight	Reduction to the Minimum Residual Flow conditions: River Medina at Blackwater: reduce from 2.7Ml/d to 1.7Ml/d River Medina at Shide: reduce from 5Ml/d to 4Ml/d

Measure Name	WRZ	Description
		This will allow increased abstraction for transfer and augmentation of flows in the River Eastern Yar.
Test Valley WSW Groundwater source	Hampshire Rural	Recommission unlicensed Test Valley site groundwater source with abstraction authorised up to 4.36Ml/d.
Lower Itchen Sources Groundwater and surface water sources	Hampshire Southampton East	Reduce the Hands-Off Flow condition in the River Itchen at Allbrook and Highbridge from 198Ml/d to 160Ml/d. Reduce the Hands-Off Flow condition relating to the Portsmouth Water's Lower Itchen abstraction licence from 194Ml/d to 150Ml/d.
Candover Augmentation Scheme	Hampshire Southampton East	Operate the Candover Augmentation Scheme source to allow discharge of groundwater to the River Itchen downstream of the Candover Stream. Increase the daily abstraction licence limit from 5Ml/d to 27Ml/d (20Ml/d during May to August) and increase the annual abstraction limit to 3750Ml (20.8Ml/d over 6 months).
Test Surface Water Drought Permit	Hampshire Southampton East and Hampshire Southampton West	Reduce the Hands-Off Flow condition in the Lower River Test from 355Ml/d to 265Ml/d.
Test Surface Water Drought Order	Hampshire Southampton East and Hampshire Southampton West	Reduce the Hands-Off Flow condition in the Lower River Test from 355Ml/d to 200Ml/d. This Drought Order would be implemented once the measured flow in the Lower River Test falls below 265Ml/d (the limit authorised under the Drought Permit)
Pulborough (1) Surface water source	Sussex North	Reduce Minimum Residual Flow at Pulborough Weir from 63.65Ml/d to 53.65Ml/d, allowing greater surface water abstraction.
Pulborough (2) Surface water source	Sussex North	Reduce Minimum Residual Flow at Pulborough Weir from 63.65Ml/d to 43.65Ml/d, allowing greater surface water abstraction.
Pulborough (3) Surface water source	Sussex North	Reduce Minimum Residual Flow at Pulborough Weir from 63.65Ml/d to 33.65Ml/d, allowing greater surface water abstraction.
Weir Wood Reservoir Surface water source	Sussex North	Reduce statutory compensation flow from Weir Wood Reservoir to the River Medway: From 3.64Ml/d to 0.04Ml/d in November to April From 5.64Ml/d to 0.06Ml/d in May to October.
East Worthing WSW Groundwater source	Sussex Worthing	Increase abstraction licence daily limit from 4.5Ml/d to 7.0 Ml/d between October and December inclusive.

Measure Name	WRZ	Description
North Arundel WSW Groundwater source	Sussex Worthing	Increase abstraction licence daily limit from 4.5Ml/d to 7.0 Ml/d.
Stourmouth Surface water source	Kent Thanet	Reduce Minimum Residual Flow from 145Ml/d to 100Ml/d on River Great Stour to allow increased abstraction (maximum 10Ml/d).
North Deal WSW Groundwater source	Kent Thanet	Increase daily peak abstraction licence limit from 2.73Ml/d to 4.0Ml/d.
Faversham sources WSWs Groundwater source	Kent Medway East	Remove abstraction licence condition preventing abstraction during the months of October to April inclusive.
River Medway Scheme Stage 1 Surface water source	Kent Medway West	In a second dry winter following a dry summer, reduce the Minimum Residual Flow in the River Medway From 200Ml/d in November to January to 150Ml/d From 250Ml/d in February to 150Ml/d From 275Ml/d in March and April to 150Ml/d
River Medway Scheme Stage 2 Surface water source	Kent Medway West	In a third dry winter following two successive dry summers, reduce the Minimum Residual Flow in the River Medway From 200Ml/d in November to January to 150Ml/d From 250Ml/d in February to 150Ml/d From 275Ml/d in March and April to 150Ml/d Modify the Bewl Water Reservoir regulation release factor from 1.1 to 1.0 to support abstraction from the River Medway
River Medway Scheme Stage 3 Surface water source	Kent Medway West	In a third dry summer after three dry winters, reduce the Minimum Residual Flow in the River Medway From 350 Ml/d in May to August to 275Ml/d Modify the Bewl Water Reservoir regulation release factor from 1.1 to 1.0 to support abstraction from the River Medway
River Medway Scheme Stage 4 Surface water source	Kent Medway West	Following a third dry summer, reduce the Minimum Residual Flow requirement in the River Medway From 200Ml/d in November to January to 0Ml/d From 250Ml/d in February to 0Ml/d From 275Ml/d in March and April to 0Ml/d Cease all Bewl Water Reservoir regulation release support for abstraction from the River Medway
Powdermill Reservoir Surface water source	Sussex Hastings	Reduce the Minimum Residual Flow in the River Brede from 6.2Ml/d to 2Ml/d to allow additional abstraction from the River Brede to Powdermill Reservoir

Measure Name	WRZ	Description
Darwell Reservoir (1) Surface water source	Sussex Hastings	Reduce the Minimum Residual Flow in the River Rother in June to September from 28.5Ml/d to 10Ml/d to allow additional abstraction from the River Rother to Darwell Reservoir.
Darwell Reservoir (2) Surface water source	Sussex Hastings	Reduce the Minimum Residual Flow in the River Rother in March to May from 40Ml/d to 10Ml/d to allow additional abstraction from the River Rother to Darwell Reservoir.

1.4.4 Supporting Information

Environmental assessment studies of Southern Water's potential Drought Permit / Order options have been carried out and these have been used to help inform the SEA.

As well as the SEA, a Habitats Regulations Assessment (HRA) was carried out to inform the development of the Drought Plan, providing an understanding the impact of potential drought management measures on designated European Sites and any associated compensatory habitat. Findings from the HRA were used in carrying out the SEA of alternative drought management measures being considered for inclusion in the Drought Plan.

Potential drought management measures, where applicable, have also been assessed in relation to the Water Framework Directive (WFD) objectives, in particular to assess whether potential supply-side drought management measures might lead to a temporary (or permanent) deterioration of the WFD status of designated water bodies. The WFD assessment findings have also informed the SEA.

1.5 Stages of Strategic Environmental Assessment

SEA incorporates the following stages:

- Stage A: Setting the context, identifying objectives, problems and opportunities, and establishing the baseline – Scoping Report published in November 2016.
- Stage B: Developing and refining options and assessing effects (impact assessment)
- Stage C: Preparing the Environmental Report (recording results)
- Stage D: Consulting on the Draft Plan and the Environmental Report (seeking consensus)
- Stage E: Monitoring the significant effects of the plan or programme on the environment (verification).

This Environmental Report encompasses Stages B and C of the SEA process, which is being issued for public consultation (Stage D) alongside the final Drought Plan.

Table 1-4 is an extract from the ODPM Practical Guide[8] that sets out the main stages of the SEA process and the purpose of each task within the process. Specific guidance on the application of the SEA process to drought plans is provided by UKWIR (2012)[9].

[8] Office of the Deputy Prime Minister (2005). A Practical Guide to the Strategic Environmental Assessment Directive.
[9] UKWIR (2012) Strategic Environmental Assessment and Habitats Regulation Assessment – Guidance for Water Resources Management Plans & Drought Plans (12/WR/02/A).

Table 1-4 SEA Stages and Tasks

Stage / Task	Purpose
Stage A: Setting the context and objectives, establishing the baseline and deciding on the scope	
Task A1. Identifying other relevant plans, programmes and environmental protection objectives	To establish how the plan or programme is affected by outside factors to suggest ideas for how any constraints can be addressed, and to help identify SEA objectives.
Task A2. Collecting baseline information	To provide an evidence base for environmental problems, prediction of effects, and monitoring; to help in the development of SEA objectives.
Task A3. Identifying environmental problems	To help focus the SEA and streamline the subsequent stages, including baseline information analysis, setting of the SEA objectives, prediction of effects and monitoring.
Task A4. Developing SEA Objectives	To provide a means by which the environmental performance of the plan or programme and alternatives can be assessed.
Task A5. Consulting on the scope of the SEA	To ensure the SEA covers the likely significant environmental effects of the plan or programme.
Stage B: Developing and refining alternatives and assessing effects	
Task B1. Testing the plan or programme objectives against SEA objectives	To identify potential synergies or inconsistencies between the objectives of the plan or programme and the SEA objectives and help in developing alternatives.
Task B2. Developing strategic alternatives	To develop and refine strategic alternatives.
Task B3. Predicting the effects of the plan or programme, including alternatives	To predict the significant environmental effects of the plan or programme and its alternatives.
Task B4. Evaluating the effects of the plan or programme, including alternatives	To evaluate the predicted effects of the plan or programme and its alternatives and assist in the refinement of the plan or programme.
Task B5. Mitigating adverse effects	To ensure that adverse effects are identified and potential mitigation measures are considered.
Task B6. Proposing measures to monitor the environmental effects of plan or programme implementation	To detail the means by which the environmental performance of the plan or programme can be assessed.
Stage C: Preparing the Environmental Report	
Task C1. Preparing the environmental report	To present the predicted environmental effects of the plan or programme, including alternatives, in a form suitable for public consultation and use by decision-makers.
Stage D: Consulting on the Draft Plan or programme and the Environmental Report	
Task D1. Consulting the public and consultation bodies on the draft plan or programme and the Environmental Report	To give the public and the consultation bodies an opportunity to express their opinions on the findings of the Environmental Report and to use it as a reference point in commenting on the plan or programme.

Stage / Task	Purpose
	To gather more information through the opinions and concerns of the public
Task D2. Assessing significant changes	To ensure that the environmental implications of any significant changes to the draft plan or programme at this stage are assessed and taken into account.
Task D3. Making decisions and providing information	To provide information on how the Environmental Report and consultees opinions were taken into account in deciding the final form of the plan or programme to be adopted.
Stage E: Monitoring the significant effects of the plan or programme on the environment	
Task E1. Developing aims and methods for monitoring	To track the environmental effects of the plan or programme to show whether they are as predicted; to help identify adverse effects.
Task E2. Responding to adverse effects	To prepare for appropriate responses where adverse effects are identified.

1.6 Structure of the Environmental Report

This SEA Environmental Report presents the findings of Tasks B1 to C1 set out in **Table 1-4,** and provides the public, stakeholders and regulatory bodies with an opportunity to express their opinions on the findings of the assessment. The Environmental Report is structured as follows:

- **Section 1** (this section): describes the requirement for, purpose and process of the SEA, and its context in relation to the Drought Plan.
- **Section 2** - Policy Context: identifies key messages and environmental protection objectives from other relevant plans and programmes.
- **Section 3** - Environmental Baseline Review: draws out the key environmental issues Southern Water intends to consider in the SEA. Identifies the current and future baseline conditions within the area of potential influence of the Drought Plan.
- **Section 4** – Methodology: provides details of the methods employed in undertaking the assessment including the cumulative effects assessment methodology.
- **Section 5** – Assessment of drought plan options: presents the potential impacts of the various drought plan options against the SEA framework.
- **Section 6** – Cumulative Effects Assessment: discusses the potential in-combination impacts of drought options (intra-zone and inter-zone), demand management options and other plans and projects in the region.
- **Section 7** - Describes how the SEA has been used to inform the development of the Drought Plan.
- **Section 8** – Mitigation and Monitoring: discusses measures envisaged to prevent, reduce and offset any significant adverse effects of implementing the Drought Plan and monitoring to track the environmental effects to show whether they are as predicted, to help identify any adverse impacts and trigger deployment of mitigation measures.
- **Section 9** – Quality Assurance: provides a checklist of requirements from the ODPM guidance.

1.7 Consultation

1.7.1 Consultation on the Scoping Report

Consultation bodies, stakeholders and the public were invited to express their views on the Scoping Report in accordance with SEA Regulation 12(5). The Scoping Report was issued on Monday 14 November 2016 to the Environment Agency, Historic England and Natural England, and was made available to the public and stakeholders on the Southern Water website. The consultation period ran until Friday 16 December 2016. The responses to comments provided on the Scoping Report and how these have been taken into account in carrying out the SEA are presented in **Appendix A**.

1.7.2 Consultation on the Environmental Report

The Environmental Report of the draft Drought Plan was produced taking into consideration the responses received from consultation bodies during the Scoping consultation. It provided assessments of the potential effects (adverse and beneficial) of the drought management options considered for the draft Drought Plan and set out how the findings were used to inform the development of the draft plan.

The public, regulatory bodies and stakeholders were invited to express their views on the Environmental Report, as part of the public consultation on Southern Water's draft Drought Plan 2019 during 5 March to 30 April 2018. The SEA Environmental Report was updated in light of this consultation and to reflect the revised draft Drought Plan 2019 submitted to the Secretary of State on 18 June 2018. The SEA Environmental Report has been updated for publication of the Final Drought Plan in 2019 following further comments from Defra and Natural England as part of the process of finalising the Drought Plan.

2 Policy Context

2.1 Introduction

Annex 1 of the SEA Directive (Directive 2001/42/EC) requires the following information to be included within the Environmental Report:

- *"an outline of the…relationship with other plans and programmes"*
- *"the relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the plan or programme"*
- *"the environmental characteristics of areas likely to be significantly affected"*
- *"any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any areas of a particular environmental importance, such as areas designated pursuant to Directives 79/409/EEC (the 'Birds Directive') and 92/43/EEC (the 'Habitats Directive')*
- *"the environmental protection objectives, established at international, (European) Community or Member State level, which are relevant to the plan or programme and the way those objectives and any environmental considerations have been taken into account during its preparation".*

In accordance with the Directive, a review of relevant plans and programmes is presented in Section 2. A summary of key messages is presented in Table 2-1 (with the full review presented in **Appendix B**).

A summary of the environmental baseline key issues is presented in Section 3 (with the full environmental baseline information presented in **Appendix C**).

2.2 Review of Policies, Plans and Programmes

2.2.1 Policies, Plans and Programmes reviewed

One of the first steps in undertaking SEA is to identify other relevant policies, plans, programmes and environmental protection objectives. The review of these other plans sets out to establish how Southern Water's Drought Plan might be affected by other plans, to identify other environmental and social objectives which the Drought Plan should consider and to help to identify the assessment objectives for the SEA.

Potentially relevant plans and programmes were identified at the international, national, regional and local level. If the plan or programme was assessed as not having a significant effect on the objectives of the Drought Plan and/or the Drought Plan does not have a significant effect on achieving the objectives of the other plan or programme, it was not reviewed in detail.

The full list of international, national, regional and local policies, plans, programmes and strategies reviewed and the key policy objectives, targets and how they relate to SEA topics and SEA objectives are provided in **Appendix B** and listed in Table 2-1.

Table 2-1 Key policy objectives derived from the review of plans, policies and programmes

SEA Topic	Key Policy Objectives	Plans, Policies and Programmes
Biodiversity, flora and fauna	Conservation and enhancement of the natural environment and of biodiversity, particularly internationally and nationally designated sites and priority habitats and species (NERC Act S41 for England), whilst taking into account future climate change. Promote a catchment-wide approach to water use to ensure better protection of biodiversity. To achieve favourable condition for priority habitats and species in particular designated sites. Avoidance of activities likely to cause irreversible damage to natural heritage. Support well-functioning ecosystems, respect environmental limits and capacities, and maintain/enhance coherent ecological networks, including provision for fish passage and connectivity for migratory/mobile species. Strengthen the connections between people and nature and realise the value of biodiversity. Protection, conservation and enhancement of natural capital. Ecosystem services from natural capital	*International:* United Nations (1992) Convention on Biological Diversity (CBD) European Commission, Birds Directive (2009/147/EC) European Commission The Water Framework Directive (2000/60/EC) European Commission, Directive on Animal health requirements for aquaculture animals and products thereof, and on the prevention and control of certain diseases in aquatic animals (2006/88/EC) European Commission, Habitats Directive (1992/43/EEC) European Commission, The EU Biodiversity Strategy to 2020 European Commission, Environmental Liability Directive (2004/35/EC) EC Regulation 1100/2007 of 18 September 2007 establishing measures for the recovery of the stock of European eel EU Regulation 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species The Bonn Convention on the Conservation of Migratory Species of Wild Animals (1983) The Bern Convention on the Conservation of European Wildlife and Natural Habitats (1979) The Convention on Wetlands of International Importance (Ramsar Convention) (1971) *National:* Conservation of Habitats and Species Regulations 2010 (as amended by the Conservation of Habitats and Species (Amendment) Regulations 2011 and 2012) The Countryside and Rights of Way (CROW) Act 2000 Environmental Protection Act 1990 Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009 SI3104 Wildlife and Countryside Act 1981 (as amended) DCLG (2012) National Policy Planning Framework Defra (2002) Working with the grain of nature: a biodiversity strategy for England Defra (2013) Catchment Based Approach: Improving the quality of our water environment Defra (2011) Water for Life - Water White Paper Defra (2011) The Natural Choice: Securing the value of nature. The Natural Environment White Paper Defra (2011) Biodiversity 2020: A Strategy for England's Wildlife and Ecosystem Services Defra (2010) Making Space for Nature: A Review of England's Wildlife Sites and Ecological Network Defra (2011) UK National Ecosystem Assessment and Defra, 2014, UK National Ecosystems Assessment Follow on, Synthesis of Key Findings

SEA Topic	Key Policy Objectives	Plans, Policies and Programmes
	contributes to the economy and therefore should be protected and, where possible, enhanced. Avoidance of activities likely to cause the spread of Invasive Non-Native Species (INNS). A need to protect the green infrastructure network.	Defra (2015) The Great Britain Invasive Non-native Species Strategy Defra (2008), England Biodiversity Strategy –climate change adaptation principles Environment Agency and RSPB (2004) Strategic Environmental Assessment and Biodiversity: Guidance for Practitioners Environment Agency (undated) Hydroecology: Integration for modern regulation Environment Agency (undated) WFD River Basin Characterisation Project Technical Assessment Method - River abstraction and flow regulation Environment Agency (2008) Sea trout and salmon fisheries. Our strategy for 2002 – 2021 The Environmental Damage (Prevention and Remediation) (England) Regulations 2015 The Eels (England and Wales) Regulations 2009 (as amended) Natural Environment and Rural Communities Act 2006 Natural England's standing advice on protected species Salmon and Freshwater Fisheries Act 1975 (as amended) The Countryside and Rights of Way (CROW) Act 2000 Wildlife and Countryside Act 1981 (as amended) Water Resources Act 1991 (as amended) Water Industry Act 1991 (as amended) Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009 SI3104 The Environment Act 1995 The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 (as amended) The Marine and Coastal Access Act 2009 *Regional/Local:* Natural England Site Improvement Plans (SIPs) Natural England National Character Area (NCA) Profiles Environment Agency and Defra, (2015) River Basin Management Plan South East River Basin district Environment Agency and Defra, (2015) River Basin Management Plan Thames River Basin district Environment Agency, Catchment Abstraction Management Strategy (various dates for relevant catchments) England Biodiversity Forum (2009) South East Biodiversity Strategy Defra (2010). Eel Management plans for the United Kingdom. South East River Basin District Environment Agency, The Wild Trout Trust, Atlantic Salmon Trust (2011) South Coast Sea Trout Action Plan RSPB Pagham Harbour Local Nature Reserve Management Plan 2013-2018 Surrey Wildlife Trust 5-year Plan 2013-2018
Population and human health	Water resources play an important role in supporting the health	*International:* United Nations Economic Commission for Europe (1998) Aarhus Convention - Convention on Access to

SEA Topic	Key Policy Objectives	Plans, Policies and Programmes
	and recreational needs of local communities and businesses. To ensure all communities have a clean, safe and attractive environment in which people can take pride. To ensure secure, safe, reliable, dependable, sustainable and affordable supplies of water are provided for all communities. Access to high quality open spaces and opportunities for sport and recreation can make an important contribution to the health and well-being of communities. Promotion of healthy communities and protection from risks to health and wellbeing. Promotion of a sustainable economy supported by access to essential utility and infrastructure services.	Information, Public Participation in Decision-making and Access to Justice in Environmental Matters The Environment Noise Directive (Directive 2002/49/EC) HM Treasury Infrastructure UK (2014) National Infrastructure European Commission The Water Framework Directive (2000/60/EC) The Natural Environment and Rural Communities (NERC) Act (2006) European Commission, Drinking Water Directive (1998/83/EC) and subsequent amendments European Commission, The 7th Environmental Action Programme (EAP) Environment Action Programme to 2020 'Living well, within the limits of our planet' (1386/2013/EU) European Commission Blueprint to Safeguard Europe's Water Resources *National:* The Countryside and Rights of Way (CROW) Act, 2000 Environmental Protection Act 1990 DCLG (2012) National Planning Policy Framework Defra (2005) Securing the Future; Delivering UK Sustainable Development Strategy Defra (2011) Water for Life -Water White Paper Defra (2011) The Natural Choice: securing the value of nature. The Natural Environment White Paper Defra (2011) Drought Direction 2011 and 2016 Defra, Environment Agency, Natural England, Forestry Commission England (2016) Creating a great place for living Environment Agency (2014) Corporate Plan 2014 – 2016 Environment Agency (2015) Creating a Better Place: Environment Agency Corporate Strategy 2014-2016 HM Treasury (2015) Fixing the Foundations: Creating a More Prosperous Nation HM Treasury Infrastructure UK (2014) National Infrastructure Plan The Natural Environment and Rural Communities (NERC) Act (2006) *Regional/Local:* Southern Water (2011) Strategic Statement 2015-40 and Southern Water (2013) updated Strategic Statement 2015-40 (Parts 1 to 4) Southern Water (2013) Five Year Business Plan 2015-2020 Public Rights of Way Improvement Plans (ROWIPs) Local level green infrastructure plans
Material assets and resource use	Promote sustainable production and consumption whilst seeking to reduce the amount of waste	*International:* United Nations (2002) Commitments arising from the World Summit on Sustainable Development, Johannesburg

SEA Topic	Key Policy Objectives	Plans, Policies and Programmes
	generated by using materials, energy and water more efficiently. Consider issues of water demand, water supply and water quality in the natural environment and ensure a sustainable use of water resources. Contribute to a resource efficient, green and competitive low carbon economy. Maintain a reliable public water supply and ensure there is enough water for human uses, whilst seeking to maintain a healthy water environment. Minimise the production of waste, ensure waste management is in line with the 'waste hierarchy', and eliminate waste sent to landfill. Promote the sustainable management of natural resources.	*National:* DCLG (2012) National Planning Policy Framework Defra (2011) Government Review of Waste Policy in England 2011 HM Treasury Infrastructure UK (2014) National Infrastructure Plan Defra (2008) Future Water: the Government's water strategy for England Environment Agency (2009) Water Resources Strategy for England and Wales Environment Agency (2010) Water Resources Action Plan for England and Wales Environment Agency (2009) Water Resources Strategy Regional Action Plan for Southern Region Environmental Protection Act 1990 Defra (2015) The government's response to the Natural Capital Committee's third State of Natural Capital report Defra (2008) Future Water: the Government's water strategy for England HM Treasury (2015) Fixing the Foundations: creating a more prosperous nation.
Water	Promote sustainable water resource management, including a reduction in water consumption. Maintain and improve water resource and water quality (surface waters, groundwater and bathing water). Meet protected area targets related to water quality and flow in the Water Framework Directive.	*International:* European Commission Floods Directive (2007/60/EC) European Commission The Water Framework Directive (2000/60/EC) European Commission Drinking Water Directive (1998/83/EC) (amended 2015) European Commission Environmental Liability Directive (2004/35/EC) Directive 2006/118EC of the European Parliament and of the council of 12 December 2006 on the protection of groundwater against pollution and deterioration European Commission Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC European Commission Urban Waste Water Treatment Directive (91/271/EEC) European Commission Nitrates Directive (91/676/EEC)

SEA Topic	Key Policy Objectives	Plans, Policies and Programmes
	Expand the scope of water quality protection measures to all waters, surface waters and groundwater. Improve the quality of the water environment and the ecology which it supports, and continue to provide high levels of drinking water quality. Ensure appropriate management of abstractions and protect flow and level variability across the full range of regimes from low to high conditions. Prevent deterioration of waterbody status. Balance the abstraction of water for supply with the other functions and services the water environment performs or provides. Steer new development to areas with the lowest probability of flooding and manage any residual flood risk, taking account of the impacts of climate change. Promote measures to enable and sustain long term improvement in water efficiency. Promote a catchment based approach to the management and work with local stakeholders to deliver catchment-based solutions to	*National:* Defra (2005) Making Space for Water Defra (2012) The UK Climate Change Risk Assessment 2012 Evidence Report Defra (2012) National Policy Statement for Waste Water Defra (2011) Water for Life - Water White Paper Defra (2011) The Natural Choice: Securing the value of nature. The Natural Environment White Paper Defra (2011) Drought Direction 2011 and 2016 Defra (2008) Future Water: the Government's water strategy for England Defra and Welsh Government (2014) River Basin Planning Guidance Defra and Environment Agency (2015) How to Write and Publish a Drought Plan Environment Agency (2016) Drought Plan guidance extra information, Environmental Assessment for water Drought Plans Defra (2013) Catchment Based Approach: Improving the quality of our water environment Defra (2002) Directing the Flow – Priorities for Future Water Policy Environment Agency (2010) Water Resources Action Plan for England and Wales Environment Agency (2009) Water Resources Strategy for England and Wales Environment Agency (2013) Managing Water Abstraction Environment Agency (2013) Evidence Climate change approaches in water resources planning – overview of new methods Environment Agency (2014) Corporate Plan 2014 – 2016 Environment Agency (2015) Creating a Better Place: Environment Agency Corporate Strategy 2014-2016 Environment Agency CAMS (various) Environment Agency and other lead authorities Shoreline Management Plans Flood and Water Management Act (2010) The Water Act (2003) The Water Environment (WFD) (England and Wales) Regulations 2003 Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009 SI3104 The Water Resources Management Plan Regulations 2007 Water Resources Act 1991 (as amended) Water Industry Act 1991 (as amended) UKTAG on the WFD Guidance Documents (various dates) Water Use (Temporary Bans) Order 2010 Defra (2016) Single Department Plan 2015 - 2020 *Regional/Local:* Environment Agency (2015) Drought response: our framework for England

SEA Topic	Key Policy Objectives	Plans, Policies and Programmes
	water quantity and quantity. Manage developments to protect and enhance the coastal zone	Drought Plans from adjacent water companies Southern water (2013) Drought Plan Environment Agency, Catchment Abstraction Management Strategy (various dates for relevant catchments) Environment Agency (2007) Water for the Future – Managing Water in the South East of England Environment Agency (2009) Water Resources Strategy, Regional Strategy Actions for South East Region Neighbouring water company Water Resource Management Plans (2015-2040). Environment Agency and Defra, (2015) South East River Basin District River Basin Environment Agency and Defra, (2015) River Basin Management Plan Thames River Basin district Environment Agency (2016) South East River Basin District, Flood risk management plan 2015-2021 Environment Agency (2007) Water for the Future - Managing Water in the South East of England. Water Resources in the South East (WRSE) Group (forthcoming) regional water resources strategy
Soil, geology and land use	Protect and enhance the quality and diversity of geology (including geological SSSIs) and soils, including geomorphology and geomorphological processes which can be lost or damaged by insensitive development. Ensure that soils will be protected and managed to optimise the varied functions that soils perform for society (e.g. supporting agriculture and forestry, protecting cultural heritage, supporting biodiversity, as a platform for construction), in keeping with the principles of sustainable development. Promote catchment-wide approach to land management by relevant stakeholders,	International: Council of Europe (2003) European Soils Charter European Commission (2006) Thematic Strategy for Soil Protection National: Defra (2009) Safeguarding our Soils – A Strategy for England Defra (2004) The First Soil Action Plan for England DCLG (2012) National Policy Planning Framework Defra (2004) Rural Strategy 2004 Defra (2006) Sustainable Farming and Food Strategy: Forward Look The Countryside and Rights of Way (CROW) Act (2000) Wildlife and Countryside Act 1981 (as amended). *Regional/local:* National Character Area (NCA) profiles Environment Agency and Defra, (2015) River Basin Management Plan South East River Basin district Environment Agency and Defra, (2015) River Basin Management Plan Thames River Basin district

SEA Topic	Key Policy Objectives	Plans, Policies and Programmes
	in order to benefit natural resources, reduce pollution and develop resilience to climate change. Promote mixed use developments, and encourage multiple benefits from the use of land in urban and rural areas, recognising that some open land can perform many functions. Encourage the effective use of land by reusing land that has been previously developed (brownfield land), provided that it is not of high environmental value.	
Air and climate	Reduce greenhouse gas emissions. Targets include: reduce the UK's greenhouse gas emissions by at least 80% (relative to 1990 levels) by 2050. Reduce the effects of air pollution on ecosystems. Improve overall air quality. Minimise energy consumption, support the use of sustainable/renewable energy and improve resilience to climate change. Build in adaption to climate change to future planning and consider the level of urgency of associated risks of climate change impacts accordingly.	International: The Cancun Agreement (2011) & Kyoto Agreement (1997) European Commission (2008) Ambient Air Quality Directive (2008/50/EC) European Commission (2009) Promotion of the use of energy from renewable sources Directive (2009/28/EC) European Commission (2005) Thematic Strategy on Air Pollution COP21 climate change summit, Paris, 2015 National: DCLG (2012) National Policy Planning Framework Defra (2012) The UK Climate Change Risk Assessment 2012 Evidence Report Defra (2008), England Biodiversity Strategy –climate change adaptation principles DECC (2007) Energy White Paper: Meeting the Energy Challenge Environment Agency (2014) Corporate Plan 2014 – 2016 Environment Agency (2015) Creating a Better Place: Environment Agency Corporate Strategy 2014-2016 The Climate Change Act 2008 The Energy Act 2013 UKCIP (2009) UK Climate Projections UKCP09 (2009) Defra (2013) The National Adaptation Programme: Making the country resilient to a changing climate. Defra (2007) The Air Quality Strategy for England, Scotland and Wales

SEA Topic	Key Policy Objectives	Plans, Policies and Programmes
	Need for adaptive measures to respond to likely climate change impacts on water supply and demand.	Department of energy and climate change (2011) Planning our electric future: a White Paper for secure, affordable and low carbon electricity *Regional/Local:* Defra (2015) Climate adaptation reporting second round: Southern Water
Archaeology and cultural heritage	Built development in the vicinity of historic buildings and Scheduled Monuments could have implications for the setting and/or built fabric and cause damage to any archaeological deposits present on the site. Ensure active management of the Region's environmental and cultural assets. Ensure effects resulting from changes to water level (surface or sub-surface) on all historical and cultural assets are avoided. Consider effects on important wetland areas with potential for paleo-environmental deposits. Promote the conservation and enhancement of the historic environment, including the promotion of heritage and landscape as central to the culture of the region and conserve and enhance distinctive characteristics of landscape and settlements. Conserve and enhance the historic environment, heritage	International: The Convention for the protection of the architectural heritage of Europe (Granada Convention) The European Convention on the protection of archaeological heritage (Valletta Convention) National: Ancient Monuments and Archaeological Areas Act 1979 DCLG (2012) National Policy Planning Framework English Heritage (2008), Climate Change and the Historic Environment English Heritage (2010), Heritage at Risk Historic England (2013) Strategic Environmental Assessment, Sustainability Appraisal and the Historic Environment Historic England (2015) The Setting of Heritage Assets, Historic Environment Historic England (2015) Historic Environment Good Practice Advice in Planning Note 3 Department for Culture, Media and Sport (2001) The Historic Environment – A Force for the Future (2001) Planning (Listed Buildings and Conservation Areas) Act 1990

SEA Topic	Key Policy Objectives	Plans, Policies and Programmes
	assets and their settings.	
Landscape and visual amenity	Protection and enhancement of landscape (including designated landscapes, landscape character, distinctiveness and the countryside) Abstraction and low river flows could negatively affect landscape and visual amenity. Enhance the value of the countryside by protecting the natural environment for this and future generations. Improve access to valued areas of landscape character in sustainable ways to enhance its enjoyment and value by visitors and stakeholders.	*International:* Council of Europe (2006) European Landscape Convention National: DCLG (2012) National Policy Planning Framework Defra (2011) The Natural Choice: Securing the value of nature. The Natural Environment White Paper Defra (2010) Making Space for Nature: A Review of England's Wildlife Sites and Ecological Network The Countryside and Rights of Way (CROW) Act (2000) Wildlife and Countryside Act 1981 (as amended) *Regional/Local:* A Strategy for the West Sussex Landscape, West Sussex County Council (2005) Natural England National Character Area (NCA) Profiles North Wessex Downs AONB Management Plan 2009-2014 Isle of Wight AONB Management Plan 2009 – 2014, Isle of Wight AONB Partnership 2009 Chichester Harbour AONB Management Plan Surrey Hills AONB Management Plan 2014-2019 (Surrey Hills Board) Kent Downs AONB Management Plan 2014-2019 High Weald AONB Management Plan 2014-2019 (High Weald Joint Advisory Committee) Dorset AONB - A Framework for the Future AONB Management Plan 2014 - 2019 Cranborne Chase AONB Management Plan 2014-2019 South Downs National Park (2013) Partnership Management Plan, Shaping the future of your south downs national park 2014-2019 Partnership Plan for the New Forest National Park (2015) An update of the National Park Management Plan with actions for 2015 -2020

3 Environmental Baseline Review

3.1 Introduction

An essential part of the SEA process is to identify the current baseline environmental conditions and their likely evolution during the life of the plan (in this case, a maximum of five years). The SEA Directive (Directive 2001/42/EC) also requires that the evolution of baseline conditions of the plan area (that would take place with or without implementation of the plan) is identified. This is useful when determining impact significance, particularly with regards to baseline conditions that may already be improving or worsening and the rate of such change.

Full environmental baseline data are presented in Appendix C and have been drawn from a variety of sources, including a number of the plans and programmes reviewed as part of the SEA process (as set out above in **Table 2-1**). This environmental baseline review also summarises the likely future trends for the environmental issues being considered (as far as information is available). The key issues arising from the review of baseline conditions are summarised in Section 3.3.

With knowledge of existing conditions and how these may evolve in the absence of the Drought Plan, the potential effects (adverse and beneficial) of the Drought Plan can be identified, mitigated where necessary and subsequently monitored. The SEA considers the effect of alternative drought plan measures against the baseline environmental and social conditions that would exist in drought conditions when the drought plan measures would be implemented.

3.2 Limitations of the data and assumptions made

The area under consideration for the SEA (hereafter referred to as the “area”) is relatively large and covers a number of different geographical and political regions, which makes establishing a baseline at the sub-regional level challenging. There are also challenges around extrapolating information from data collated at differing spatial resolutions. Spatial data have been obtained wherever possible in relation to the SEA topics and the baseline is presented graphically as mapped information where appropriate (see Appendix C). In some instances, reporting cycles mean that available information is dated. The assessments presented in Section 5 and 6 include consideration of the uncertainty and limitations of the available data and comments are provided as to any underpinning assumptions made where data are lacking or dated.

3.3 Key Issues

Biodiversity, Fauna and Flora

The key sustainability issues arising from the baseline assessment for biodiversity are:

- The need to protect or enhance and support the achievement of favourable condition the region’s biodiversity, particularly within designated sites, species and habitats of principal importance.
- The need to avoid activities likely to cause irreversible damage to natural heritage.
- The need to take opportunities to improve connectivity between fragmented habitats to create functioning habitat corridors and habitat patches or stepping stones.
- The need to control the spread of Invasive Non-Native Species (INNS).
- The need to recognise the importance of allowing wildlife to adapt to climate change.

- The need to engage more people in biodiversity issues so that they personally value biodiversity and know what they can do to help, including through recognising the value of the ecosystem services

Population and Human Health

The key sustainability issues arising from the baseline assessment for population and human health are:

- The need to ensure water supplies remain affordable especially for deprived or vulnerable communities, reflecting the importance of water for health and wellbeing.
- The need to ensure continued improvements in levels of health across the region, particularly in urban areas and deprived areas.
- The need to ensure public awareness of drought conditions and importance of maintaining resilient, reliable public water supplies without the need for emergency drought measures.
- The need to ensure water quantity and quality is maintained for a range of uses including tourism, recreation, navigation and other use such as agriculture.
- The need to ensure a balance between different aspects of the built and natural environment that will help to provide opportunities for local residents and tourists, including opportunities for access to, protecting and enhancing recreation resources, green infrastructure and the natural and historic environment.
- The need to accommodate an increasing population and housing growth through provision of essential services including water supply.
- Sites of nature conservation importance, heritage assets, water resources, important landscapes and public rights of way contribute to recreation and tourism opportunities and subsequently health and wellbeing and the economy.

Material Assets and Resource use

The key sustainability issues arising from the baseline assessment for material assets and resource use are:

- The need to minimise the consumption of resources, including water and energy.
- The need to reduce the total amount of waste produced in the region, from all sources, and to reduce the proportion of this waste sent to landfill.
- The need to continue to reduce leakage from the water supply system to help reduce demand for water.
- Daily consumption of water is relatively high and consequently there is a continued need to encourage more efficient water use by consumers.

Water

The key issues arising from the baseline assessment for water are:

- The need to further improve the quality of the regions river, estuarine and coastal waters taking into account WFD objectives.
- The need to maintain the quantity and quality of groundwater resources taking into account WFD objectives.
- The need to improve the resilience, flexibility and sustainability of water resources in the region, particularly in light of potential climate change impacts on surface water and groundwaters.

- The need to ensure sustainable abstraction to protect the water environment and meet society's needs for a resilient water supply.
- The need to ensure that people understand the value of water.

Flooding is not viewed as a key issue for the SEA water topic in relation to the Drought Plan because none of the drought management measures are likely to involve the construction of permanent physical infrastructure within areas at risk of flooding or contribute to an increase in flood risk.

Soil, Geology and landscape

The key sustainability issues arising from the baseline assessment for soil, geology and land use are:

- The need to protect and enhance geological features of importance (including geological SSSIs) and maintain and enhance soil function and health.
- The need to manage the land more holistically at the catchment level, benefitting landowners, other stakeholders, the environment and sustainability of natural resources (including water resources).
- The Drought Plan is unlikely to affect land-use as no permanent development will be required to meet the objectives of the plan.

Air and Climate change

The key sustainability issues arising from the baseline assessment for air and climate are:

- The need to reduce air pollutant and greenhouse emissions and limit air emissions to comply with air quality standards.
- The need to reduce greenhouse gas emissions (industrial processes and transport).
- The need to adapt to the impacts of climate change for example through, sustainable water resource management, water use efficiencies, specific aspects of natural ecosystems (e.g. connectivity) as well as accommodating potential opportunities afforded by climate change.

Archaeology and Cultural Heritage

The key sustainability issues arising from the baseline assessment for archaeology and cultural heritage are:

- The need to conserve or enhance sites of archaeological importance and cultural heritage interest, particularly those which are sensitive to the water environment.
- The need to protect water-dependent heritage sites during drought conditions.

Landscape and Visual Amenity

The key sustainability issues arising from the baseline assessment for landscape and visual amenity are:

- The need to protect and improve the natural beauty of the area's AONBs, National Parks and other areas of natural beauty.
- The need to protect and improve the character of landscapes and townscapes.

3.4 Inter-relationships

It is noted that there are inter-relationships between SEA topics. These include impacts of changes to water flows and quality on biodiversity, the economy, recreation, tourism, navigation, cultural heritage and landscape. Inter-relationships that result in changes to individual effects are considered by evaluation of synergistic effects throughout the assessment.

4 Methodology

4.1 Introduction

This section outlines the methodology that has been used to undertake the SEA of the drought management options in the Southern Water final Drought Plan, taking account of the relevant key parts of the SEA Regulations:

> ***Regulation 12***:
> *(2) The report shall identify, describe and evaluate the likely significant effects on the environment of –*
> *(a) implementing the plan or programme; and*
> *(b) reasonable alternatives taking into account the objectives and the geographical scope of the plan or programme*
>
> ***Schedule 2***:
> The Environmental Report should include:
> *(6). The likely significant effects on the environment, including short, medium and long-term effects, permanent and temporary effects, positive and negative effects and secondary, cumulative and synergistic effects.*
> *(8). An outline of the reasons for selecting the alternatives dealt with, and a description of how the assessment was undertaken including any difficulties (such as technical deficiencies or lack of know-how) encountered in compiling the required information.*

4.2 Assessment Methodology and SEA Framework

The environmental and social assessment of the alternative drought plan options adopts an 'objectives-led' approach. Establishing assessment objectives is a recognised way of considering the environmental effects of a plan and comparing the effects of alternatives. The SEA objectives are derived from environmental and social objectives established in law, policy or other plans and programmes, as well as from the review of baseline information and environmental problems associated with the SEA topics.

An assessment framework of objectives has been developed based on:

- The key policy messages and environmental and social protection objectives identified in the review of policies, and other plans and programmes (see Section 2). This helps to highlight any area where the Drought Plan will support or hinder the achievement of the objectives of policies, other plans and programmes.
- The current state of the environment in the area under consideration, its likely future evolution and the key environmental issues identified (see Section 3).

The SEA objectives are set out in **Table 4-1** and take account of the comments received on the draft SEA objectives presented in the SEA Scoping Report. The following sections describe how these SEA objectives have been used in the assessment of the environmental and social effects of the potential drought plan measures. By assessing each option against these objectives, the effects of the different drought management measures can be objectively compared and the findings used to help determine the measures to be included in the Drought Plan, their timing and phasing of implementation.

As well as the overall SEA objectives, a number of key questions have been developed for each SEA topic. These key questions prompted the assessment and ensured it considered all

the relevant aspects. These key questions have been updated from those presented in the SEA Scoping Report in light of comments received from consultees.

The assessment of each option included consideration of the following information:

- Details of each potential drought management measure;
- Likelihood and predicted frequency of deployment of the measure;
- Construction (where applicable) and operational/implementation details;
- Relevant information contained in Environmental Assessment Reports (EARs) relating to Drought Permit or Drought Order options;
- Benefits to the water supply-demand position in a drought (taking uncertainty into account); and
- Key elements of the baseline environment, such as location of designated sites, priority habitats and species, landscape areas or heritage assets, recreational facilities and other environmental features.

Table 4-1 SEA objectives and assessment approach

SEA Topic	SEA objective	Key questions	Sources of information
Biodiversity, fauna and flora	1.1 To conserve and enhance biodiversity, including designated sites of nature conservation interest and protected habitats and species and to enhance natural capital.	• Will it contribute to favourable condition or favourable conservation status of the most important sites for nature conservation (SAC, SPA, Ramsar, and SSSI)? • Will it have Likely Significant Effects on Natura 2000 sites (with reference to HRA undertaken in parallel)? Or will it cause significant harm to a SSSI or priority habitat? • Will it protect and enhance aquatic, transitional and terrestrial priority species and habitats? • Will it help to restore the natural ecosystem function? • Will it ensure maintenance or support provision of fish passage with respect to migratory fish functioning habitat connectivity? • Will it contribute to the sustainable management of natural habitats and ecosystems, i.e. within their limits and capacities? • Will it promote wildlife's ability to adapt to climate change? • Will it affect WFD compliance e.g. good ecological potential/status? • Will it protect or enhance natural capital and ecosystem services? • Will it create areas of improved biodiversity in urban or deprived areas or easily accessible to those areas?	Drought Plan information EARs: • Significance of effects on environmental features assessment. • WFD status • Hydrological assessment HRA Screening and Appropriate Assessments
	1.2 To avoid introducing or spreading INNS.	• Will it limit, reduce or increase the risk of spread of Non-Native Species (INNS)?	EARs significance of effects on environmental features assessment.
Population and human health	2.1 To protect and enhance health and well-being (including raising awareness of the importance and value of the water environment for health and well-being).	• Will it help to ensure provision of access to a secure resilient and affordable supply of drinking water? • Will it help to protect or improve drinking water quality? • Will it raise awareness of the importance and value of the water environment for health and well-being?	Drought Plan information

SEA Topic	SEA objective	Key questions	Sources of information
		• Will it assist in ensuring provision of essential services to support health and well-being?	
	2.2 To protect and enhance the water environment for other users including sustainable recreation, tourism and navigation, as well as terrestrial recreational resources.	• Will it protect or enhance opportunities for recreation and tourist activities such as public rights of way, including navigation, National Trails and Public Rights of Way)? • Will it help to promote healthy communities and protect from risks to health and wellbeing (for example through nuisance or resulting from traffic or transport changes, disruption to safe and reliable water /sewerage services)? • Does it protect and enhance the green infrastructure network?	Drought Plan information EARs: • Recreation assessment • Navigation assessment
	2.3 To promote a sustainable economy with good access to essential services, including a resilient, high quality and affordable supply of water.	• Will it assist in ensuring provision of essential services to good access to essential services?	Drought Plan information
Material assets and resource use	3.1 To reduce, and make more efficient, the domestic, industrial and commercial consumption of resources, minimise the generation of waste, encourage its re-use and eliminate waste sent to landfill.	• Will it help to minimise the demand for resources? • Will it use natural rather than built solutions where appropriate? • Will it minimise the use of energy and promote energy efficiency? • Will it make use of existing infrastructure? • Will it help to encourage sustainable design or use of sustainable materials (e.g. supplied from local resources)? • Will it reduce the amount of waste generated and increase the proportion sent to reuse or recycling?	Drought Plan information
	3.2 To promote and secure the efficient and sustainable use of water to ensure resilient water supplies for people and businesses.	• Will it enable efficient water use and ensure maintenance of water supplies? • Will it help to minimise the demand for water?	Drought Plan information

SEA Topic	SEA objective	Key questions	Sources of information
Water	4.1 To avoid adverse impact on surface and groundwater levels and flows, including when this impacts on habitats.	• Will it lead to a change in river flows, wetted width or river level? • Will it alter the flow regime or residence time of surface waters? • Will it lead to changes in groundwater levels and recharge? • Will it promote a catchment based approach to the management and work with local stakeholders to deliver catchment-based solutions to water quantity? • Will it contribute towards improving the awareness of water sustainability and its true value? • Will it promote measures to enable improvements in water efficiency and assist in reducing water abstraction? • Will it lead to a temporary or permanent deterioration to WFD water body status?	EARs hydrological assessment
	4.2 To protect and enhance surface and groundwater quality and protect and enhance estuarine waterbodies.	• Will it present a risk to water quality of groundwater, surface water or estuarine waters? • Will it promote a catchment based approach to the management and work with local stakeholders to deliver catchment-based solutions to water quality? • Will it achieve WFD compliance? E.g. good ecological potential/status, prevent deterioration of WFD status between status classes? • Will it prevent water pollution? • Will it affect WFD protected areas?	EARs water quality assessment
	4.3 To ensure appropriate and sustainable management of abstractions to maintain water supplies whilst protecting ecosystem functions and services that rely on water resources.	• Will it achieve an appropriate balance of supply with other functions and services (including agriculture and navigation)? • Will it ensure sustainable abstractions, taking account of water resources availability status? • Will it promote achievement of protected area targets on flow or water quality?	Drought Plan Information

SEA Topic	SEA objective	Key questions	Sources of information
Soil, geology and land use	5.1 To protect and enhance geology, geomorphology and the quality and quantity of soils.	• Will it avoid damage to and protect geologically important sites (e.g. geological SSSIs)? • Will it protect and enhance geomorphology and geomorphological processes? • Will it protect and enhance the quality of soils? • Will it prevent soil erosion?	Spatial information for geological SSSIs EARs geomorphological assessment
Air and Climate	6.1 To reduce air pollutant emissions.	• Will it reduce or minimise air pollutant emissions? • Will it increase emissions to air in an areas sensitive to emissions (e.g. in proximity to an Air Quality Management Area (AQMA) or to sensitive habitat or more deprived area)?	Drought Plan information Spatial information for AQMAs
	6.2 To reduce energy consumption and greenhouse gas emissions.	• Will it reduce or minimise greenhouse gas emissions? • Will it result in an increase in greenhouse gas emissions over and above that that would be produced to supply an equivalent quantity of water in non-drought conditions?	Drought Plan information
	6.3 To adapt and improve resilience to the threats of climate change.	• Will it reduce vulnerability or increase resilience to risks associated with climate change effects (e.g. drought)? • Will it create opportunities to benefit from potential effects of climate change? • Will it make use of renewable energy?	Drought Plan information
Archaeology and cultural heritage	7.1 To conserve and enhance the historic environment, heritage assets and their settings and protect archaeologically important sites.	• Will it avoid damage to and protect the historic environment, heritage assets and their settings, places and spaces that enhance local distinctiveness? • Will it maintain and enhance the historic environment, including paleo-environmental deposits? • Will the hydrological setting of water-dependent assets be altered, such as important wetland areas with potential for paleo-environmental deposits? • Will it improve access, value, understanding or enjoyment of heritage assets and culturally/historically important assets in the region?	EAR Archaeology assessment and spatial information

SEA Topic	SEA objective	Key questions	Sources of information
Landscape and visual amenity	8.1 To protect, enhance the quality of and improve access to designated and undesignated landscapes, townscapes and the countryside.	• Will it avoid adverse effects and enhance designated landscapes at a strategic level? • Will it help to protect and improve non-designated areas of natural beauty and distinctiveness (e.g. woodlands) and avoid the loss of landscape features and local distinctiveness?	EAR Landscape assessment and spatial information

4.3 Proposed Framework for Assessment

4.3.1 Primary Assessment

The appraisal framework set out in **Table 4-2** (below) has been used to assess each of the potential drought plan measures against the SEA objectives. The outcomes of the assessment have been used to inform the development of the Drought Plan, primarily the selection and phasing of measures for inclusion in Southern Water's Drought Plan.

The first and second columns set out the SEA topics and objectives. The third column provides commentary and evaluation of the impact of each alternative measure on the objectives for each topic, with reference to the key questions set out above in **Table 4-1**. The assessment assumes the implementation of standard industry best practice methods in implementing the measures as well as any defined mitigation measures (which are set out in the commentary) such that the significance of effects relates to the residual effects after the application of any mitigation measures in line with the ODPM Practical Guide and UKWIR SEA national guidance.

The eighth column identifies the magnitude of the effect assessed against a scale of negligible to high. The effect magnitude includes consideration of the nature of the impact, likelihood, duration and permanence (fourth, fifth and seventh columns of Table 4-2) in compliance with criteria for determining the likely significance of effects specified in the SEA Directive Article 3(5) and Annex II, and the SEA Regulations Part 2, Regulation 9(2a) and Schedule 1. The value and sensitivity of the receptor(s) is identified in the ninth column on a scale of negligible to high. The scale of the effect, which might relate to either geographical scale or the size of the population affected, is identified in the sixth column on a scale of negligible to large. With respect to duration, short-term effects are defined as those that last for up to six months, medium term effects are those that extend beyond six months to two years whilst long term effects are assessed as those that continue for greater than two years.

The residual adverse and beneficial effects (after application of best practice approaches and any appropriate and explicitly defined mitigation measures) are identified in the tenth and eleventh columns respectively. These are identified separately so as to avoid mixing adverse and beneficial effects, in line with SEA best practice, so that these are clearly understood and the transparency of the effects is maintained throughout the Drought Plan decision-making process.

Where qualitative and/or quantitative information was available (e.g. as identified by a Drought Permit/Order Environmental Assessment Report (EAR), or the HRA or WFD assessment process), this has been used to inform the assessment. Objectives or key questions that are not supported by available data or information have been evaluated using spatial analysis, professional judgement and applicable assessment guidelines relating to that topic/objective.

Varying levels of uncertainty are inherent within the assessment process. The level of uncertainty of the option assessment for each SEA objective is included in the appraisal framework. Where there is significant uncertainty which precludes an effects assessment category being assigned for a particular SEA objective, an "uncertain" residual effects assessment label is applied to that specific SEA objective.

Table 4-2 SEA appraisal framework completed for each potential Drought Plan measure

Column 1	2	3	4	5	6	7	8	9	10	11
Topic	SEA objective	Potential residual effect on sensitive receptors (assuming good practice construction methods)	Scale of effect: (Small/ Medium/ Large)	Certainty of effect (Low/ Medium/ High)	Duration of effect (Short/ Medium /Long term)	Permanence of effect (Permanent/ Temporary)	Magnitude of effect (Low/ Medium/ High)	Value/ sensitivity of receptor (Low/ Medium/ High)	Residual adverse effect	Residual beneficial effect
Biodiversity, fauna and flora	1.1 To conserve and enhance biodiversity, including designated sites of nature conservation interest and protected habitats and species and to enhance natural capital.									
	1.2 To avoid introducing or spreading INNS.									
Population and human health	2.1 To protect and enhance health and well-being (including raising awareness of the importance and value of the water environment for health and well-being).									
	2.2 To protect and enhance the water environment for other users including sustainable recreation, tourism and navigation, as well as terrestrial recreational resources.									

Column 1	2	3	4	5	6	7	8	9	10	11
Topic	**SEA objective**	**Potential residual effect on sensitive receptors (assuming good practice construction methods)**	**Scale of effect: (Small/ Medium/ Large)**	**Certainty of effect (Low/ Medium/ High)**	**Duration of effect (Short/ Medium /Long term)**	**Permanence of effect (Permanent/ Temporary)**	**Magnitude of effect (Low/ Medium/ High)**	**Value/ sensitivity of receptor (Low/ Medium/ High)**	**Residual adverse effect**	**Residual beneficial effect**
	2.3 To promote a sustainable economy with good access to essential services, including a resilient, high quality and affordable supply of water.									
Material assets and resource use	3.1 To reduce, and make more efficient, the domestic, industrial and commercial consumption of resources, minimise the generation of waste, encourage its re-use and eliminate waste sent to landfill.									
	3.2 To promote and secure the efficient and sustainable use of water to ensure resilient water supplies for people and businesses.									
Water	4.1 To avoid adverse impact on surface and groundwater levels and flows, including									

Column 1	2	3	4	5	6	7	8	9	10	11
Topic	**SEA objective**	**Potential residual effect on sensitive receptors (assuming good practice construction methods)**	**Scale of effect: (Small/ Medium/ Large)**	**Certainty of effect (Low/ Medium/ High)**	**Duration of effect (Short/ Medium /Long term)**	**Permanence of effect (Permanent/ Temporary)**	**Magnitude of effect (Low/ Medium/ High)**	**Value/ sensitivity of receptor (Low/ Medium/ High)**	**Residual adverse effect**	**Residual beneficial effect**
	when this impacts on habitats.									
	4.2 To protect and enhance surface and groundwater quality and protect and enhance estuarine waterbodies.									
	4.3 To ensure appropriate and sustainable management of abstractions to maintain water supplies whilst protecting ecosystem functions and services that rely on water resources.									
Soil, geology and land use	5.1 To protect and enhance geology, geomorphology and the quality and quantity of soils.									
Air and Climate	6.1 To reduce air pollutant emissions. 6.2 To reduce energy consumption and greenhouse gas emissions.									

Column 1	2	3	4	5	6	7	8	9	10	11
Topic	**SEA objective**	**Potential residual effect on sensitive receptors (assuming good practice construction methods)**	**Scale of effect: (Small/ Medium/ Large)**	**Certainty of effect (Low/ Medium/ High)**	**Duration of effect (Short/ Medium /Long term)**	**Permanence of effect (Permanent/ Temporary)**	**Magnitude of effect (Low/ Medium/ High)**	**Value/ sensitivity of receptor (Low/ Medium/ High)**	**Residual adverse effect**	**Residual beneficial effect**
	6.3 To adapt and improve resilience to the threats of climate change.									
Archaeology and cultural heritage	7.1 To conserve and enhance the historic environment, heritage assets and their settings and protect archaeologically important sites.									
Landscape and visual amenity	8.1 To protect, enhance the quality of and improve access to designated and undesignated landscapes, townscapes and the countryside.									

For each SEA objective, a residual effects assessment was determined against a significance of effects matrix (**Figure 4-1**) which takes into account the value/sensitivity of the receptor (e.g. species, air quality, river water quality, landscape value, heritage feature) and the magnitude of the assessed effect. This significance matrix comprises effects on a scale ranging from 'major beneficial' to 'major adverse'. For the box signifying low magnitude and high receptor value/sensitivity, this could result in a greater than 'moderate' effects being assigned dependent on the sensitivity/value of the receptor. This colour coding was used to complete the columns for residual effects in the appraisal framework.

The resulting significance of effects has been used in helping Southern Water to select the measures for inclusion in the Drought Plan and the subsequent timing and phasing of the selected measures. Where major adverse effects are predicted, measures envisaged to prevent, reduce (and as far as possible, offset) these effects on the environment (as a result of implementing the measure) are outlined where relevant/appropriate.

Figure 4-1 Significance of effect matrix

Significance of Effect		Value/sensitivity of receptor: High	Value/sensitivity of receptor: Medium	Value/sensitivity of receptor: Low
Effect magnitude (includes scale of effect)	High	Major Beneficial / Major Adverse	Major Beneficial / Major Adverse	Moderate Beneficial / Moderate Adverse
	Medium	Major Beneficial / Major Adverse	Moderate Beneficial / Moderate Adverse	Minor Beneficial / Minor Adverse
	Low	= Significance of effect dependent on value/sensitivity of receptor and magnitude	Minor Beneficial / Minor Adverse	Negligible

General Significance Definitions

Major - effects represent key factors in the decision-making process. They are generally associated with sites and features of international, national or regional importance. If adverse, such resources/features are generally those which cannot be replaced or relocated.

Moderate - effects are likely to be important considerations at a regional or district scale. If adverse, they are likely to be of potential concern.

Minor - effects are not likely to be decision-making issues. Nevertheless, the cumulative effect of such issues may lead to an increase in the overall effects on a particular area or on a particular resource.

Negligible - effects which are not perceptible, being within normal bounds of variation or the margin of forecasting error.

For the **'high' effect magnitude** (top row), a major effect significance is assigned for both high and medium value receptors to reflect the magnitude of the effect.

For the **'low' effect magnitude and 'high' value receptor** (bottom left box), the significance of effect could be minor, moderate or major dependent on the precise nature of the impact or benefit.

All options (both supply-side options and demand management measures) are assessed to the same level of detail, in line with the SEA legislative requirements, national SEA guidance and the UKWIR SEA guidance. The level of detail is consistent with the strategic nature of SEA.

Summarising the effects assessment

The completed appraisal framework tables for each drought plan measure are presented in **Appendix D**. The completed appraisal framework table for each measure is also accompanied by a summary comprising an overview of the adverse and beneficial. In assessing each alternative measure, the effects (beneficial or adverse) of any interactions between SEA topics are also identified, assessed and reported.

A summary visual evaluation matrix (see example in **Table 4-3**) has been completed for each drought plan option and presented in full in **Appendix D**. The summary of the assessment is presented in Section 5. Each coloured box represents the assessed significance of effect for that SEA objective for the particular drought plan measure (for example, a red box indicates a major adverse significance of effect whilst blue indicates a negligible significance of effect and dark green a major beneficial significance of effect). Adverse and beneficial effects are kept separate in line with SEA best practice.

Table 4-3 Example of a Visual Evaluation Matrix

Drought Plan measure	SEA objective – adverse effects									SEA objective – beneficial effects								
	Objective 1.1	*Objective 1.2*	*Objective 1.3*	*Objective 2.1*	*Objective 2.2*	*Objective 2.3*	*Objective 3.1*	*Objective 3.2*	*Objective 4.1*	*Objective 1.1*	*Objective 1.2*	*Objective 1.3*	*Objective 2.1*	*Objective 2.2*	*Objective 2.3*	*Objective 3.1*	*Objective 3.2*	*Objective 4.1*
[Measure 1]																		
[Measure 2]																		

Secondary, Cumulative and Synergistic Environmental Effects

Schedule 2(6) of the SEA Regulations requires the assessment of "the likely significant effects on the environment, including short, medium and long-term effects, permanent and temporary effects, positive and negative effects, and secondary, cumulative and synergistic effects…." For the purposes of this report, "cumulative effects" is taken to include secondary and synergistic effects.

A cumulative effects assessment has been carried out in order to identify if different measures are mutually exclusive or whether combinations of measures might lead to greater adverse impacts (or beneficial effects). This involved examining the likely significant effects of each of the drought measures individually, in combination with each other (both inter- and intra- water resource zone), and in combination with the implementation of other plans and programmes. A matrix has been used to help consider interactions between the measures. In assessing

these effects, consideration has been given to other factors which may affect the receiving environment during implementation of the measures.

The following cumulative assessments have been undertaken (see Section 6 for the assessment findings):

- An assessment of cumulative effects of drought plan measures that could potentially be implemented at the same time. Mutually exclusive measures (e.g. those that draw upon the same resource or use the same site) are also identified.
- Assessment of cumulative effects of the Drought Plan with the Southern Water draft 2019 Water Resource Management Plan (WRMP), other water company drought plans and WRMPs, Environment Agency drought plans (and any other drought plans prepared by other bodies, such as the Canal & River Trust).
- Assessment of potential cumulative effects of the Southern Water Drought Plan with any other identified relevant programmes, plans and projects that may be in place / implemented during the period of the Drought Plan.

Neighbouring water companies will be invited to comment on the final Drought Plan and Southern Water is also continuing its communications with neighbouring companies regarding potential measures in their respective future drought plans and WRMPs to identify any new trans-boundary issues that may arise. Potential effects with other plans are identified, particularly in the context of spatial and temporal proximity.

Drought Plans comprise a basket of measures, the implementation of which are dependent on the particular drought conditions experienced and are subject to temporal, spatial and other factors. The exact timing of implementation of drought management measures will not be known until a drought is experienced. One of the limitations of the cumulative or in-combination assessment of Southern Water's Drought Plan is that whilst an environmental appraisal of each measure has been undertaken, the lack of predictability of which measures will be implemented in any particular drought event means that it is not possible to provide a definitive cumulative assessment of the impacts of the plan for a possible future drought event. Cumulative assessments have therefore been undertaken assuming as a worst case that the implementation of measures could occur simultaneously. Spatial proximity and potential impacts on a common receptor is the primary consideration (e.g. the same designated area, reach of river or the same estuary).

Due to the uncertainty of timing of implementation of drought measures, the findings of the SEA will need to be reviewed during an actual drought and the cumulative assessment updated based on the actual measures proposed for implementation at that time taking account of the findings of the cumulative assessments set out in Section 6.

4.4 Limitations of the Assessment

SEA is a planning level assessment aimed at highlighting potential environmental concerns at a strategic level. Where particular limitations or outstanding issues are known, these are described in the SEA appraisal tables for the relevant drought management option concerned. Further detailed assessment will still be required in an actual drought as part of preparations to implement any specific drought management measure to take account of the prevailing environmental conditions and any new evidence that is available at that time.

5 Assessment of Drought Plan Options

5.1 Assessment of Measures against SEA Objectives

Assessment of the drought management measures has been carried out in accordance with the methodology described in Section 4. Appraisal framework assessment tables have been completed for each drought management measure and are presented in full in **Appendix D**. A summary of the assessment is presented in this section as colour-coded visual evaluation (VE) summary matrices (**Figures 5.1, 5.2 and 5.3**). The colour coding represents a range from major adverse effect in red through to major beneficial effects in dark green as shown in the legend below.

Legend:

Colour		Significance of Effect
	Dark Green	Major Beneficial
	Mid Green	Moderate Beneficial
	Light Green	Minor Beneficial
	Blue	Negligible
	Yellow	Minor Adverse
	Orange	Moderate Adverse
	Red	Major Adverse
	None	Not Applicable

5.2 Demand-Side Measures Assessment Findings

A visual summary of the SEA conclusions for each of the demand side measures considered for Southern Water's final Drought Plan is provided in **Figure 5-1**. The completed appraisal tables for each of the options are provided in **Appendix D**.

Overall, demand-side measures serve to reduce pressure on water resources by reducing customer demand for water and thereby helping to reduce the volumes of water abstracted from the water environment. This, in turn, also contributes to reducing the amount of energy needed for water abstraction, treatment and distribution.

Demand management measures typically provide mostly minor beneficial effects through their contribution to sustainable abstraction, protecting human health and well-being by helping conserve water supplies in drought for customers' essential uses, and helping to reduce drought stress on the water environment. However, some moderate to major adverse effects have also been identified with respect to those demand management measures that temporarily prohibit specific non-essential water uses due to the adverse effects such measures have on those people who rely on those uses of water for their livelihoods. Minor adverse effects on landscape/townscapes, land use, population, air quality (restrictions on using water for dust suppression) and some water dependent recreation and heritage facilities may be associated with Temporary Use Bans and non-essential water use ban Drought Order.

The potential application of an Emergency Drought Order to ration water supplies by using standpipes or rota cuts in emergency conditions is a last resort drought management option and would lead to major adverse effects on the wider population and livelihoods across the Southern Water supply area, in particular in relation to risks to human health.

Figure 5-1 Visual evaluation matrix summary for demand measures

		SEA Topic															Commentary
		Biodiversity, Flora and Fauna		Population and Human Health			Material Assets and Resource Use		Water			Soil, Geology and Land Use	Air and Climate			Archae-ology and Cultural Heritage	Land-scape	
SEA Objective Reference Number		1.1	1.2	2.1	2.2	2.3	3.1	3.2	4.1	4.2	4.3	5.1	6.1	6.2	6.3	7.1	8.1	
Media/ water efficiency campaign	Adverse Effects																	No adverse effects have been identified for this drought management measure.
	Beneficial Effects																	Minor beneficial effects include reducing demand for water and securing essential supplies of water to protect population and human health. Reducing demand for water will have minor beneficial effects by helping to reduce stress on the water environment and contributing to sustainable abstraction. Reducing water demand will also help to improve the resilience of water supplies to drought.
Increased leak detection and repair activity	Adverse Effects																	Minor adverse effects identified are associated with emissions to air (air pollutants and greenhouse gas emissions) as a result of traffic disruption and vehicle movements, as well as temporary nuisance to local communities. All other adverse effects identified are negligible.
	Beneficial Effects																	Minor beneficial effects include reducing demand for water and securing essential supplies of water to protect population and human health. Reducing demand for water will have minor beneficial effects by helping to reduce stress on the water environment and contributing to sustainable abstraction. Reducing water demand will also help to improve the resilience of water supplies to drought.
Temporary Use Ban	Adverse Effects																	A moderate adverse effect has been identified in terms of promoting a sustainable economy due to the effect of the ban on livelihoods for water dependent trades (e.g. landscaping). Minor adverse effects in respect of impact on some recreational facilities, soils management in dry weather, localised townscape effects and effects on certain water settings of heritage features
	Beneficial Effects																	Minor beneficial effects include reducing demand for water and securing essential supplies of water to protect population and human health. Reducing demand for water will have minor beneficial effects by helping to reduce stress on the water environment and contributing to sustainable abstraction. Reducing water demand will also help to improve the resilience of water supplies to drought.

		SEA Topic																
		Biodiversity, Flora and Fauna		Population and Human Health			Material Assets and Resource Use		Water			Soil, Geology and Land Use	Air and Climate			Archae-ology and Cultural Heritage	Land-scape	
SEA Objective Reference Number		1.1	1.2	2.1	2.2	2.3	3.1	3.2	4.1	4.2	4.3	5.1	6.1	6.2	6.3	7.1	8.1	Commentary
Non-essential use ban Drought Order	Adverse Effects																	A major adverse effect has been identified in terms of promoting a sustainable economy due to the effect of the ban on livelihoods for water dependent trades (e.g. window cleaners, car washing). Moderate adverse effects in respect of impact on some recreational facilities and some aspects of tourism. Minor adverse effect on soils management in dry weather, localised townscape effects and effects on certain water settings of heritage features
	Beneficial Effects																	Minor beneficial effects include reducing demand for water and securing essential supplies of water to protect population and human health. Reducing demand for water will have minor beneficial effects by helping to reduce stress on the water environment and contributing to sustainable abstraction. Reducing water demand will also help to improve the resilience of water supplies to drought.
Emergency Drought Order to ration water supplies by rota cuts or standpipes	Adverse Effects																	Significant major adverse effects relating to the impacts on population and human health and safety, livelihoods, plus impacts on water-dependent recreational facilities and the availability of secure, resilient water supplies. Water rationing will cause significant disruption to social and commercial functioning in the areas affected. Potential moderate adverse effects on the setting of certain heritage assets and visual amenities/townscapes. Minor adverse effect on soils management in dry weather.
	Beneficial Effects																	Reducing demand for water will have minor beneficial effects by helping to reduce stress on the water environment and contributing to sustainable abstraction.

5.3 Supply-Side Measures Assessment Findings

A visual summary of the SEA conclusions for each of the supply-side measures considered for inclusion in Southern Water's Drought Plan is provided in **Figure 5-2**. The completed appraisal tables for each of these options are provided in **Appendix D**. The findings of the WFD assessments and the HRA have also informed the SEA assessment. These options relate to those supply-side measures that do not require a Drought Order or Drought Permit and include:

- "resting" certain water sources to conserve water stored in reservoirs or natural groundwater bodies for use at a later stage in a drought
- increasing the import of water from neighbouring water companies
- use of temporary emergency desalination plants at defined locations along the coast or within estuaries
- potential use of water tankering to bring small volumes of water to specific locations from areas where there is a surplus availability of water supplies (likely to be from outside of the Southern Water supply area).

Most of these options do not require any construction works, with the exception of the emergency desalination plants (Sandown, Littlehampton and Sheerness). All options lead to some adverse operational effects on the environment, but equally they contribute some beneficial effects in respect of those SEA objectives relating to public health, maintaining access to water supply provision and delivery of a resilient water supply system.

"Rest" water sources

The options to "rest" certain water sources by reducing abstraction during the onset of drought conditions to conserve water storage for later use if drought conditions intensify provides minor beneficial effects in respect of resilience to the prolonged effects of drought, as well as minor beneficial effects on the water environment by reducing the impact of abstraction at times of more intense drought conditions by drawing on the stored water rather than impacting on river flow.

Imports from other water companies

Options involving imports from other water companies would result in moderate beneficial effects on human health and resilient water supplies, with only minor adverse effects linked to energy and materials use for treating and pumping water to Southern Water's supply area.

Emergency desalination

The emergency desalination options would avoid drawing on stressed freshwater resources in times of drought but there may be some adverse effects on the coastal or estuarine environment from construction activities and from the discharge of brine (water with a high salt content in excess of that of sea water) from the treatment process back to the coastal or estuarine environment.

Each of the emergency desalination options (Sandown, Sheerness and Littlehampton) has the potential for moderate beneficial effects regarding resilience to drought. However, the construction requirements, treatment processes and waste stream discharges have the

potential for moderate adverse effects on resource use and minor to moderate adverse effects on the coastal or estuarine water environment.

The Sandown and Sheerness desalination plant sites are located in proximity to a number of sensitive environmental receptors, in some cases including designated European conservation sites, with the risk of minor to moderate adverse environmental effects after taking account of mitigation measures on biodiversity, flora and fauna.

Tankering of water

Tankering of water as an emergency measure to maintain water supplies has negligible adverse effects on biodiversity, archaeology and cultural heritage, or landscape and visual amenity. There is the potential for minor adverse effects with respect to local nuisance due to increased traffic on the roads and the resulting local impact on air quality and greenhouse gas emissions. Tanker movements and operations at tanker filling and discharge sites (which could involve 24 hour activity, lighting and use of pump generators) have the potential for minor to moderate temporary adverse effects regarding the wellbeing of local communities.

Tankering of water would result in minor beneficial effects in respect of human health through maintaining water supply during severe drought conditions. However, on the basis of previous droughts, there is likely to be limited resource availability across the Southern Water supply area and neighbouring water companies are likely to be similarly affected and seeking to conserve their own resources, so the scale of beneficial effects is limited.

Figure 5-2 Visual evaluation matrix summary for supply-side measures

		SEA Topic																Commentary
		Biodiversity, Flora and Fauna		Population and Human Health			Material Assets and Resource Use		Water			Soil, Geology and Land Use	Air and Climate			Archae-ology and Cultural Heritage	Landscape	
SEA Objective Reference Number		1.1	1.2	2.1	2.2	2.3	3.1	3.2	4.1	4.2	4.3	5.1	6.1	6.2	6.3	7.1	8.1	
Additional import from Portsmouth Water to Hampshire Southampton East Water Resource Zone	Adverse Effects																	Import will use existing infrastructure and water source. Implementation would result in minor adverse effects relating to energy consumption, air pollution and greenhouse gas emissions associated with the increased volume of water that would be pumped. The increased pumping operations would have a negligible impact on environmental receptors. Note that the adverse effects of the Lower Itchen sources Drought Order to maintain this import under very low flow conditions is addressed under the Drought Order effects assessment.
	Beneficial Effects																	Implementation of this drought measure would result in moderate beneficial effects on human health and society through maintaining water supply during drought conditions. This option would also deliver moderate beneficial effects associated with the sustainable management of water resources and resilience to climate change, reducing the need for Drought Orders or permits while river flows in the Lower Itchen remain above the hands-off flow conditions that apply to the Portsmouth Water abstraction.
Additional import from Portsmouth Water to Sussex North Water Resource Zone	Adverse Effects																	Import will use existing infrastructure and water sources. Implementation would result in minor adverse effects relating to energy consumption, air pollution and greenhouse gas emissions associated with the increased volume of water that would be pumped. The increased pumping operations would have a negligible impact on environmental receptors.
	Beneficial Effects																	Implementation of this option would result in moderate beneficial effects on human health and society through maintaining water supply during drought conditions. This option would also deliver moderate beneficial effects associated with the sustainable management of water resources and resilience to climate change, reducing the need for Drought Orders or permits.
Emergency Desalination - Sandown	Adverse Effects																	The HRA has identified no likely significant effects of this option on the qualifying features of the South Wight Maritime SAC, or the Bembridge Marine Conservation Zone given the use of the existing WwTW outfall and mixing of the hypersaline discharge with WwTW treated effluent to bring it below ambient salinity levels (see Appendix D for updated dispersion modelling). Some moderate effects to biodiversity, flora and fauna may arise linked to residual effects (after mitigation) of an elevated saline discharge (brine) at a very localised level (although the salinity of the discharge is likely to be below ambient levels). The construction requirements, treatment processes, pumping and waste stream management has the potential for moderate adverse effects on resource use and major adverse effects regarding energy consumption and greenhouse gas emissions. Permanent visible infrastructure will be located outside of the AONB but might require mitigation regarding effects on views on the coastline. Minor adverse effects relate to the permanent loss of a small area of non-designated land, potential spread of INNS during construction, and some minor temporary disruption to people and ecology during construction of the abstraction intake.

		SEA Topic																
		Biodiversity, Flora and Fauna		Population and Human Health			Material Assets and Resource Use		Water			Soil, Geology and Land Use	Air and Climate			Archae-ology and Cultural Heritage	Landscape	
SEA Objective Reference Number		1.1	1.2	2.1	2.2	2.3	3.1	3.2	4.1	4.2	4.3	5.1	6.1	6.2	6.3	7.1	8.1	Commentary
	Beneficial Effects																	The option would avoid drawing on stressed water resources. Potential for minor beneficial effects regarding maintenance of supply reliability in drought conditions. The availability of source water is not influenced by the effects of drought therefore it improves resilience to some of the likely effects of climate change.
Emergency Desalination - Littlehampton	Adverse Effects																	Minor adverse effects on biodiversity, flora and fauna are limited to potential construction effects, including the risk of spreading INNS, and the permanent loss of small areas of non-designated land, considered to be of minor significance. Dispersal modelling has shown impacts on the Kingmere MCZ (located 5-10km offshore) would be negligible. The construction requirements, scale of water abstraction, treatment processes including reverse osmosis, and waste stream pumping required for implementation suggests the potential for moderate adverse effects on resource use and major adverse effects regarding energy consumption and greenhouse gas emissions. Some infrastructure associated with the scheme (e.g. the intake and pumping station) will be located on the coast at Littlehampton and would require mitigation (sympathetic design and screening) to ensure only minor adverse effects.
	Beneficial Effects																	The option would avoid drawing on stressed water resources. Potential for minor beneficial effects regarding maintenance of supply reliability in drought conditions. The availability of source water is not influenced by the effects of drought therefore it improves resilience to some of the likely effects of climate change.
Emergency Desalination - Sheerness	Adverse Effects																	A new abstraction pipeline and sea outfall at The Lappel could impact the Medway Estuary and Marshes SPA and Ramsar. However, with mitigation measures, there will be no adverse effects on the European sites. The precise location of the waste stream (brine) discharge point will be optimised so that it minimises any impact on the Medway Estuary MCZ. Initial modelling identified a potential impact radius of ~33m around the outfall where the concentrated brine discharge could impact habitats and benthic communities. Following further generic modelling for desalination plants, this was refined to ~6m for a 5Ml/d, therefore the impacts are considered to be minor/negligible. The construction requirements, scale of water abstraction, treatment processes including reverse osmosis, and waste stream pumping required for implementation suggests the potential for moderate adverse effects on resource use and major adverse effects regarding energy consumption and greenhouse gas emissions. Some infrastructure associated with the scheme such as the intake and pumping station will be located on the coast and would require mitigation (sympathetic design and screening) to ensure only minor adverse effects.
	Beneficial Effects																	The option would avoid drawing on stressed water resources. Potential for minor beneficial effects regarding maintenance of supply reliability in drought conditions. The availability of source water is not influenced by the effects of drought therefore it improves resilience to some of the likely effects of climate change.

		SEA Topic																
		Biodiversity, Flora and Fauna		Population and Human Health			Material Assets and Resource Use		Water			Soil, Geology and Land Use	Air and Climate			Archae-ology and Cultural Heritage	Landscape	
SEA Objective Reference Number		1.1	1.2	2.1	2.2	2.3	3.1	3.2	4.1	4.2	4.3	5.1	6.1	6.2	6.3	7.1	8.1	Commentary
Rest Groundwater Sources – Isle of Wight	Adverse Effects																	The option aims to limit the use of key groundwater sources early on in a drought to improve drought resilience later on in a severe or prolonged drought. No or negligible adverse effects are anticipated with implementation of this option, reflecting optimised use of existing water sources.
	Beneficial Effects																	The option would help make existing resources more resilient to the prolonged effects of drought and helping to reduce stress on the water environment by conserving groundwater storage so that increased abstraction later in a drought can be met from storage with lower effects on the water environment.
Rest Groundwater Worthing Sussex	Adverse Effects																	The option aims to limit the use of key groundwater sources early on in a drought to improve drought resilience later on in a severe or prolonged drought. No or negligible adverse effects are anticipated with implementation of this option, reflecting optimised use of existing water sources.
	Beneficial Effects																	The option would help make existing resources more resilient to the prolonged effects of drought and helping to reduce stress on the water environment by conserving groundwater storage so that increased abstraction later in a drought can be met from storage with lower effects on the water environment.
Rest Weir Wood Reservoir	Adverse Effects																	Implementation of this option would result in minor adverse effects relating to a net increase in energy consumption, air pollution and greenhouse gas emissions associated with the increased volume of water that would be pumped from other sources to rest use of the reservoir. The negligible increase in the level of Weir Wood Reservoir could have a negligible adverse impact on migrating waders in the SSSI.
	Beneficial Effects																	The option would help make existing resources more resilient to the prolonged effects of drought and helping to reduce stress on the water environment by conserving reservoir storage so that increased abstraction later in a drought can be met from storage with lower effects on the water environment and reducing the risk of requiring a Drought Order at Weir Wood Reservoir.
Tankering of water	Adverse Effects																	Tankering of water is unlikely to significantly affect the environment in terms of biodiversity, archaeology and cultural heritage, or landscape and visual amenity. However, there is the potential for minor adverse effects with respect to increased traffic on the roads and the resulting emissions to air. This includes nuisance and air quality effects to the local population and minor adverse effects regarding energy consumption and CO2 emissions. The tanker movements, traffic effects, and operations at loading and unloading sites (which could involve 24hour activity, lighting and possibly powered by generators) have the potential for minor to moderate temporary adverse effects regarding the wellbeing of local communities,

		SEA Topic																
		Biodiversity, Flora and Fauna		Population and Human Health			Material Assets and Resource Use		Water			Soil, Geology and Land Use	Air and Climate			Archae-ology and Cultural Heritage	Landscape	
SEA Objective Reference Number		1.1	1.2	2.1	2.2	2.3	3.1	3.2	4.1	4.2	4.3	5.1	6.1	6.2	6.3	7.1	8.1	Commentary
	Beneficial Effects																	Tankering of water would result in minor beneficial effects on human health and economic activity through maintaining essential water supplies during severe drought conditions. Tankering also has the potential to make a small contribution to relieving pressure on water resources during times of severe drought. However, on the basis of previous droughts, there is likely to be limited resource availability across the supply area and neighbouring companies are likely to be similarly affected and seeking to conserve their own water resources.

5.4 Drought Permit and Drought Order Options

The key SEA findings of the Drought Permit and Drought Order options are summarised in **Figure 5-3**. The completed appraisal tables for each of these options are provided in **Appendix D**. The findings of the WFD assessment and HRA have been informed the SEA.

Many of the Drought Permit and Drought Order options involve temporary modifications to existing abstraction licence conditions (e.g. to increase the volume of water that can be abstracted or to reduce the river flow conditions at which abstraction would normally need to cease) and therefore they do not involve any construction works. However, there are some options which require a Drought Permit to recommission unlicensed water sources (Test Valley site Water Supply Works and Stourmouth river abstraction), with modest construction activities having the potential for localised temporary minor adverse effects on human and environmental receptors. Construction works are also associated with a new pipeline to enable implementation of the Candover Augmentation Scheme Drought Order. Very minor construction works are also required to provide a small diameter pipeline to discharge a compensation flow to the Lukely Brook for the Lukely Brook Water Supply Works (WSW) Drought Permit.

All of these options lead to some adverse operational effects on the environment (ranging from negligible to major significance of effect), but equally they contribute minor to major beneficial effects in respect of those SEA objectives relating to population and human health plus maintaining water supply resilience in drought conditions. The adverse effects of the Drought Permit or Drought Order measures vary considerably depending on the scale of the additional abstraction to be authorised and the sensitivity of affected environmental receptors.

In reviewing the SEA findings in **Figure 5-3**, it is important to note that the assessment relates to the specific SEA objectives (see Table 4-2 earlier) and the “significance of effect” findings are based on the methodology and significance of effect criteria set out earlier in Section 4. Whilst the HRA and WFD assessments have informed the assessment, the SEA objectives for the biodiversity, flora and fauna topic and the water topic are more broadly defined than the specific regulatory tests that apply to the HRA and WFD assessments. The approach to the assessment of effects is also different in the SEA compared to the HRA and WFD assessment methodology and therefore conclusions reached in the SEA cannot be directly translated to HRA or WFD compliance. For example, a finding that the significance of an effect is “major adverse” against the SEA biodiversity, flora and fauna objective does not necessarily imply that the option would result in adverse effects on a European site. Similarly, a finding that the significance of an effect is “major adverse” against the water topic SEA objectives does not necessarily imply a temporary deterioration in WFD water body status or that it might hinder achievement of WFD good ecological status.

Figure 5-3 Visual evaluation matrix summary for Drought Order and Drought Permit options

		SEA Topic															
		Biodiversity, Flora and Fauna		Population and Human Health			Material Assets and Resource Use		Water			Soil, Geology and Land Use	Air and Climate			Archae-ology and Cultural Heritage	Landscape	
SEA Objective Reference Number		1.1	1.2	2.1	2.2	2.3	3.1	3.2	4.1	4.2	4.3	5.1	6.1	6.2	6.3	7.1	8.1	Commentary
Lukely Brook WSW	Adverse Effects																	Implementation of the Drought Permit would result in minor adverse effects on river flows in Lukely Brook assuming the provision of compensation flow of water to the river from the groundwater source to maintain a flow in the river. There would be a moderate adverse effect on the biodiversity of Lukely Brook to be mitigated by the compensation flow. There would be potential effects on the Medina estuary. Additional energy will be required to pump the compensation water flow to the river leading to negligible adverse effects on air quality and carbon emissions. There is also the potential for minor adverse effects on the Clatterford Roman Villa Scheduled Monument and negligible adverse effects on the landscape setting of the river valley and wetland features.
	Beneficial Effects																	Implementation of this Drought Permit would result in minor beneficial effects on population and human health through maintaining essential water supplies during drought conditions. This Drought Permit would also deliver minor beneficial effects associated with the augmenting water supply resilience including due to climate change effects.
Caul Bourne WSW	Adverse Effects																	Implementation of the drought order would result in a moderate adverse impact on groundwater levels and flows in the Caul Bourne and freshwater flow inputs to the Newtown Estuary. There would be an associated moderate adverse impact on water quality and ecology in the Caul Bourne. The Appropriate Assessment has identified potential adverse impacts on the designated Solent Maritime SAC, Solent and Southampton Water SPA and Ramsar as a result of the reduction in freshwater input which could lead to a change in wetted area and a change in nutrient loading and flushing, resulting in a potential change to the benthic invertebrate communities and feeding patterns of bird species. Uncertainty in these conclusions will be addressed through a Monitoring and Mitigation Package being developed in consultation with Natural England and Environment Agency. There is the potential for moderate adverse effects on the Caul Bourne Water Mill operation and a minor adverse effect on the Isle of Wight AONB due to lower flows in the Caul Bourne. The increased abstraction associated with this Drought Order would also result in only a negligible net change in energy use overall by Southern Water as demand will be reduced by water use restrictions prior to implementing the Drought Order.
	Beneficial Effects																	Implementation of this Drought Order would result in minor beneficial effects on population and human health through maintaining essential water supplies during drought conditions. This Drought Order would also deliver minor beneficial effects associated with augmenting water supply resilience including due to climate change effects.

		SEA Topic																
		Biodiversity, Flora and Fauna		Population and Human Health			Material Assets and Resource Use		Water			Soil, Geology and Land Use	Air and Climate			Archae-ology and Cultural Heritage	Landscape	
SEA Objective Reference Number		1.1	1.2	2.1	2.2	2.3	3.1	3.2	4.1	4.2	4.3	5.1	6.1	6.2	6.3	7.1	8.1	Commentary
Shalcombe WSW	Adverse Effects																	Implementation of the Drought Order would result in a moderate adverse impact on groundwater levels and flows in the Shalcombe Stream and Caul Bourne and freshwater flow inputs to the Newtown Estuary. Moderate adverse effects may arise in relation to the water levels and aquatic ecology of the groundwater-fed Shalcombe Manor Pond, but water levels may already be very low due to natural drought conditions prior to implementation of the drought order. There would be moderate adverse impact on water quality and ecology in the Shalcombe Stream and Caul Bourne. The Appropriate Assessment has identified potential adverse impacts on the designated Solent Maritime SAC, Solent and Southampton Water SPA and Ramsar as a result of the reduction in freshwater input which could lead to a change in wetted area and a change in nutrient loading and flushing, resulting in a potential change to the benthic invertebrate communities and feeding patterns of bird species. Uncertainty in these conclusions will be addressed through a Monitoring and Mitigation Package being developed in consultation with Natural England and Environment Agency. There is the potential for moderate adverse effects on the Caul Bourne Water Mill operation and a minor adverse effect on the Isle of Wight AONB due to lower flows in the Caul Bourne. The increased abstraction associated with this Drought Order would also result in only a negligible net change in energy use overall by Southern Water as demand will be reduced by water use restrictions prior to implementing the Drought Order.
	Beneficial Effects	-																Implementation of this Drought Order would result in minor beneficial effects on population and human health through maintaining essential water supplies during drought conditions. This Drought Order would also deliver minor beneficial effects associated with augmenting water supply resilience including due to climate change effects.
Eastern Yar Augmentation Scheme	Adverse Effects																	Implementation of this Drought Order would lead to a major reduction in flows in the River Medina and freshwater flows to the Medina estuary. The Appropriate Assessment has identified potential adverse impacts on the designated Solent Maritime SAC, Solent and Southampton Water SPA and Ramsar as a result of the reduction in freshwater input which could lead to a change in wetted area and a change in nutrient loading and flushing, resulting in a potential change to the benthic invertebrate communities and feeding patterns of bird species. Uncertainty in these conclusions will be addressed through a Monitoring and Mitigation Package being developed in consultation with Natural England and Environment Agency. There is a risk of moderate adverse effects on aquatic ecology in the River Medina and Medina Estuary which may lead to an overall major adverse effect on biodiversity, flora and fauna in drought conditions. Effects on landscape and recreation features are assessed as minor adverse.
	Beneficial Effects	-					-											Implementation of this Drought Order would result in minor beneficial effects on population and human health through maintaining essential water supplies during drought conditions. This Drought Order would also deliver minor beneficial effects associated with augmenting water supply resilience including due to climate change effects.

		SEA Topic																
		Biodiversity, Flora and Fauna		Population and Human Health			Material Assets and Resource Use		Water			Soil, Geology and Land Use	Air and Climate			Archae-ology and Cultural Heritage	Landscape	
SEA Objective Reference Number		1.1	1.2	2.1	2.2	2.3	3.1	3.2	4.1	4.2	4.3	5.1	6.1	6.2	6.3	7.1	8.1	Commentary
Test Valley site WSW	Adverse Effects													-				Implementation of the Drought Permit would result in a moderate adverse effect on local groundwater levels and flow in the Wallop Brook. There would be an associated minor adverse effect on water quality and minor to moderate adverse effects on aquatic ecology and habitat. There would be minor adverse effects on informal river side recreation and moderate adverse effects on angling activities.
	Beneficial Effects																	Implementation of this Drought Permit would result in minor beneficial effects on population and human health through maintaining essential water supplies during drought conditions. This Drought Permit would also deliver minor beneficial effects associated with the augmenting water supply resilience, including to climate change effects.
Candover Augmentation Scheme	Adverse Effects																	The HRA screening assessment concluded that the water-sensitive habitats/species that could be adversely affected by the Drought Order implementation were the chalkstream habitat, Southern damselfly and White-clawed crayfish. Overall, it is considered that, based on available evidence, adverse effects cannot be ruled out on the conservation objectives of certain qualifying features of the River Itchen SAC and therefore on overall site integrity. The HRA Appropriate Assessment concluded that an adverse effect on the site integrity of the River Itchen SAC due to implementation of this option could not be ruled out. This conclusion, and the consequent need to provide compensation measures under the Habitats Directive, is therefore reflected in the assignment of a "major adverse effect" significance for the biodiversity, flora and fauna Objective 1.1.in line with the SEA significance of effects criteria. There would be no likely significant effects on the River Itchen SAC features of Bullhead, Atlantic salmon, Brook Lamprey, and Otter. There may be minor temporary adverse effects during construction of the discharge pipeline. Construction works for the discharge pipeline may also lead to some temporary disruption to local communities as well as recreational activities, including angling and access to public rights of way. The option may result in temporary moderate adverse effects towards visual amenity (including within the setting of the National Park) during construction, but operation of the scheme will result in a minor increase in river levels with negligible adverse effects towards unknown water dependant heritage features.
	Beneficial Effects	-																Implementation of this option would result in major beneficial effects on human health and economic activity through maintaining water supplies during drought conditions.

		SEA Topic																
		Biodiversity, Flora and Fauna		Population and Human Health			Material Assets and Resource Use		Water			Soil, Geology and Land Use	Air and Climate			Archae-ology and Cultural Heritage	Landscape	
SEA Objective Reference Number		1.1	1.2	2.1	2.2	2.3	3.1	3.2	4.1	4.2	4.3	5.1	6.1	6.2	6.3	7.1	8.1	Commentary
Test Surface Water Drought Permit	Adverse Effects																	The incremental impact of the Drought Permit beyond that of the prevailing drought conditions (i.e. without the Drought Permit in place) is not likely to have a significant effect on designated SSSI features, but a moderate adverse effect has been assessed based on the uncertainties arising from a paucity of ecological evidence. Water quality concerns in the zone of influence of the abstraction during application of the Drought Permit are largely limited to the parameters of temperature and dissolved oxygen, other water quality parameters have been shown to be well within levels of concern for the ecology and therefore not considered likely to lead to a significant impact on the River Test SSSI. The Drought Permit is not considered likely to damage the notified features of the Lower Test Valley SSSI. Given that during a drought, river flows would naturally be low, the additional recreational effects of the Drought Permit are expected to be minimal. The Drought Permit will result in a minor increase in pumping for abstraction and therefore in resource and energy use and associated carbon emissions.
	Beneficial Effects																	Implementation of this option would result in major beneficial effects on human health and economic activity through maintaining water supplies during drought conditions. This option would also deliver major beneficial effects associated with the sustainable management of resources and major beneficial effects associated with resilience to climate change. Importantly, implementation of this option will help minimise the risk of requiring implementation of other Drought Order options which have a greater effect on the water environment.
Test Surface Water Drought Order	Adverse Effects																	The incremental impact of the Drought Order beyond that of the prevailing drought conditions (i.e. without the drought order in place) is not likely to have a significant effect on designated SSSI features, but a moderate adverse effect has been assessed based on the uncertainties arising from a paucity of ecological evidence. Water quality concerns in the zone of influence of the abstraction during application of the Drought Permit are largely limited to the parameters of temperature and dissolved oxygen, other water quality parameters have been shown to be well within levels of concern for the ecology and therefore not considered likely to lead to a significant impact on the River Test SSSI. The drought order is not considered likely to damage the notified features of the Lower Test Valley SSSI. Given that during a drought, river flows would naturally be low, the additional recreational effects of the Drought Order are expected to be minimal. The Drought Order will result in a minor increase in pumping for abstraction and therefore in resource and energy use and associated carbon emissions

		SEA Topic																
		Biodiversity, Flora and Fauna		Population and Human Health			Material Assets and Resource Use		Water			Soil, Geology and Land Use	Air and Climate			Archae-ology and Cultural Heritage	Landscape	
SEA Objective Reference Number		1.1	1.2	2.1	2.2	2.3	3.1	3.2	4.1	4.2	4.3	5.1	6.1	6.2	6.3	7.1	8.1	Commentary
	Beneficial Effects																	Implementation of this option would result in major beneficial effects on human health and economic activity through maintaining water supplies during drought conditions. This option would also deliver major beneficial effects associated with the sustainable management of resources and major beneficial effects associated with resilience to climate change. Importantly, implementation of this option will help minimise the risk of requiring implementation of other drought order options which have a greater effect on the water environment.
Lower Itchen Sources (includes assessment of the changes to the Portsmouth Water Lower Itchen abstraction licence under this Drought Order)	Adverse Effects																	The SEA has considered the effects of implementation of this Drought Order which varies the Hands-Off Flow conditions on both the Southern Water and Portsmouth Water lower Itchen abstraction licences. The HRA Appropriate Assessment concluded that an adverse effect on the site integrity of the River Itchen SAC due to implementation of this option could not be ruled out. This conclusion, and the consequent need to provide compensation measures under the Habitats Directive, is therefore reflected in the assignment of a “major adverse effect” significance for the biodiversity, flora and fauna Objective 1.1.in line with the SEA significance of effects criteria. Whilst adverse effects on SAC site integrity cannot be ruled out, detailed ecological assessment concluded that the reduction in river flow due to the drought order would have a very minor effect on river flow velocities and river water depths downstream of the abstraction. During extreme drought, groundwater heads in the chalk aquifer would already be low and any incremental effect of additional abstraction due to the drought order would not affect the hydrological functioning of wetlands, or recovery after the drought. Consequent effects on flora and fauna are assessed as low to negligible: there would be no likely significant effects on the River Itchen SAC features of Bullhead, White-clawed Crayfish, Brook Lamprey, and Otter. Impacts on the Ranunculus plant species and underlying chalk river habitat, the Southern Damselfly and River Itchen salmon would be minor and reversible. Any incremental effects from the additional abstraction are not likely to cause permanent damage to the River Itchen SSSI features. This includes the SSSI wetland communities and assemblages of breeding birds. The Drought Order will result in a minor increase in pumping for abstraction and therefore resource and energy use and associated carbon emissions.
	Beneficial Effects																	Implementation of this Drought Order would result in major beneficial effects on population and human health through maintaining essential water supplies during drought conditions and helping to avoid the need for an Emergency Drought Order. This Drought Order would also deliver major beneficial effects associated with the augmenting water supply resilience, including to climate change effects.

		SEA Topic																Commentary
		Biodiversity, Flora and Fauna		Population and Human Health			Material Assets and Resource Use		Water			Soil, Geology and Land Use	Air and Climate			Archae-ology and Cultural Heritage	Landscape	
SEA Objective Reference Number		1.1	1.2	2.1	2.2	2.3	3.1	3.2	4.1	4.2	4.3	5.1	6.1	6.2	6.3	7.1	8.1	
Pulborough - reduce MRF by 10Ml/d	Adverse Effects																	The implementation of the Drought Permit would result in negligible adverse effects on river flows and levels, water quality and biodiversity, flora and fauna in the River Rother. There is a minor adverse effect in relation to a risk of an increase in the spread of Himalayan balsam (invasive species).
	Beneficial Effects																	Implementation of this Drought Permit would result in minor beneficial effects on population and human health through maintaining essential water supplies during drought conditions. This Drought Permit would also deliver minor beneficial effects associated with the augmenting water supply resilience including due to climate change effects.
Pulborough - reduce MRF by 20Ml/d	Adverse Effects																	Implementation of the Drought Permit would result in minor adverse impacts on water flow and levels and water quality of the impacted reaches, with consequent minor adverse effects on biodiversity, flora and fauna. There is a minor adverse effect in relation to a risk of an increase in the spread of Himalayan balsam (invasive species).
	Beneficial Effects																	Implementation of this Drought Permit would result in moderate beneficial effects on population and human health through maintaining essential water supplies during drought conditions. This Drought Permit would also deliver minor beneficial effects associated with the augmenting water supply resilience including due to climate change effects.
Pulborough - reduce MRF by 30Ml/d	Adverse Effects																	The implementation of the Drought Permit would result in a major adverse effect on flows in the River Rother in summer and moderate adverse effects in winter. There would be associated moderate adverse impact on water quality and ecology, notably migratory fish and the Least Water Snipe Fly. The reduction in river flows and levels would have a minor adverse effect on visual amenity.
	Beneficial Effects																	Implementation of this Drought Permit would result in major beneficial effects on population and human health through maintaining essential water supplies during drought conditions. This Drought Permit would also deliver minor beneficial effects associated with the augmenting water supply resilience including due to climate change effects.
Weir Wood Reservoir	Adverse Effects	-					-		-	-	-	-				-	-	Implementation of this Drought Order would lead to a major reduction in flows in the River Medway immediately downstream of the reservoir but the effects would decrease with distance downstream due to other catchment and tributary flows. Reduced flows in the upper Medway may lead to the risk of moderate adverse effects on river geomorphology and water quality. The effects on the physical environment have the potential to result in moderate adverse effects on fish and other aquatic ecology in the upper reaches of the River Medway. Changes to river levels are also predicted to result in the risk of moderate adverse effects to visual amenity and local water-dependent archaeology and cultural heritage features.

		SEA Topic																
		Biodiversity, Flora and Fauna		Population and Human Health			Material Assets and Resource Use		Water			Soil, Geology and Land Use	Air and Climate			Archae-ology and Cultural Heritage	Landscape	
SEA Objective Reference Number		1.1	1.2	2.1	2.2	2.3	3.1	3.2	4.1	4.2	4.3	5.1	6.1	6.2	6.3	7.1	8.1	Commentary
	Beneficial Effects	-	-															Implementation of this Drought Order would result in minor beneficial effects on population and human health through maintaining essential water supplies during drought conditions. This Drought Order would also deliver minor beneficial effects associated with the augmenting water supply resilience including due to climate change effects. It would also have minor beneficial effects on water levels in Weir Wood Reservoir for a negligible benefit to flora and fauna at the reservoir.
North Arundel WSW	Adverse Effects																	Implementation of the Drought Order would result in a moderate adverse effects on groundwater levels and dependent surface water bodies including Park Bottom tributary and Swanbourne Lake, as well as a risk of moderate adverse effects water features within Arundel Park SSSI. There would be an associated minor adverse effect on water quality and a moderate adverse effect on aquatic ecology in these surface water bodies. There would be a negligible adverse effect on the Arun Banks SSSI. The reduction in river flow and surface water levels would have a moderate adverse effect on visual amenity in the local area, notably around Swanbourne Lake and Arundel Park.
	Beneficial Effects																	Implementation of this Drought Order would result in minor beneficial effects on population and human health through maintaining essential water supplies during drought conditions. This Drought Order would also deliver minor beneficial effects associated with the augmenting water supply resilience including due to climate change effects.
East Worthing WSW	Adverse Effects																	Implementation of this Drought Permit will result in groundwater drawdown in the Chalk aquifer with minor adverse effects (uncertain) on flows in the Broadwater Brook (Teville Stream). The stream is anticipated to be dry during severe drought conditions prior to implementing the Drought Permit but impacts are likely due to the delay in recovery of flow in the stream at the end of the drought. Minor adverse effects are anticipated to water quality and ecology in the stream.
	Beneficial Effects																	Implementation of this Drought Permit would result in minor beneficial effects on population and human health through maintaining essential water supplies during drought conditions. This Drought Permit would also deliver minor beneficial effects associated with the augmenting water supply resilience including due to climate change effects.
North Deal WSW	Adverse Effects																	Implementation of this Drought Order will result in moderate adverse effects on groundwater levels with moderate adverse effects on groundwater-fed surface water bodies, including the Wingham River and various spring-fed watercourses. Reduced river flow will result in moderate adverse effects on water quality downstream of Wingham wastewater treatment works. Minor to moderate effects will arise in relation to aquatic ecology in the affected watercourses. The Drought Order has the potential for moderate adverse effects on other groundwater abstractors in the vicinity due to the reduction in groundwater levels.

		SEA Topic																
		Biodiversity, Flora and Fauna		Population and Human Health			Material Assets and Resource Use		Water			Soil, Geology and Land Use	Air and Climate			Archae-ology and Cultural Heritage	Landscape	
SEA Objective Reference Number		1.1	1.2	2.1	2.2	2.3	3.1	3.2	4.1	4.2	4.3	5.1	6.1	6.2	6.3	7.1	8.1	Commentary
	Beneficial Effects																	Implementation of this Drought Order would result in minor beneficial effects on population and human health through maintaining essential water supplies during drought conditions. This Drought Order would also deliver minor beneficial effects associated with the augmenting water supply resilience including due to climate change effects.
Stourmouth	Adverse Effects																	Implementation of this Drought Permit would result in a negligible adverse effect on flow in the River Great Stour, with negligible adverse effects on the water environment. During construction of the water supply infrastructure required to abstract and treat the water from the River Great Stour, there may temporary minor adverse effects to the local population regarding disruption to recreational activities or nuisance from transport and deliveries. Construction requirements would also require some additional materials and associated air and carbon emissions, but these effects are assessed as negligible.
	Beneficial Effects																	Implementation of this Drought Permit would result in minor beneficial effects on population and human health through maintaining essential water supplies during drought conditions. This Drought Permit would also deliver minor beneficial effects associated with the augmenting water supply resilience including due to climate change effects.
Faversham sources	Adverse Effects																	Implementation of this Drought Permit would lead minor adverse effects on groundwater levels with moderate to minor adverse effects on surface waterbodies (springs, ephemeral watercourses and spring-fed watercourses) arising from the delay in the recovery of groundwater levels and stream flows following the end of the drought. Minor adverse effects are predicted with respect to water quality. Minor to moderate effects to the macrophyte, macroinvertebrate and fish community are anticipated in the River Len and the Upper Great Stour. Those relating to macrophytes and fish may extend to the medium or long-term but are temporary and reversible. There is the potential for the Drought Permit to result in moderate adverse effects on other groundwater abstractors. Parts of the area affected by lower river flows are located within the Kent Downs AONB and the potential impacts on surface water flow and water levels may result in temporary minor adverse visual effects on the landscape setting of the area.
	Beneficial Effects																	Implementation of this Drought Permit would result in minor beneficial effects on population and human health through maintaining essential water supplies during drought conditions. This Drought Permit would also deliver minor beneficial effects associated with the augmenting water supply resilience including due to climate change effects.
River Medway Scheme Stage 1	Adverse Effects						-							-				Implementation of the Drought Permit in winter would result in negligible impacts on river flows in the upper reaches of the river system but minor to moderate adverse effects on river flows in the Lower Medway and Medway Estuary. There would be a minor adverse effect on water quality and minor adverse effects on aquatic ecology. No likely significant effects are anticipated on the Medway Estuary and Marshes SPA, SSSI and Ramsar sites. There is also the potential for a minor adverse effect on the Weald landscape and a number of water-dependent heritage assets. Effects on navigation and recreation are assessed as negligible.

		SEA Topic																
		Biodiversity, Flora and Fauna		Population and Human Health			Material Assets and Resource Use		Water			Soil, Geology and Land Use	Air and Climate			Archae-ology and Cultural Heritage	Landscape	
SEA Objective Reference Number		1.1	1.2	2.1	2.2	2.3	3.1	3.2	4.1	4.2	4.3	5.1	6.1	6.2	6.3	7.1	8.1	Commentary
	Beneficial Effects																	Implementation of this Drought Permit would result in major beneficial effects on population and human health through maintaining essential water supplies during drought conditions. This Drought Permit would also deliver major beneficial effects associated with the augmenting water supply resilience including due to climate change effects.
River Medway Scheme Stage 2	Adverse Effects																	Implementation of the Drought Permit in winter would result in minor adverse effects on river flows in the upper reaches of the river system but moderate adverse effects on river flows in the Lower Medway and Medway Estuary. There would be a minor adverse effect on water quality and moderate adverse effects on aquatic ecology. No likely significant effects are anticipated on the Medway Estuary and Marshes SPA, SSSI and Ramsar sites. There is also the potential for minor adverse effects on the Weald landscape and a number of water-dependent heritage assets. Effects on navigation and recreation are assessed as minor.
	Beneficial Effects																	Implementation of this Drought Permit would result in major beneficial effects on population and human health through maintaining essential water supplies during drought conditions. This Drought Permit would also deliver major beneficial effects associated with the augmenting water supply resilience including due to climate change effects.
River Medway Scheme Stage 3	Adverse Effects																	Implementation of the Drought Permit in summer would result in minor adverse effects on river flows in the upper reaches of the river system but moderate adverse effects on river flows in the Lower Medway and Medway Estuary. There would be a minor adverse effect on water quality and moderate adverse effects on aquatic ecology. No likely significant effects are anticipated on the Medway Estuary and Marshes SPA, SSSI and Ramsar sites. There is also the potential for minor adverse effects on the Weald landscape and a number of water-dependent heritage assets. Effects on navigation and recreation are assessed as minor.
	Beneficial Effects																	Implementation of this Drought Permit would result in major beneficial effects on population and human health through maintaining essential water supplies during drought conditions. This Drought Permit would also deliver major beneficial effects associated with the augmenting water supply resilience including due to climate change effects.
River Medway Scheme Stage 4	Adverse Effects																	Implementation of the Drought Order in winter would result in major adverse effects on river flows downstream of Bewl Water Reservoir and through all downstream river reaches to the tidal limit of the river, with moderate adverse effects on freshwater flow to the Medway Estuary. There would be a moderate adverse effect on water quality and major adverse effects on aquatic ecology in the freshwater reaches of the river. Minor to moderate adverse effects on aquatic ecology in the Medway Estuary Marine Conservation Zone are anticipated, with no likely significant effects anticipated on the Medway Estuary and Marshes SPA, SSSI and Ramsar sites. There is also the potential for a minor adverse effects on the Weald landscape and a number of water-dependent heritage assets. Effects on navigation and recreation are assessed as moderate.

		SEA Topic																
		Biodiversity, Flora and Fauna		Population and Human Health			Material Assets and Resource Use		Water			Soil, Geology and Land Use	Air and Climate			Archae-ology and Cultural Heritage	Landscape	
SEA Objective Reference Number		1.1	1.2	2.1	2.2	2.3	3.1	3.2	4.1	4.2	4.3	5.1	6.1	6.2	6.3	7.1	8.1	Commentary
	Beneficial Effects																	Implementation of this Drought Order would result in major beneficial effects on population and human health through maintaining essential water supplies during drought conditions, and helping to avoid the need for an Emergency Drought Order in severe drought. This Drought Order would also deliver major beneficial effects associated with the augmenting water supply resilience including due to climate change effects.
Darwell - reduce MRF (Summer: 18.5Ml/d)	Adverse Effects																	Implementation of this Drought Order would lead to moderate adverse effects on flows in the River Rother decreasing in effect with distance downstream to the Rye Estuary. A reduction in flow will lead to a change in the availability of water that can be pumped across the Walland Marsh ditch system via the Royal Military Canal, and therefore could impact the Dungeness, Romney Marsh and Rye Bay SPA and Ramsar. As a result of the reductions in flow there is also the potential for minor geomorphological changes and moderate adverse effects on water quality in the River Rother and Darwell Reservoir. Reduced river flows are expected to result in minor to moderate adverse effects on aquatic ecology in the freshwater river reaches. Reduced river flows and levels are also predicted to result in potential moderate adverse effects to visual amenity, recreation and navigation.
	Beneficial Effects																	Implementation of this Drought Order would result in moderate beneficial effects on population and human health through maintaining essential water supplies during drought conditions. This Drought Order would also deliver minor beneficial effects associated with the augmenting water supply resilience including due to climate change effects. There would be minor beneficial effects on water levels in Darwell Reservoir.
Darwell - reduce MRF (Spring: 30Ml/d)	Adverse Effects																	Implementation of this Drought Order would lead to major adverse effects on flows in the River Rother decreasing in effect with distance downstream to the Rye Estuary. A reduction in flow will lead to a change in the availability of water that can be pumped across the Walland Marsh ditch system via the Royal Military Canal, and therefore could impact the Dungeness, Romney Marsh and Rye Bay SPA and Ramsar. As a result of the reductions in flow there is also the potential for minor geomorphological changes and major adverse effects on water quality in the River Rother and Darwell Reservoir. Reduced river flows are expected to result in moderate to major adverse effects on aquatic ecology in the freshwater river reaches. Reduced river flows and levels are also predicted to result in potential moderate adverse effects to visual amenity, navigation and recreation.
	Beneficial Effects																	Implementation of this Drought Order would result in major beneficial effects on population and human health through maintaining essential water supplies during drought conditions. This Drought Order would also deliver major beneficial effects associated with the augmenting water supply resilience including due to climate change effects. There would be moderate beneficial effects on water levels in Darwell Reservoir.

		SEA Topic																
		Biodiversity, Flora and Fauna		Population and Human Health			Material Assets and Resource Use		Water			Soil, Geology and Land Use	Air and Climate			Archae-ology and Cultural Heritage	Landscape	
SEA Objective Reference Number		1.1	1.2	2.1	2.2	2.3	3.1	3.2	4.1	4.2	4.3	5.1	6.1	6.2	6.3	7.1	8.1	Commentary
Powdermill – reduce MRF from 6.2Ml/d to 2Ml/d	Adverse Effects													-			-	The implementation of the Drought Permit would result in a major adverse impact on the river flow and level in the River Brede below the abstraction intake. As a result of the reductions in flow there is also the potential for minor geomorphological changes and moderate adverse effects on water quality in the River Rother and Powdermill Reservoir. Reduced river flows are expected to result in moderate adverse effects on aquatic ecology in the freshwater river reaches. No likely significant effects are anticipated to the Dungeness, Romney Marsh and Rye Bay SPA and Ramsar. Reduced river flows and levels are also predicted to result in potential moderate adverse effects to visual amenity, navigation and recreation. Minor adverse effects have been assigned in relation to the risk of the spread of Himalayan Balsam (invasive species).
	Beneficial Effects																	Implementation of this Drought Permit would result in minor beneficial effects on population and human health through maintaining essential water supplies during drought conditions. This Drought Permit would also deliver minor beneficial effects associated with the augmenting water supply resilience including due to climate change effects. There would be minor beneficial effects on water levels in Powdermill Reservoir.

6 Cumulative Assessment

6.1 Introduction

The cumulative assessments presented in this section have been carried out in line with the methodology described earlier in Section 4.

6.2 Cumulative Effects of Demand Management Options

Table 6-1 describes the potential cumulative impacts between the demand management measures.

Table 6-1 Cumulative impacts between demand management measures

Cumulative beneficial effects	Cumulative beneficial effects identified for all options in relation to increasing the overall demand savings in a drought to contribute to sustainable abstraction and helping to reduce stress on the water environment and water settings of heritage features.
Cumulative adverse effects	Cumulative adverse effects anticipated in relation to impacts on population and livelihoods, plus certain recreation, landscape and heritage features as a result of the Temporary Use Ban, non-essential use ban Drought Order and Emergency Drought Order
No adverse cumulative effects	No cumulative adverse effects identified in relation to the media/ water efficiency campaigns or increased leak detection and repair activity measures.

Demand management measures to restrict water use are implemented sequentially, with each measure adding a greater number of water uses to be restricted, bringing both cumulative adverse effects and cumulative beneficial effects.

Cumulative effects with supply augmentation measures have been only been identified in relation to carbon and air quality effects between leakage control measures and operation of emergency desalination measures. Cumulative effects between leakage control measures and construction activities for some of the supply augmentation options are considered to be negligible given the relative locations of the construction activities with leak repair activities.

6.3 Cumulative Effects of Supply Augmentation Options

Cumulative effects between each supply augmentation option have been identified as presented in **Table 6-1**. The interactions are categorised by the potential for cumulative effects to arise due to construction or operation. The assessment of these potential cumulative effects are summarised in **Table 6-1 and Table 6-2**. The assessments have also been informed by the HRA and WFD assessments, as well as Environmental Assessment Reports for Drought Permit and Drought Order options.

All of the options bring some level of cumulative **beneficial effects** by helping to provide additional water supplies during drought conditions and maintaining essential water supply provision.

Table 6-1 shows the grouping of options that have been assessed as having potential cumulative **adverse effects** (grouped by WFD water bodies) and **Table 6-2** shows the assessment in relation to European designated sites, as set out in the accompanying HRA

report. The assessment has concluded that for the majority of combinations of supply augmentation measures, cumulative adverse effects are unlikely, but the assessment identified some risks, for example, where both supply augmentation measures draw on the same river, groundwater body or estuary. These cumulative effects are summarised below:

- The Lukely WSW Drought Permit option may have cumulative, in combination effects with the Eastern Yar Augmentation Scheme Drought Order option that could potentially lead to a slight increase in the overall adverse effects of the Eastern Yar Augmentation Scheme Drought Order on the Medina estuary.

- The Caul Bourne WSW and Shalcombe WSW Drought Order measures in combination with one another could increase the risk of adverse effects on the chalk groundwater body form which both sources abstract and on the groundwater-dependent Caul Bourne River. In turn, there could be an increased risk of adverse effects on freshwater flows to the Shalfleet Creek and Newtown estuary.

In both of these cases, the risk of cumulative adverse effects on European sites (Solent Maritime SAC and the Solent and Southampton Water SPA and Ramsar site) was identified and assessed under the HRA process. The risk of cumulative effects between all these Isle of Wight Drought Permits and Drought Orders on these three internationally important conservation sites was also been assessed under the HRA process. The HRA Appropriate Assessment concluded there would be no adverse cumulative effects on these European sites as a result of these Drought Permits and orders being implemented concurrently.

- The Candover Augmentation Scheme and the Lower Itchen sources Drought Order measures in combination with one another could increase the magnitude of potential adverse effects on the chalkstream habitat and Southern damselfly designated features of the River Itchen SAC. The HRA concluded there may be adverse effects on the integrity of the SAC. Further details are provided in the HRA Report (Annex 11).

Figure 6-1 Cumulative impacts matrix: supply augmentation options

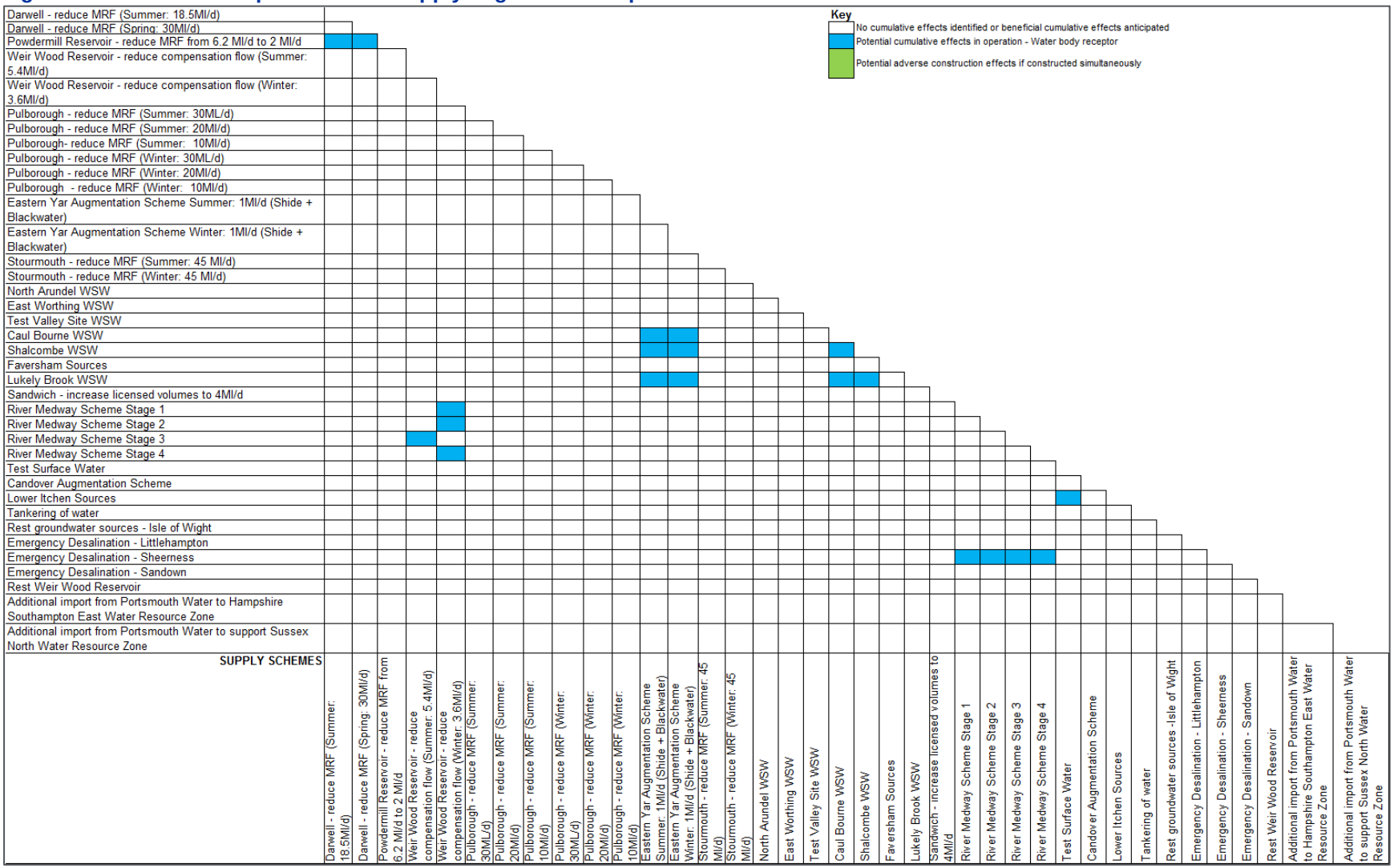


Table 6-1 Cumulative effects assessment of supply augmentation measures (grouped by WFD water body)

Water Body	Drought management measures	Hydrological/ Hydrogeological Cumulative Effects Summary	Cumulative Environmental Effects Summary
Medina Transitional Water Body (GB520710101600)	Lukely Brook WSW / Eastern Yar Augmentation Scheme	These Drought Permit/Order measures may have a cumulative impact on the Medina estuary (transitional water) by reducing freshwater flows from Lukely Brook (Lukely Brook option) and the River Medina (Eastern Yar option). Impacts of the Lukely Brook option are much smaller compared to the Eastern Yar option because of the dominance of the River Medina flows to the estuary. As a result, the cumulative hydrological effect of both options being implemented concurrently is only marginally greater than the Eastern Yar option on its own.	Risks to ecology could increase slightly to the Medina estuary from concurrent implementation of both options in relation to adverse effects on macrophytes, macroalgae, phytoplankton, macroinvertebrates and freshwater fish due to the marginal further decrease in freshwater flow to the estuary.
Caul Bourne (GB107101006020) / Newtown River (GB520710101700)	Caul Bourne WSW / Shalcombe WSW	The Shalcombe Stream flows into the Caul Bourne and, in turn, the Caul Bourne flows into the Newtown River estuary (transitional water body). Potential cumulative effects of the Caul Bourne and Shalcombe WSW Drought Orders are expected to be of moderate impact on river flows in Caul Bourne. The reduction of freshwater flows into the Newtown River is only marginally greater with both Drought Orders implemented concurrently rather than just one of option being implemented.	Risks to aquatic ecology in the Caul Bourne likely to increase from medium to high magnitude for macrophytes, macroinvertebrates and fish. Cumulative risks to ecology in the Newtown River estuary (specifically Shalfleet Creek) assessed as remaining at moderate-major significance.

Water Body	Drought management measures	Hydrological/ Hydrogeological Cumulative Effects Summary	Cumulative Environmental Effects Summary
IoW Central Downs Chalk (GB40701G503200)	Shalcombe WSW/ Caul Bourne WSW / Lukely Brook WSW	The Shalcombe WSW, Caul Bourne and Lukely Brook Drought Permit / Order options may all have a cumulative impact on the Isle of Wight Chalk groundwater body due to the additional abstraction of groundwater. Further to this, the surface water catchment of Lukely Brook is adjacent to that of Caul Bourne. It is noted that there is a risk of cumulative drawdown impacts in the groundwater radius of influence, but this is expected to be limited. Where the radius of influence overlaps between the Drought Permits, the cumulative impact will be more significant. Cumulative hydrogeological impact assessed as moderate.	Both Lukely Brook and Caul Bourne are at medium risk of temporary deterioration due to the potential impact on dependent water bodies and groundwater dependent terrestrial ecosystems. There is an increased (but uncertain) risk of a greater magnitude of impact with these three Drought Orders/permits implemented concurrently, but the magnitude is uncertain due to the absence of a groundwater model to assess cumulative effects.
Medway at Maidstone (GB106040018440) Medway Transitional (GB530604002300)	Weir Wood Reservoir (winter) / River Medway Scheme (winter Stage 1)	The Weir Wood Reservoir (winter) Drought Order and River Medway Scheme (Stage 1 - winter) Drought Permit would have a cumulative impact on the Medway at the confluence of the Teise/Beult near Maidstone (Medway near Maidstone) and downstream to the Medway estuary (transitional water body). However, due to the flow amelioration in the intervening River Medway catchment between Weir Wood reservoir and near Maidstone, the additional cumulative hydrological impact is expected to be negligible.	Due to the negligible additional cumulative hydrological impacts, impacts to the aquatic ecology in the River Medway would not increase as a result of these Drought Orders/permits being implemented in combination.

Water Body	Drought management measures	Hydrological/ Hydrogeological Cumulative Effects Summary	Cumulative Environmental Effects Summary
	Weir Wood Reservoir (winter) / River Medway Scheme (winter Stage 2)	The Weir Wood Reservoir (winter) Drought Order and River Medway Scheme (Stage 2 - winter) Drought Permit would have a cumulative impact on the Medway at the confluence of the Teise/Beult near Maidstone (Medway at Maidstone) and downstream to the Medway estuary (transitional water body). However, due to the flow amelioration in the intervening River Medway catchment between Weir Wood reservoir and near Maidstone, the additional cumulative hydrological impact is expected to be negligible.	Due to the negligible additional cumulative hydrological impacts, impacts to the aquatic ecology in the River Medway would not increase as a result of these Drought Orders/permits being implemented in combination.
	Weir Wood (summer) / River Medway Scheme (summer Stage 3)	The Weir Wood Reservoir (summer) Drought Order and River Medway Scheme (Stage 3 - summer) Drought Permit would have a cumulative impact on the Medway at the confluence of the Teise/Beult near Maidstone (Medway at Maidstone) and downstream to the Medway estuary (transitional water body). However, due to the flow amelioration in the intervening River Medway catchment between Weir Wood reservoir and near Maidstone, the cumulative impact is expected to be negligible.	Due to the negligible additional cumulative hydrological impacts, impacts to the aquatic ecology would not increase as a result of these Drought Orders/permits being implemented in combination.
	Weir Wood (winter) / River Medway Scheme	The Weir Wood Reservoir (winter) Drought Order and River Medway Scheme (Stage 4 - winter) Drought Order would have a cumulative impact on the Medway at the confluence of the Teise/Beult in the vicinity of Maidstone (Medway	Due to the negligible additional cumulative hydrological impacts, impacts to the aquatic ecology would not increase as a result of these

Water Body	Drought management measures	Hydrological/ Hydrogeological Cumulative Effects Summary	Cumulative Environmental Effects Summary
	(winter Stage 4)	at Maidstone) and downstream to the Medway estuary (transitional water body). However, due to the flow amelioration in the intervening River Medway catchment between Weir Wood reservoir and near Maidstone, the additional cumulative impact is expected to be negligible.	Drought Orders being implemented in combination.
Medway Transitional (GB530604002300)	Emergency Desalination - Sheerness, Isle of Sheppey / River Medway Scheme - Stages 1 to 4	The River Medway Scheme Drought Permits/Order have a minor (Stages 1 to 3) or moderate (Stage 4) hydrological impact on the Medway transitional water body. The Emergency desalination plant at Sheerness would abstract water from the estuary and discharge brine. It is considered that the hydrological impacts of these two drought management measures being implemented in combination would not increase over and above that assessed for the River Medway Scheme Drought Permits/Order.	Given the distance downstream of the temporary desalination plant within the Medway estuary it is considered that the risks of adverse effects on the environment of the Medway estuary is no greater that the moderate risks identified for each measure individually.
Lower Rother from Etchingham to Scots Float (GB107040013640) and Rother Transitional Water Body (GB540704016100)	Darwell Reservoir Freshet Removal Drought Permit / Darwell Reservoir Drought Order	The 'freshet' volume of water that is normally required to be held in reserve in Darwell Reservoir equates to 500Ml. This Drought Permit would enable this 500 Ml to instead be abstracted for public water supply. The permit is unlikely to have any hydrological impact on the downstream water bodies during a drought. Consequently there is no cumulative hydrological impact between the Darwell 'freshet' removal Drought Permit and the Darwell reservoir Drought Order (spring or summer) to reduce the Minimum	Due to the lack of cumulative hydrological impacts, the impacts to the aquatic environment would not increase due to the concurrent implementation of the Darwell Reservoir freshet Drought Permit with the Darwell Reservoir Drought Order. The cumulative risk to the environment in the Lower River Rother from Etchingham to Scots Float and to the Rother estuary (transitional water) would remain unchanged.

Water Body	Drought management measures	Hydrological/ Hydrogeological Cumulative Effects Summary	Cumulative Environmental Effects Summary
		Residual Flow in the River Rother at Robertsbridge.	
Rother Transitional Water Body (GB540704016100)	Darwell Reservoir (summer or spring) Drought Order / Powdermill Drought Permit	The cumulative hydrological impact is dependent on the prevailing control of flows to the estuary in drought conditions from the freshwater river Rother, but it is likely that flow releases from the sluice gates to the estuary will already be low, and therefore the cumulative effects of the Drought Order and Drought Permit are no greater than when compared to only one of these drought management measures being implemented due to the flow control management.	No additional cumulative risk to the water environment in the Rother estuary (transitional water) due to concurrent operation of the Drought Order and Drought Permit.

Table 6-2 Cumulative effects assessment of supply augmentation measures (by European designated site)

European Site	Drought Management Measures	Cumulative effects assessment	Likely Cumulative Effects?	HRA Conclusions
Medway Estuary and Marshes SPA and Ramsar	River Medway Scheme / Weir Wood Reservoir	Flow impacts on the River Medway downstream of Weir Wood reservoir are sufficiently ameliorated by intervening catchment flows prior to the confluence of the River Medway with the River (Greater) Teise near Maidstone, such that cumulative, in-combination impacts with the River Medway Scheme would be no greater than negligible downstream, with no impact on the Medway estuary. No likely cumulative significant effects anticipated on the SPA and Ramsar site.	No	No Likely Significant Effects
Peter's Pit SAC		Supplementary advice to the Conservation Objectives states that the maintenance of water within the ponds on the sites is controlled by groundwater levels. As the impacts resulting from the River Medway Scheme and Weir Wood Reservoir options will be confined to the River Medway only, no likely cumulative significant effects are anticipated on the SAC.	No	No Likely Significant Effects
Thames Estuary and Marshes SPA and Ramsar		No likely cumulative significant effects due to the distance from the confluence near Maidstone where cumulative effects assessed as negligible and no cumulative effects are considered likely in Medway estuary upstream of Thames estuary.	No	No Likely Significant Effects
Medway Estuary and Marshes SPA and Ramsar	River Medway Scheme/ Sheerness emergency desalination	The impacts of the River Medway Scheme Drought Permits/Orders are predominantly confined to the upper Medway estuary, between Allington and Hoo Ness, which is upstream of the main area of the SPA and Ramsar. Sheerness is located at the very mouth of the Medway estuary. Given the volume of water within the estuary in the middle section, and freshwater inputs from the creek systems, no likely cumulative significant effects between these two measures are anticipated.	No	No Likely Significant Effects
Arun Valley SAC, SPA and Ramsar	North Arundel WSW/ Pulborough	The North Arundel WSW groundwater zone of influence has negligible impacts on the Lower River Arun, downstream of the Arun Valley SAC, SPA and Ramsar. No impacts were identified as a result of the	No	No Likely Significant Effects

European Site	Drought Management Measures	Cumulative effects assessment	Likely Cumulative Effects?	HRA Conclusions
	Drought Permits and orders	Pulborough Drought Order on the designated sites given the limited connectivity between the habitats and the river due to the presence of the flood banks. No likely cumulative significant effects are anticipated.		
Dungeness SAC	Darwell Reservoir/ Powdermill Reservoir	Great crested newt are the only surface water dependent feature of the SAC designation. The main populations are found at Lydd Ranges, Dungeness RSPB reserve to Lydd Airport, and Romney Warren. None of these areas will be affected by either Drought Orders/permits as impacts are confined to the River Brede, River Rother and Rye Harbour Estuary. No likely cumulative significant effects are anticipated.	No	No Likely Significant Effects
Dungeness, Romney Marsh and Rye Bay SPA and Ramsar		Freshwater inputs to Rye Harbour Estuary and the Royal Military Canal from the River Rother, and to Rye Harbour Estuary from the River Brede, are controlled by tidal sluices and other abstraction regimes. The operation of these systems are influenced by dry springs and summers, with no, or limited, freshwater being passed forward into Rye Harbour Estuary, during these conditions. The River Brede does not supply water to any of the wetland areas forming part of the designation. As a consequence, no likely cumulative significant effects are anticipated.	No	No Likely Significant Effects
Stodmarsh SAC Stodmarsh SPA and Ramsar	North Deal/Stourmouth	The designated sites are located upstream of the Stourmouth abstraction and outside the groundwater drawdown zone of the North Deal WSW abstraction, and upstream of the impacts on the Little Stour. No likely cumulative significant effects are anticipated.	No	No Likely Significant Effects
Thanet Coast and Sandwich Bay SPA and Ramsar		The two Drought Order/permit options both influence the estuarine area of the SPA and Ramsar site on the River Stour. However, as both the individual assessments have concluded negligible hydrological effects on the River Stour, no likely cumulative significant effects are anticipated.	No	No Likely Significant Effects

European Site	Drought Management Measures	Cumulative effects assessment	Likely Cumulative Effects?	HRA Conclusions
Briddlesford Copse SAC	Lukely Brook WSW/ Eastern Yar Augmentation Scheme	Both Drought Permit/Order options affect the River Medina watercourse which is located within the known buffer zone used by Bechstein's bats to feed (as identified through the Environment Agency's Review of Consents work) – these bats are a designated feature of the SAC. However, there are no water dependent habitats used by the bat species in direct hydrological connectivity with the River Medina. Therefore, changes to levels and flows resulting from the combined operation of the Lukely Brook and Eastern Yar Drought Permits/Orders are unlikely to affect the bat species. As such no likely cumulative significant effects are anticipated.	No	No Likely Significant Effects
Isle of Wight Downs SAC		The SAC is outside the groundwater drawdown zone for the Lukely Brook WSW Drought Permit option and is not reliant on water supply from the River Medina or River Yar. Therefore no likely cumulative significant effects are anticipated.	No	No Likely Significant Effects
Solent Maritime SAC		The combined reduction in freshwater flow to the Medina Estuary from the combined use of the Lukely Brook and Eastern Yar Drought Orders and permits is only 1% greater in winter and no change in summer when compared to the impact of the Eastern Yar Drought Order in isolation, so no likely cumulative significant effects on the SAC habitats due to the hydrological change.	No	No Likely Significant Effects
Solent and Southampton Water SPA and Ramsar		The combined reduction in freshwater flow to the Medina Estuary from the combined use of the Lukely Brook WSW and Eastern Yar Augmentation Scheme Drought Orders and permits is only 1% greater in winter and no change in summer when compared to the impact of the Eastern Yar Augmentation Scheme Drought Order in isolation, so no likely cumulative significant effects on the SAC habitats due to the hydrological change. Changes to macroinvertebrate assemblages on the mudflat and sandflat habitats have been identified for both options separately, and	No	No Likely Significant Effects

European Site	Drought Management Measures	Cumulative effects assessment	Likely Cumulative Effects?	HRA Conclusions
		therefore the additional reduction in freshwater inputs could further exacerbate the changes in community structure and composition leading to potentially greater impacts on the following species; Mediterranean gull (feeding), dark-bellied brent goose (feeding), black-tailed godwit (feeding), ringed plover (feeding), shelduck (feeding), redshank (feeding), grey plover (feeding), wigeon (feeding), pintail (feeding) and dunlin (feeding), little egret (feeding), water rail (feeding). The combined impact of the two options is not considered to be materially greater to lead to likely cumulative adverse effects on the designated sites.		
Isle of Wight Downs SAC	Caul Bourne WSW/ Shalcombe WSW	The European dry heath habitat of this SAC is situated on the superficial deposits overlying the chalk aquifer. The hydrogeology assessment has concluded that there is a low connectivity between these deposits and the aquifer, with the direction of the groundwater flow in the aquifer being to the north, away from the SAC. No likely cumulative significant effects are anticipated.	No	No Likely Significant Effects
Solent Maritime SAC		Both Drought Order options impact the River Caul Bourne which discharges into Shalfleet Creek in Newtown Estuary, which is a particularly notable area of estuarine habitat within the SAC. Reductions in freshwater flow into the upper sections of the creek system due to concurrent implementation of both Drought Orders could potentially impact the estuarine salinity profile, the Atlantic salt meadows and mudflat and sandflat habitat features of the SAC.	Yes	Appropriate Assessment concluded no adverse effects on the European site
Solent and Southampton Water SPA and Ramsar		Both Drought Orders will reduce the freshwater flow input to Newtown Estuary. Reductions in freshwater flow into the upper sections of the estuary (Shalfleet Creek) due to concurrent implementation of both Drought Orders could potentially impact the estuarine salinity profile, the Atlantic salt meadows and mudflat and sandflat habitat features of	Yes	Appropriate Assessment concluded no adverse effects on the

European Site	Drought Management Measures	Cumulative effects assessment	Likely Cumulative Effects?	HRA Conclusions
		the SAC, which in turn could have adverse effects on the bird species for which the SPA and Ramsar site are designated.		European sites
Isle of Wight Downs SAC	Eastern Yar Augmentation Scheme, Lukely Brook WSW, Caul Bourne WSW, Shalcombe WSW	The European dry heaths are situated on the superficial deposits overlying the chalk aquifer. The hydrogeology assessments for Caul Bourne and Shalcombe WSW have concluded that there is a low connectivity between the deposits and the aquifer, with the direction of the groundwater flow in the aquifer being to the north away from the SAC. The assessment for Lukely Brook has identified that the SAC is outside the groundwater drawdown zone of influence, and the site has no hydrological connectivity or reliance on water flows in the River Medina in respect of the Eastern Yar Augmentation Scheme Drought Order. Therefore, no likely cumulative significant effects are anticipated from the concurrent implementation of these four Drought Order/permit options.	No	No Likely Significant Effects
Solent Maritime SAC		The four options affect two different estuaries within the overall SAC; Eastern Yar and Lukely Brook impact the Medina Estuary, whilst Caul Bourne and Shalcombe WSW impact Newtown Estuary. Given the potential impact of the Eastern Yar, Caul Bourne and Shalcombe WSW options individually on flows to the estuaries, cumulative adverse effects may arise when these three options are implemented concurrently.	Yes	Appropriate Assessment concluded no adverse effects on the European site
Solent and Southampton Water SPA and Ramsar		Cumulative effects between Eastern Yar, Caul Bourne and Shalcombe options could occur in relation to flows and consequent effects on bird habitat and food sources in the Newtown and Medina estuaries.	Yes	Appropriate Assessment concluded no adverse effects on the European sites

European Site	Drought Management Measures	Cumulative effects assessment	Likely Cumulative Effects?	HRA Conclusions
Solent Maritime SAC	Lower Itchen Sources, Eastern Yar Augmentation Scheme, Caul Bourne WSW, Shalcombe WSW	The five options affect three different estuaries: Eastern Yar and Lukely Brook impact the Medina Estuary; Caul Bourne and Shalcombe WSW impact the Newtown Estuary; Lower Itchen Sources impacts the lower reaches of the River Itchen. The River Itchen itself does not support any areas of the Solent Maritime SAC, the closest area being Southampton Water but the Drought Order has no adverse effects on this water body. As such, no likely cumulative significant effects on the SAC from all five options are anticipated.	No	No Likely Significant Effects
Solent and Southampton Water SPA and Ramsar		The five options affect three different estuaries: Eastern Yar and Lukely Brook impact the Medina Estuary; Caul Bourne and Shalcombe WSW impact the Newtown Estuary; Lower Itchen Sources impacts the lower reaches of the River Itchen. There is only a small area of mudflats in the River Itchen estuary compared to the larger and more prominent areas within the Solent that are used by species associated with mudflat habitat. The Lower Itchen sources Drought Order has no adverse effects on the mudflat habitat and so no likely significant effects are anticipated on invertebrate food sources or designated bird species. Consequently, there are no likely cumulative significant effects between the Lower Itchen sources Drought Order and the Isle of Wight Drought Permit/Order options.	No	No Likely Significant Effects
River Itchen SAC	Test Surface Water/ Lower Itchen sources	HRA screening concluded that likely significant effects could not be ruled out in respect of the cumulative effects of the Test Surface Water Drought Order with the Lower Itchen sources Drought Order	Yes	Appropriate Assessment concluded that adverse effects on the European

European Site	Drought Management Measures	Cumulative effects assessment	Likely Cumulative Effects?	HRA Conclusions
				site could not be ruled out

6.4 Assessment of effects on Marine Conservation Zones

The Marine and Coastal Access Act 2009 allows for the creation of Marine Conservation Zones (MCZs). MCZs protect a range of nationally important marine wildlife, habitats, geology and geomorphology, and can be designated anywhere in territorial and offshore waters. Desktop assessments of potential effects have been carried out for four schemes (River Medway Scheme Drought Order (Stage 4), Sheerness, Sandown and Littlehampton Emergency Desalination Plants) towards the conservation of the Medway Estuary MCZ, Bembridge recommended MCZ, and the Kingsmere MCZ. The Weir Wood reservoir Drought Order options were screened out of any likely significant effects alone or in combination towards the Medway Estuary MCZ. The assessments have taken into account Natural England's advice note[10] issued in July 2017. These assessments will need to be further updated should these options need to be brought forward for implementation, including as part of any supporting evidence for any applications to the Marine Management Organisation for a Marine Licence to carry out any construction work for the temporary emergency desalination plants.

6.4.1 Medway Estuary MCZ

1. Bewl Water Reservoir/River Medway Scheme Drought Permit/Order (Stage 4)

The Bewl Water Reservoir/River Medway Scheme Drought Permit/Order (Stage 4) has the potential to affect the Medway Estuary MCZ. A desktop assessment of potential effects has been carried, taking account of Natural England's advice note (NE 2017) issued in July 2017, to inform the SEA, as detailed below.

The Medway Estuary MCZ was designated in 2013. The Medway Estuary is an onshore site located on the Kent coast. The MCZ encompasses a total area of 60km² in the Medway Estuary and extends seaward from near Rochester to the Isle of Grain and Sheerness. This site is important because it provides a highly fertile environment for a number of invertebrates, fish and birds. Additionally, a large number of commercially important fish utilise this area as a nursery, including bass, herring, cod and sole.

Of the qualifying features of the Medway Estuary MCZ, only the broad scale marine habitat of sub-tidal mud, and the polychaete species Tentacled lagoon worm (*A. romijni*) are considered sensitive to impact as a result of a reduction in freshwater influx to the Medway Estuary due to the River Medway scheme (Stage 4). They have also been recorded as being present in the upper estuary, around Rochester and Strood, where the impacts of the Drought Order could extend. As such, only these two features have been scoped into the following assessment. Environmental attributes, which are deemed to be those ecological characteristics of the designated species and habitats within the site which best describe the features ecological integrity, have been accorded target levels which, if safeguarded, will enable achievement of the conservation objectives for the feature and the site. These attributes and targets are set out in the Supplementary Advice Tables (SATs) for the Medway Estuary MCZ.

Those environmental attributes, integral to the conservation objectives of the Tentacled lagoon worm species, which are considered sensitive to hydrological impact from reduced freshwater influx areL population size; biological connectivity; physico-chemical properties; water quality

[10] Natural England (2017). Tips and advice on how to assess potential impacts of water company statutory plans on the marine environment – Focussing on Marine Conservation Zones (MCZ). Natural England (v2 July 2017).

- dissolved oxygen; water quality – nutrients and extent and spatial distribution of supporting habitat.

A. romijni (Tentacled lagoon worm) has been recorded in subtidal habitats in the upper stretches of the estuary in the vicinity of Rochester and Strood, specifically around Sun Pier and Chatham Ness - alongside a brackish lagoon on Common Marsh, at Cuxton, (above Mean High Water). Confidence in the presence and extent of this species is low. There is evidence that the estuary contains extensive areas of subtidal mud; it is found throughout the whole Medway estuary from the mouth through to the upper stretches at Rochester and Strood. This habitat can be further divided into biotope complexes and biotopes. The biotope complex, which has been mapped in the upper Medway Estuary (upstream of Gashouse Point, Rochester), is "Sublittoral Mud in Variable Salinity" (SS.SMu.SMuVS).

A desktop assessment of the potential effects of the changes to salinity concentrations on key estuarine features and designations has been carried out (as detailed in the Environmental Assessment Report) which has informed the SEA.

The desktop assessment concluded that the possible adverse effects on the upper Medway Estuary due to operation of the Medway reuse scheme may include the following:

- Immediate, local temporary salinity effects.
- short to medium term temporary impact on water quality (dissolved oxygen (DO) and dissolved inorganic nitrogen (DIN)).

Key findings of the desktop assessment were:

1. *A. romniji* is considered tolerant of a wider range of salinities, from below 5 to a salinity as high as 48[11]. As such any local, temporary short to medium term change to the salinity regime of the upper estuary (specifically in a minor upstream migration of the saline intrusion distance in the main channel at high water, resulting in slight alterations to the salinity regime in the extreme upper reaches of the estuary) is considered to result in **negligible** adverse effects to this species.
2. A reduction in mud-dominated substrate distribution is considered unlikely as a result of a temporary reduced freshwater influx to the estuary. *A. romniji* is considered resilient to short term anoxic conditions, however its resistance to low oxygen conditions decreases with increasing temperature. The supplementary advice for this feature recommends that dissolved oxygen (DO) concentrations are maintained at levels equating to good ecological status for the Medway WFD transitional waterbody (specifically ≥ 4.0 mg L-1 (at 35 salinity) for 95 % of year), avoiding deterioration from existing levels. This species is tolerant of excess organic matter enrichment, however all invertebrates are susceptible to increase in nutrient concentrations, which result in excessive algal growth and decay. The target for Dissolved Inorganic Nitrogen (DIN) levels is to maintain at moderate, where biological indicators of eutrophication do not affect the integrity of the site and features.
3. The target DO concentration (4.0 mg L-1 (at 35 salinity) for 95 % of year) for the sub-tidal mud habitat is unlikely to be significantly impacted by the Drought Permit/Order, as the condition is set for high water (a salinity of 35 parts per thousand (ppt). Maintenance of the moderate DIN concentration, a target for the water quality attribute

[11] Gilliland, P., & Sanderson, W. (2000). Re-evaluation of marine benthic species of nature conservation importance: a new perspective on certain 'lagoonal specialists' with particular emphasis on *Alkmaria romijni* Horst (Polychaeta: Ampharetidae). *Aquatic Conservation: Marine and Freshwater Ecosystems*,

of the sub-tidal mud habitat, could be impacted by the reduced freshwater influx to the estuary. Tidal bed stress and light are the main mechanisms controlling macroalgal growth in the Medway Estuary rather than nutrients, with *Enteromorpha* spp. and *Ulva* spp. favouring areas of low tidal energy (such as the upper creek). As the Drought Permit/Order will not impact these physical mechanisms, limited excessive macroalgal growth is predicted as a result of any possible increase in nutrient concentrations.

Further dialogue will need to take place with Natural England as part of any pre-implementation discussions on this Drought Permit/Order should it be required in a very severe drought (in excess of a 1 in 200year drought), including any required monitoring and mitigation measures. Annex 5 of the Drought Plan provides further information on the likely monitoring and mitigation measures that would be necessary.

2. Sheerness Temporary Emergency Desalination Plant

The Sheerness temporary emergency desalination plant has the potential to affect the Medway Estuary MCZ. A desktop assessment of potential effects has therefore been carried out to inform the SEA, as detailed below.

At this planning stage (i.e. Drought Plan), the precise details of the emergency desalination plant have not been developed and the assessment is necessarily based on outline design assumptions. As this is an emergency measure only, detailed design would take place at the drought conditions trigger level (see Drought Plan), providing sufficient time to mobilise the detailed design working with the appointed contractors, confirming the exact location of the intake and outfall, proposed use of chemicals in the treatment process etc. The outline design assumptions are summarised in the assessment below.

The Medway Estuary MCZ surrounds the Port of Sheerness and covers the main channel and consequently, the abstraction intake and discharge point for the plant will be within the MCZ. The proposed scheme would allow for discharge of hypersaline (brine) effluent into the Medway Estuary, south of The Lappel, Port of Sheerness. The Medway Estuary MCZ is designated for the following habitats; intertidal mixed sediments, intertidal sand and muddy sand, subtidal coarse sediment, subtidal mud, subtidal sand, low energy intertidal rock, estuarine rocky habitats and peat and clay exposures. The MCZ is also designated for the Tentacled lagoon worm which has been recorded in the estuary at Rochester.

Construction
The proposed location of the outfall pipeline, and intake structure, within the Medway Estuary will be optimised to reduce impacts to sensitive habitats. The construction location for the treatment units are within the industrial area of the docks. The intake structure and pipeline will be constructed close to the waterfront on the Medway estuary, allowing for a 100% saline intake. If the intake cannot be located on the existing hard structures of the dock itself, a short pipeline and intake structure (off the river bed so sediment is not taken in) will be required. The long-sea outfall would be constructed within the same corridor as the intake, but further offshore, allowing for discharge of hypersaline (brine) effluent into deeper waters of the Medway Estuary, at The Lappel, Port of Sheerness. Two potential construction methods have been considered in the assessment; either installation by floating the pipeline and then sinking it (this would be the quickest method) or burying it in sections (providing better protection given the high volume of shipping traffic).

The construction of the desalination plant will not require landtake from the MCZ itself, however it may impact on the MCZ features. During construction and decommissioning there could be a short-term, temporary increase in noise while pipelines and intakes/outfalls are built (removed) and the temporary treatment facilities are installed (removed). Impacts to water quality and changes to the tidal regime immediately adjacent to any pipelines have also been considered.

The construction process would cause a loss of habitat and/or temporary disturbance along the line of the pipeline route itself and associated structures, and an increase in sedimentation and turbidity in the immediate adjacent area. Habitat loss from the laying of the pipeline and associated intake/outfall structures would be minor. From the available marine habitat mapping and coastal priority habitat mapping data, the sensitive habitats as designated under the MCZ have not been recorded immediately adjacent to the industrial area, with the exception of the mudflats to the south which will be avoided. Baseline habitat mapping will be required to confirm this position, and if required, the location of the outfall pipeline and intake structures optimised to avoid impacts to the most sensitive areas.

Sedimentation and turbidity loading would be temporary as the suspended sediment would redeposit after construction is completed. However, it could impact the benthic invertebrate communities along the pipeline and this could have a resultant impact on fish and bird communities. The likely distance from the pipeline over which sedimentation is likely to occur will depend on the method used, however an approximate distance of ~20m has been assumed as an impact zone either side of the trench. Assuming an approximate pipeline length of 0.7km within the subtidal zone, this would impact approximately 3ha of subtidal habitat.

Operational effects

Brine discharge

A desktop assessment of the potential effects of the hypersaline discharge on the features of the MCZ has been carried out.

The proposed scheme would allow for discharge of hypersaline (brine) effluent (up to 2Ml/d approximately) into the Medway Estuary, at The Lappel, Port of Sheerness. The hyper-saline discharge is likely to have a higher density than the surrounding waters, which are the transitional waters of the Medway (with a salinity of ~35 ppt). As such the effluent is expected to sink to the seabed and could result in highly localised (i.e. 33m radius) smothering of benthic habitats with hypersaline water.

Although dispersion modelling has not been specifically completed for the Sheerness emergency desalination option, the general principles from the modelling of other desalination schemes, completed in 2018 to support the draft Water Resources Management Plan 2019, can be applied. It must be noted that this modelling is indicative and would need to be refined at project level should the scheme be required to be implemented in a severe drought. The modelling suggested that distances to achieve salinity concentrations within 10% of the ambient salinity would be approximately 6m for a 5Ml/d emergency desalination scheme thus reducing the area over which potential impacts would be likely to occur.

The macrotidal regime of the Medway Estuary at this potential discharge location results in strong tidal streams flowing through the narrow channel at the mouth of Medway Estuary on both the flood and ebb tides. Within this narrow channel, these tidal streams are orientated approximately NNW (on the ebb tide) and SSE on the flood tide – in alignment with the orientation of the channel.

It is also assumed that discharge from the proposed temporary desalination plant will only occur during the ebbing tide which is standard practice for estuarine desalination plants and will need to be reflected in the detailed scheme design.

Other chemicals

During operation of the works a number of chemicals will be required in the operational processes e.g. biocides and anti-scalants. The settlement stage of the process will use an inlet storage tank to provide settlement of solids and to balance salinity. It is anticipated that any solids that are settled out (without treatment aid – see below) would be discharged in a controlled manner with the brine, ensuring that the suspended sediment load is not too high for the receiving waters. The pre-filtration stage will remove solids that aren't settled in the first stage and it is anticipated that backwash water would be discharged with the brine.

The exact chemicals to be used in the above process are not known but the following are envisaged as being required:

- Ferric chloride and flocculants to remove solids
- Sodium hypochlorite used in pre-chlorination to reduce organic fouling and membrane cleaning
- Sodium metabisulphite used to mitigate the chlorine levels from the pre-chlorination process.
- Antiscalants
- Remineralisation using lime and CO2 (no discharge)
- Citric acid for membrane cleaning.

A number of these are specific membrane cleaning chemicals and so would only be used during a larger scale cleaning process i.e. part of the plant would be shut down to allow cleaning. The need for these, given the temporary nature of the desalination plant in a severe drought would be confirmed at the detailed design stage. If the chemical volumes are too high for direct inclusion in the brine discharge the residuals will be stored and neutralised before release. Those chemicals added to the inflow to prevent biological, mineral and oxidant fouling of membranes will be separated within the RO process, and would again be stored and neutralised before release.

Impingement and entrainment

The intake for the desalination plant could lead to impingement of organisms (organisms trapped on filter screens), entrainment (organisms drawn into the intake structure) and/or entrapment (organisms trapped within offshore intake pipeline structure). These impacts to marine biota could change the food availability, distribution and density in the area immediately around the intake and therefore impact the feeding patterns of the qualifying bird species.

Research from California suggests that a desalination plant of ~200Ml/d capacity will impinge approximately 1kg/day of marine biota. Entrainment however is likely to be larger and site specific[12].

Use of best practice technologies and design should be able to minimise the impacts of the intake process. At the detailed design stage consideration will be given to use of a surface or

[12] Water Reuse Association (2011) Desalination Plant Intakes Impingement and Entrainment Impacts and Solutions White Paper March 2011; Revised June 2011

sub-surface intake, capped intake to reduce vertical flow, low velocities through the screens, sizing of the screens and deflection technologies.

Cumulative Effects
Both the River Medway Scheme Drought Order (Stage 4) and Sheerness emergency desalination plant potentially impact the Medway Estuary MCZ. The impacts of the River Medway Scheme Drought Order (Stage 4) will extend into the upper reaches of the estuary, but are unlikely to be detectable downstream at Hoo Ness. None of the MCZ habitats have been mapped within the proposed corridor for the outfall pipeline and intake structures. This will be confirmed through baseline surveys at a project level, however on the basis of the available information, cumulative effects are unlikely.

Further dialogue will need to take place with Natural England as part of any pre-implementation discussions for this Temporary Emergency Desalination Plant should it be required in a very severe drought (in excess of a 1 in 200 year drought), including any required monitoring and mitigation measures. Annex 5 of the Drought Plan provides further information on the likely monitoring and mitigation measures that would be necessary.

6.4.2 Bembridge Recommended MCZ

Sandown Temporary Emergency Desalinisation Plant

The SEA identified that the Sandown temporary emergency desalinisation scheme has the potential to affect the Recommended Bembridge MCZ (rMCZ). A desktop assessment of potential effects has been carried out to inform the SEA, as detailed below.

At this planning stage (i.e. Drought Plan), the precise details of the emergency desalination plant have not been developed and the assessment is necessarily based on outline design assumptions. As this is an emergency measure only, detailed design would take place at the drought conditions trigger level (see Drought Plan), providing sufficient time to mobilise the detailed design working with the appointed contractors, confirming the exact location of the intake and outfall, proposed use of chemicals in the treatment process etc. The outline design assumptions are summarised in the assessment below.

The Bembridge rMCZ lies adjacent to the east coast of the Isle of Wight, encompassing a total area of 85km² and is comprised of an intertidal area (including Sandown Bay and Bembridge Harbour) and a subtidal area. The site has been recommended for designation to fill gaps in the network for maerl beds, sea pens and burrowing megafauna and stalked jellyfish. The site has an exceptionally diverse range of habitats and species including both long-snouted and short-snouted seahorse the reef-building ross worm, native oysters and seagrass beds. The site has also been identified by Natural England and the Joint Nature Conservation Committee as being at high risk of damage and degradation due to the presence of sensitive habitats and species within the site.

The Sandown emergency desalination plant will discharge into and abstract from the Bembridge recommended MCZ.

Construction
There may be short-term impacts of the construction of the abstraction intake. The existing wastewater treatment works long sea outfall will be used to discharge the brine. The intake will be constructed to avoid any high sensitivity habitat (notably chalk reef located some 2km away) along the same corridor as the existing outfall, off Culver Parade. However, there could be moderate impacts to the other habitats and species protected by the Bembridge rMCZ.

Habitat mapping and species surveys will be required to understand the location of these, and the location of the abstraction intake optimised to avoid impacts to the most sensitive areas.

Operation
A desktop assessment of the potential effects of the hypersaline discharge (up to 2Ml/d approximately) on the features of the MCZ has been carried out. Initial results from modelling work completed by Atkins in 2007 showed that the salinity would drop to within 10% of the ambient salinity, at approximately 25 to 33m from the existing outfall. This concluded that there would be a highly localised risk (i.e. within a ~33m radius) of an impact on benthic habitats due to the greater density of the saline/sewage effluent mixed discharge, but these impacts were unlikely to extend to sensitive designated features due to the high mixing and dispersion characteristics.

Brine discharge
Further high level CORMIX modelling of the dispersion plumes was completed in 2018 to support the Water Resource Management Plan for modelled schemes that can be applied to the temporary desalination drought option. It must be noted that this modelling was indicative and would need to be refined at project level should the scheme be required to be implemented in a severe drought. The modelling suggested that distances to achieve salinity concentrations within 10% of the ambient salinity would be approximately 7m for a 8.5Ml/d scheme for a temporary emergency desalination plant, thus reducing the area over which potential impacts would be likely to occur. However, when taking into account the likely brine concentration from the reverse osmosis process of approximately 67psu and combining this with the wastewater treatment works treated effluent (the salinity of which is effectively zero), then the combined discharge salinity for a 8.5Ml/d scheme would be 15.6psu, therefore well below the assumed ambient salinity of 35psu. Therefore, when mixed with the wastewater treated effluent, the salinity of the discharge is reduced such that negligible impacts are predicted.

Other chemicals
During operation of the works a number of chemicals will be required in the operational processes e.g. biocides and anti-scalants. The settlement stage of the process will use an inlet storage tank to provide settlement of solids and to balance salinity. It is anticipated that any solids that are settled out would be discharged in a controlled manner with the brine, ensuring that the suspended sediment load is not too high for the receiving waters. The pre-filtration stage will remove solids that aren't settled in first stage and it is anticipated that backwash water would be discharged with the brine. A number of other chemicals may be required to clean the membrane, subject to how long the plant is needed for. If the chemical volumes are too high for direct inclusion in the brine discharge the residuals will be stored and neutralised before release. Those chemicals added to the inflow to prevent biological, mineral and oxidant fouling of membranes will be separated within the RO process, and would again be stored and neutralised before release. Precise details of the chemicals to be used will be confirmed during the drought conditions trigger level (see Drought Plan), once the need for the scheme has been identified and contractors appointed to design the works.

Impingement and entrainment
The intake for the desalination plant will be located along the same corridor as the existing outfall, off Culver Parade, and could lead to impingement of organisms (organisms trapped on filter screens), entrainment (organisms drawn into the intake structure) and/or entrapment (organisms trapped within offshore intake pipeline structure). These impacts to marine biota could change the food availability, distribution and density in the area immediately around the intake and therefore impact the feeding patterns of the qualifying bird species. Research from California suggests that a desalination plant of ~200Ml/d capacity will impinge approximately

1kg/day of marine biota. Entrainment however is likely to be larger and site specific13. However, the scheme will be designed using best practice technologies to minimise the impacts of the intake process. Where possible the intake will be located outside the littoral zone where impingement and entrainment impacts tend to be highest, thereby reducing the potential for an impact. At the detailed design stage consideration will be given to use of a surface or sub-surface intake, capped intake to reduce vertical flow, low velocities through the screens, sizing of the screens and deflection technologies.

Further dialogue will need to take place with Natural England as part of any pre-implementation discussions for this Temporary Emergency Desalination Plant should it be required in a very severe drought (in excess of a 1 in 200 year drought), including any required monitoring and mitigation measures. Annex 5 of the Drought Plan provides further information on the likely monitoring and mitigation measures that would be necessary.

6.4.3 Kingsmere MCZ

Littlehampton Emergency Desalinisation Plant

Kingmere MCZ is between 5 and 10km off the coast of Littlehampton and covers an area of 47.84km² of subtidal marine environment. The site was designated in 2013. Designated features of this site include Black seabream, *Spondyliosoma cantharus*, moderate energy infralittoral rock and thin mixed sediment subtidal chalk. This site is one of the most well-known for spawning Black seabream and may be one of the most important spawning sites within UK waters. The site also contains two marine Sites of Nature Conservation Interest (SNCI): Kingmere Rocks and Worthing Lumps.

Brine discharge

The potential effects to Kingmere MCZ relate to the dispersion of the hypersaline discharge from the desalination plant (up to 2Ml/d approximately). It is anticipated that the effluent would be discharged through the existing wastewater treatment works long sea outfall. Initial dispersion modelling completed by Atkins in 2007 concluded that the salinity would drop to within 10% of the ambient salinity, at approximately 25 to 33m from the outfall, therefore resulting in a highly localised risk (i.e. within a ~33m radius) impact on benthic habitats due to the greater density of the saline/sewage effluent mixed discharge. Further modelling completed in 2018 to support the draft Water Resource Management Plan 2019 suggested that distances to achieve salinity concentrations within 10% of the ambient salinity would be approximately 7m for a 8.5Ml/d temporary emergency desalination scheme. When taking into account the likely brine concentration from the reverse osmosis process of approximately 67psu and combining this with the wastewater treatment works treated effluent (assuming the salinity of this is zero) then the combined discharge salinity for a 8.5Ml/d scheme would be 15.6psu, therefore well below the assumed ambient salinity of 35psu. Therefore, when mixed with the wastewater treated effluent, the salinity of the discharge is reduced such that impacts on the Kingmere MCZ (located 5-10km offshore) would be of a negligible residual effect.

As identified by the WFD assessment (Annex 13) there was a low risk of ecological deterioration regarding mussel beds (*Modiolus modiolus*, *Mytilus edulis* and others, which are a WFD higher sensitivity habitat) as these are located 1km from the discharge point. However, with regard to the latest dispersion modelling (2018), it is unlikely that there will be any detectable impact given the dilution of the brine discharge.

[13] Water Reuse Association (2011) Desalination Plant Intakes Impingement and Entrainment Impacts and Solutions White Paper March 2011; Revised June 2011

Other chemicals

During operation of the works a number of chemicals will be required in the operational processes e.g. biocides and anti-scalants. The settlement stage of the process will use an inlet storage tank to provide settlement of solids and to balance salinity. It is anticipated that any solids that are settled out would be discharged in a controlled manner with the brine, ensuring that the suspended sediment load is not too high for the receiving waters. The pre-filtration stage will remove solids that aren't settled in first stage and it is anticipated that backwash water would be discharged with the brine. A number of other chemicals may be required to clean the membrane, subject to how long the plant is needed for. If the chemical volumes are too high for direct inclusion in the brine discharge the residuals will be stored and neutralised before release. Those chemicals added to the inflow to prevent biological, mineral and oxidant fouling of membranes will be separated within the RO process, and would again be stored and neutralised before release. Precise details of the chemicals to be used will be confirmed during the drought conditions trigger level (see Drought Plan), once the need for the scheme has been identified and contractors appointed to design the works.

6.5 Cumulative Effects with Existing Relevant Plans, Programme and Projects

6.5.1 Other Water Company Drought Plans

Assessment of the potential cumulative impacts with drought management measures listed in neighbouring water companies' current drought plans has been undertaken. It should be noted that all water company Drought Plans are subject to review on timescales that may not be aligned with the timescale of Southern Water's Drought Plan update. The information used to carry out these assessments is the most up-to-date information available at the time of writing, but the assessments should be reviewed at the time of implementing any Drought Plan measures to ensure that no changes to the neighbouring water company drought options have been made in the intervening period, and that the assessment in this Environmental Report remains valid.

Potential cumulative effects with some of the supply augmentation measures in the South East Water, SES Water and Portsmouth Water Drought Plans have been identified as set out in **Table 6-3.** No other potential for cumulative effects have been identified with drought plan supply augmentation measures of other neighbouring water companies.

No temporary emergency desalination plants have been identified in any other current neighbouring water company Drought Plans, so no cumulative effects are currently anticipated.

Concurrent implementation of Temporary Use Bans and/or Drought Orders to ban non-essential water use by neighbouring water companies has the potential to increase the risk of adverse effects on population, recreation and landscape/townscapes. Concurrent implementation of an Emergency Drought Order by other neighbouring water companies would possibly place additional adverse effects on population and human health.

The conclusions of the cumulative effects assessment with other water company supply augmentation options in their published drought plans are set out below.

Portsmouth Water Drought Plan 2013

The plan includes the potential need for a Drought Permit for its Chichester groundwater source which may have combined impacts with Southern Water's North Arundel Drought

Order. Further dialogue with Portsmouth Water is required to confirm the assessment in **Table 6-3**.

South East Water Drought Plan 2017

The plan includes the River Ouse Drought Permit option and the Halling Drought Permit. No cumulative effects were identified in relation to the River Ouse option. **Table 6-3** sets out the cumulative assessment for the Halling Drought Permit option with the River Medway scheme Drought Permits/Order options.

SES Water Drought Plan 2017

The plan includes a potential need for a Drought Permit for the Bough Beech Reservoir based on modifications to the River Eden abstraction licence. **Table 6-3** sets out the cumulative assessment for the Bough Beech reservoir / River Eden Drought Permit option with the River Medway Scheme Drought Permits/Order options and the Weir Wood reservoir Drought Order option.

Table 6-3 Cumulative effects assessment of drought measures between Southern Water's Drought Plan measures and other water company drought plan measures

Water Body	Drought management measures	Hydrological/ Hydrogeological Cumulative Effects Summary	Cumulative Environmental Effects Summary
Mid Medway from Eden Confluence near Maidstone (GB106040018182)	Weir Wood Reservoir (summer) Drought Order/ SES Water Bough Beech Reservoir/River Eden Drought Order	The SES Water Drought Order for Bough Beech Reservoir/River Eden is expected to have a negligible hydrological impact (if implemented in May only) and up to a moderate hydrological impact if implemented from June onwards. The hydrological impact of the Weir Wood summer Drought Order on the Mid Medway river reach from the Eden confluence is assessed as negligible. Consequently, cumulative hydrological impacts between Weir Wood Reservoir (summer) Drought Order and the Bough Beech/River Eden Drought Permit on the Mid Medway from Eden Confluence to near Maidstone (GB106040018182) will be no greater than that relating to the Bough Beech/River Eden Drought Order if implemented in isolation.	No additional cumulative effects during summer on hydrology and ecology are anticipated.
Medway at Maidstone (GB106040018440) Medway Transitional (GB530604002300)	Weir Wood Reservoir (summer) Drought Order / River Medway Scheme (summer Stage 3) Drought Permit/ SES Water Bough Beech/River Eden Drought Order	Concurrent implementation of the Weir Wood Reservoir Drought Order (summer), the River Medway Scheme Drought Permit (summer) SES Water's Bough Beech/River Eden Drought Order would only occur during the summer period (May onwards). Impacts of the Weir Wood Reservoir summer Drought Order are negligible on lower reaches of the River Medway and the Medway estuary. Given the dominant effect of the River Medway Scheme Drought Permit on flows in the River Medway compared to the other two options, the cumulative hydrological impact is assessed as no greater than the moderate hydrological	Cumulative effects on aquatic ecology and the water environment would be slightly greater but would remain within the moderate effects assessment category assigned to the River Medway Scheme Drought Permit on its own.

Water Body	Drought management measures	Hydrological/ Hydrogeological Cumulative Effects Summary	Cumulative Environmental Effects Summary
		impact assessed for the River Medway Scheme implemented on its own.	
Chichester chalk groundwater body (GB40701G505200) and Arun Transitional water body (GB540704105000)	North Arundel Drought Order/ Portsmouth Water Chichester groundwater source Drought Permit	The Portsmouth Water Drought Permit for Chichester groundwater source may increase abstraction by 8.5Ml/d (from the licensed volume of 2.5Ml/d). Cumulative hydrogeological effects may be major as a consequence but further information is required from Portsmouth Water to provide a more accurate assessment. There may be increased groundwater level drawdown leading to reduced water levels in Swanbourne Lake, although this lake may be dry prior to any Drought Permits being implemented due to natural drought conditions, although recovery of water levels in the lake may take longer due to the Drought Permits being implemented concurrently.	Cumulative effects are uncertain but provisionally assessed as leading to increased risks to the water environment compared to the North Arundel Drought Order being implemented on its own.
Medway Transitional (GB530604002300)	River Medway Scheme Drought Permits or Order/ South East Water Halling Drought Permit	The South East Water source is located adjacent to the Medway Estuary (transitional water) and has a hydraulic connection to the Grey Pit, which overflows into the Medway Marshes. However, this overflow is known to cease in summer. The hydrological impact of this Drought Permit on the Medway estuary is assessed as negligible and therefore there is no change to overall hydrological impact of the River Medway Scheme Drought Permits/Order.	No additional cumulative risks to the water environment of the Medway estuary have been identified.
Brede (GB107040013550) Rother Transitional Water Body GB540704016100	Powdermill Drought Permit/South East Water Sedlescombe Drought Permit	The South East Water Sedlescombe Drought Permit would likely abstract from the gourndwater source and the Vinehall Stream. This could result in the loss of ~1Ml/d flowing into the Brede (the Vinehall stream is a	Concurrent implementation of both Drought Permits could increase the magnitude of adverse effects on aquatic ecology and the water environment of the River Brede from moderate to major,

Water Body	Drought management measures	Hydrological/ Hydrogeological Cumulative Effects Summary	Cumulative Environmental Effects Summary
		tributary), but there is some uncertainty as to the effect of this groundwater abstraction on river flows at times of drought. Further information is required from South East Water as to the potential effects of its Drought Permit on river flows. The additional flow reduction would not change the overall hydrological impact assessment for the Powdermill Drought Permit of major impact for the River Brede and minor impact for the Rother transitional water body.	but is unlikely to alter the impacts on the Rother estuary due to how flows to the estuary are managed in low flow conditions.

There are no other cumulative effects identified with other drought plan supply augmentation measures in other neighbouring water company drought plans:

- Bournemouth Water component of the South West Water 2017 draft Drought Plan
- Thames Water 2017 draft Drought Plan
- Wessex Water 2017 draft Final Drought Plan
- Cholderton and District Water company Drought Plan 2012

6.5.2 Water Resource Management Plans

Southern Water draft WRMP19

Southern Water issued its draft Water Resource Management Plan 2019 for public consultation in March to May 2018.

The scope for in-combination effects of the draft WMRP19 with the drought management measures included in the final Drought Plan 2019 is limited as in most cases the drought management measures will come into operation once the operation of the WRMP schemes has ceased due to abstraction licence conditions. However, the following potential in-combination, cumulative effects were identified:

There is potential for in-combination effects between the Lukely Brook, Eastern Yar Augmentation Scheme, Caul Bourne, Shalcombe, Candover Augmentation Scheme, Test Surface Water and Lower Itchen Sources, plus the Sandown temporary emergency desalination plant option and the following draft WRMP19 schemes:

- Fawley desalination
- Test Estuary WwTW industrial reuse scheme.
- Sandown WwTW indirect potable reuse scheme
- Import from Bournemouth Water

The draft WRMP19 Fawley desalination and Sandown indirect potable reuse schemes are not expected to be completed until 2027 at earliest and therefore the operation of these schemes do not overlap with the Drought Plan timeframe of 2019 to 2022. Consequently, there is no potential for operational cumulative effects during the lifetime of the Drought Plan; the potential for operational cumulative effects will be further reviewed as part of the next Drought Plan update in 2022. However, construction activities for these two schemes will potentially take place during the lifetime of the Drought Plan. The environmental assessment concluded that the Fawley desalination plant construction works would have no in-combination effects with the Sandown emergency desalination plant. The Sandown emergency desalination plant construction activity would take place on the south-eastern coastline of the Isle of Wight which is geographically remote from the Fawley construction work.

The environmental assessment concluded that the construction of the draft WRMP19 Sandown WwTW indirect potable reuse scheme and the Sandown temporary emergency desalination plant are effectively mutually exclusive as the treatment process plant would occupy the same land area.

The draft WRMP19 Test Estuary WwTW industrial reuse scheme is forecast to be operational by 2023. In-combination impacts of this draft WRMP19 scheme with the Drought Plan measures affecting the Test estuary, Southampton Water and the Solent are considered unlikely given (a) the volumes of water in Southampton Water relative to the combined abstractions under the Drought

Plan options and the draft WRMP19 scheme; (b) the hydrographic regime of Southampton Water and the Solent; and (c) the spatial distance between most of the options which are located on different estuaries/coastlines draining to the Solent/Southampton Water as applicable. Cumulative effects will however arise in spatial proximity between the Test Surface Water Drought Permit or Drought Order and the Test Estuary WwTW industrial water reuse scheme on flows from the Test Estuary to Southampton Water, but the relative reduction in flow arising from these schemes compared to the hydrographic regime and volume of water in Southampton Water is not considered to lead to any likely significant effects on these European sites.

The draft WRMP19 Bournemouth Water import scheme (abstraction from the Hampshire River Avon and new pipeline to Hampshire Southampton West Water Resource Zone) will not be constructed or operated during the lifetime of the Drought Plan

The two Drought Order options in the River Itchen catchment (Lower Itchen Sources and Candover Augmentation Scheme) may have in-combination effects with the draft WRMP19 schemes to further increase bulk supplies from Portsmouth Water and works to provide greater supply interconnections within south Hampshire. The only potential effects of the draft WRMP19 schemes on the SAC is during construction work to lay pipelines but these effects are unlikely to be greater than of minor residual effects after taking account of mitigation measures.

The WRMP scheme for carrying out in-stream river restoration works on the Lower Itchen will have cumulative beneficial effects with the Lower Itchen Drought Order and Candover Drought Order options on the River Itchen SAC.

Cumulative effects may potentially arise between the Pulborough and North Arundel Drought Permits/Orders and the Littlehampton emergency desalination plant with two draft WRMP19 schemes: the Pulborough winter transfer scheme and the Littlehampton water reuse scheme. The draft WRMP19 schemes are not expected to be completed until 2027 at earliest and therefore operationally do not overlap with the Drought Plan timeframe of 2019 to 2022. There is no likely in-combination construction effects between the Littlehampton temporary emergency desalination plant and the Littlehampton water reuse scheme as they are effectively mutually exclusive as the treatment process plant would occupy the same land area. Consequently, there is no potential for cumulative effects during the lifetime of the Drought Plan; the potential for cumulative effects will be further reviewed as part of the next Drought Plan update in 2023.

There is the potential for cumulative beneficial effects between the river restoration options for River Test and River Itchen (for implementation from 2018 onwards, incorporating agreed mitigation measures under the s20 agreement) with the Test Surface Water Drought Permit/Order and the Lower Itchen sources Drought Order by helping improve the environmental resilience of these rivers to abstraction at times of low river flows.

Cumulative effects may potentially arise between three Southern Water Drought Order/Permit options (Faversham sources, Weir Wood Reservoir, River Medway Scheme) and the Sheerness emergency desalination plant together with the draft WRMP19 Medway reuse scheme (joint Southern Water and South East Water proposed scheme). However, the Medway reuse scheme is not due to be implemented until at least 2027, which is beyond the lifetime of the Drought Plan 2019. Consequently, no cumulative effects are anticipated. No construction-related cumulative effects would arise due to construction activities for the Medway reuse scheme and the Sheerness emergency desalination plant construction (if required) due to the spatial distance between the construction sites.

Other Water Company Draft Water Resource Management Plans (WRMPs) 2019

The information used to carry out these assessments is considered to be the most up to date information available at the time of finalising the revised draft Drought Plan (June 2018).

All of the neighbouring water companies to Southern Water have published draft 2019 WRMPs which have been examined along with outputs of a Water Resources South East Group (WRSE) environmental assessment project. The WRSE group includes six south east water companies (Affinity Water, Portsmouth Water, South East Water, Southern Water, SES Water and Thames Water). The purpose of the project was to input to the development of long term best value plans for securing water supplies in the south east. Since 2016 the WRSE has been working to improve the approach to undertaking cumulative effects assessment for WRMP options developed by neighbouring water companies in the South East of England.

The latest piece of work aimed to identify the potential for cumulative effects between the six WRSE water companies, to support their WRMP19 and related SEAs in a regional context. It provided a unique opportunity for communication between the six water companies and sharing of respective Draft WRMP19 geographical information.

Information sharing facilitated through WRSE together with the information contained in the published draft WRMP19 strategies highlighted the following draft WRMP19 schemes that required in-combination assessment:

a) joint Southern Water / South East Water Medway water reuse scheme: the potential for in-combination cumulative effects of this scheme are the same as those already identified above under the Southern Water draft WRMP19 assessment

b) three groundwater options included in the Affinity Water draft WRMP19 feasible list would involve increased abstraction from the East Kent Chalk - Stour WFD groundwater body together with the Southern Water North Deal Drought Permit option may lead to increased pressure on this groundwater body but, in view of the temporary effects of the Drought Permit, operational effects during the lifetime of the Drought Plan are considered to be no greater than a minor adverse cumulative effect.

For other water companies outside of the WRSE group, but neighbouring Southern Water (Bournemouth Water (part of South West Water), Cholderton and District Water and Wessex Water), the review of published draft WRMP19 strategies have indicated no potential in-combination likely significant effects on any European sites with the final Drought Plan.

Bournemouth Water's draft 2019 WRMP scheme to provide a bulk supply to Southern Water's Western operational area has already been discussed above and has no likely in-combination effects with drought plan measures.

As such, no cumulative effects are anticipated in relation to the WRMPs of these other three water companies.

6.5.3 Other Plans and Projects

Environment Agency National Drought Plan

Assessment of the potential for cumulative impacts of supply side and Drought Permit/Order options with drought options listed in the Environment Agency national Drought Plan[14] has been undertaken. The information used to carry out these assessments is considered to be the most up to date information available at the time of writing, but the assessments should be reviewed at the time of drought option implementation to ensure that no changes to the Environment Agency Drought Plan have been made in the intervening period, and that the assessment, therefore, remains valid.

Part of the Environment Agency's role is to reduce the impact of drought on the natural environment by taking specific actions. They can apply for environmental Drought Orders if the environment is suffering serious damage because of abstraction during a drought. The plan confirms that the Environment Agency would work with stakeholders, including water companies, to identify where and when it would be necessary to take actions to protect the environment and its potential effects on any essential public supplies or infrastructure. The Environment Agency can restrict spray irrigation during periods of drought which would have a cumulative beneficial effect alongside Southern Water's demand management measures. No cumulative adverse effects have been identified with Southern Water's supply augmentation options.

River Basin Management Plans (RBMP) (Thames River Basin District and South East River Basin District Plans)

Assessment of the potential for cumulative effects with these River Basin Management Plans (RBMPs) has been undertaken. The information used to carry out these assessments is considered to be the most up to date information available at the time of writing, but the assessments should be reviewed at the time of drought option implementation to ensure that no changes to the River Basin Management Plans have been made in the intervening period, and that the assessment, therefore, remains valid.

The 2015 Thames and South East RBMPs describes the planned steps to implement the measures required to achieve the environmental objectives of the Water Framework Directive (WFD). They provide the framework for protecting and enhancing the water environment. The SEAs[15,16] of the RBMPs determined that the plan was likely to have significant positive effects on the environment, particularly in respect of biodiversity, water, population and human health and that any local negative effects would expect to be mitigated during implementation. Therefore, there will be **no cumulative impacts** between the Thames or South East RBMPs and the Southern Water's Drought Plan measures.

Canal & River Trust Water Resources Strategy 2015–2020

The Canal & River Trust Water Resources Strategy[17] sets out the vision for how it intends to manage water resources across its network through to 2050. It contains the Trust's planned actions over the next five years relating to the canal network. The Kennet and Avon Canal hydrological unit partially overlaps with Southern Water's Drought Plan area. However, the main actions for the strategy are to undertake a range of modelling scenarios for the hydrological units in order of preference. Specific restoration projects or other canal developments are not detailed, however Strategic Action 4 states that appropriate water resource assessments will be undertaken aiming for "no net impact on long term water resource levels of service."

14 Environment Agency (2015). Drought response: our framework for England. June 2015.
15 Environment Agency (2016) The River basin management plan for the Thames River Basin District Strategic Environmental Assessment: Statement of Particulars Updated December 2015. https://www.gov.uk/government/collections/river-basin-management-plans-2015
16 Environment Agency (2016) The River basin management plan for the South East River Basin District Strategic Environmental Assessment: Statement of Particulars Updated December 2015. https://www.gov.uk/government/collections/river-basin-management-plans-2015
17 Canal & Rivers Trust (2015) Putting the water into waterways: Water Resources Strategy 2015-2020.

No cumulative impacts between the Canal & River Trust Water Resources Strategy and the drought management measures included in Southern Water's final Drought Plan have been identified.

At the time of writing (March 2017), the Canal & River Trust had not published its Drought Plans in the public domain.

Cumulative effects with identified relevant strategic level projects

There are a number of infrastructure priorities identified in regional and local planning documents in addition to national programmes. These include the improvement of existing infrastructure by extension, redevelopment or increasing existing capacity. With regard to other projects that may result in a cumulative effect with the Southern Water final Drought Plan, those considered to be **relevant at the strategic level** comprise large scale high profile infrastructure schemes and particularly those that may affect water flows or groundwater levels in the same catchments as those affected by the Drought Plan. These projects comprise:

- Lower Tidal Arun flood risk management scheme – The scheme was formally approved in March 2014 by the Environment Agency and is outlined to manage flood risk in the Arun Valley, from Pallingham Weir to Littlehampton. The scheme consists of a range of measures and recommends maintaining and enhancing many existing flood defences and providing some new ones in strategic locations. The new defences however do rely on funding, so it is anticipated that construction will be staggered. In the more rural areas, it is recommended to work with natural processes and increase landowner involvement in decisions. Consultation is in the early stages and the work is expected to be carried out by developing a strategic approach, over the next 100 years[18]. As the Lower Tidal Arun flood risk management scheme is currently in its early stages, it is not expected to be in operation at the same time as Southern Water's Drought Plan (2019-2022) and the operation of the Pulborough Drought Order. Therefore**, no cumulative impacts** are predicted.
- Leigh flood storage area – The Leigh Barrier is an existing flood storage area to protect properties and 300 business in the town of Tonbridge in Kent (River Medway)[19]. The Leigh Barrier is due to be upgraded to increase its storage capacity by a further 30%. This was originally programmed for 2035; however, it is anticipated to be completed sooner, should appropriate funding be secured. It is therefore not expected to be in operation at the same time as Southern Water's Drought Plan (2019-2022) and therefore **no cumulative impacts** are predicted. It is however considered unlikely that construction or operation of the scheme would lead to cumulative effects with the Southern Water Drought Plan.

Other current National Infrastructure projects listed for the South East[20] are considered too distant from the Drought Plan management measures and the respective zones of hydrological influence to result in any cumulative effects.

Cumulative effects on landscapes

The measures contained in the final Drought Plan do not lead to the permanent construction of any assets - all assets required are temporary in nature and therefore would not have permanent landscape or visual amenity effects. We have identified a small number of potential cumulative temporary effects on landscape that could potentially materialise if a drought arises over the period covered by the Drought Plan (2019-2022) and coincides with construction activities of some of Southern Water's draft WRMP 2019 schemes. There is a potential for cumulative temporary adverse effects arising from construction of the Candover Augmentation Scheme Drought Order temporary

18https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/307894/Lower_Tidal_River_Arun_final_strategy_report.pdf
19 https://www.gov.uk/government/publications/leigh-flood-storage-area/leigh-flood-storage-area
20 https://infrastructure.planninginspectorate.gov.uk/projects/south-east/

pipeline near to (and, for a small section, within) the boundary of the South Downs National Park and within the River Itchen SSSI and SAC concurrent with construction activities associated with laying of new treated water pipelines to better integrate the water supply system in Hampshire, including additional bulk water supplies from Portsmouth Water.

There is a risk of cumulative adverse landscape effects between the North Arundel and Portsmouth Water "Source S" Drought Permits in their combined effect on surface water features in the vicinity of Arundel Park.

The final Water Resources Management Plan (WRMP) 2019 – currently being developed – will consider further the potential for cumulative effects on the landscape between those schemes included in that plan and those included in neighbouring water company WRMP and drought plans. Southern Water will work with neighbouring companies through the Water Resources South East Group, Natural England and with relevant Protected Landscape Officers to develop a Protected Landscape Mitigation Strategy for each AONB and/ or National Park which could be affected by multiple schemes in the lifetime of the Drought Plan and WRMP, and this will support subsequent, more detailed development of the relevant schemes.

Cumulative effects with Shoreline Management Plans

Shoreline Management Plans provide a policy context for shoreline / coastal zone management and development. The following Shoreline Management Plans are available within the public domain and were considered for in-combination impacts:

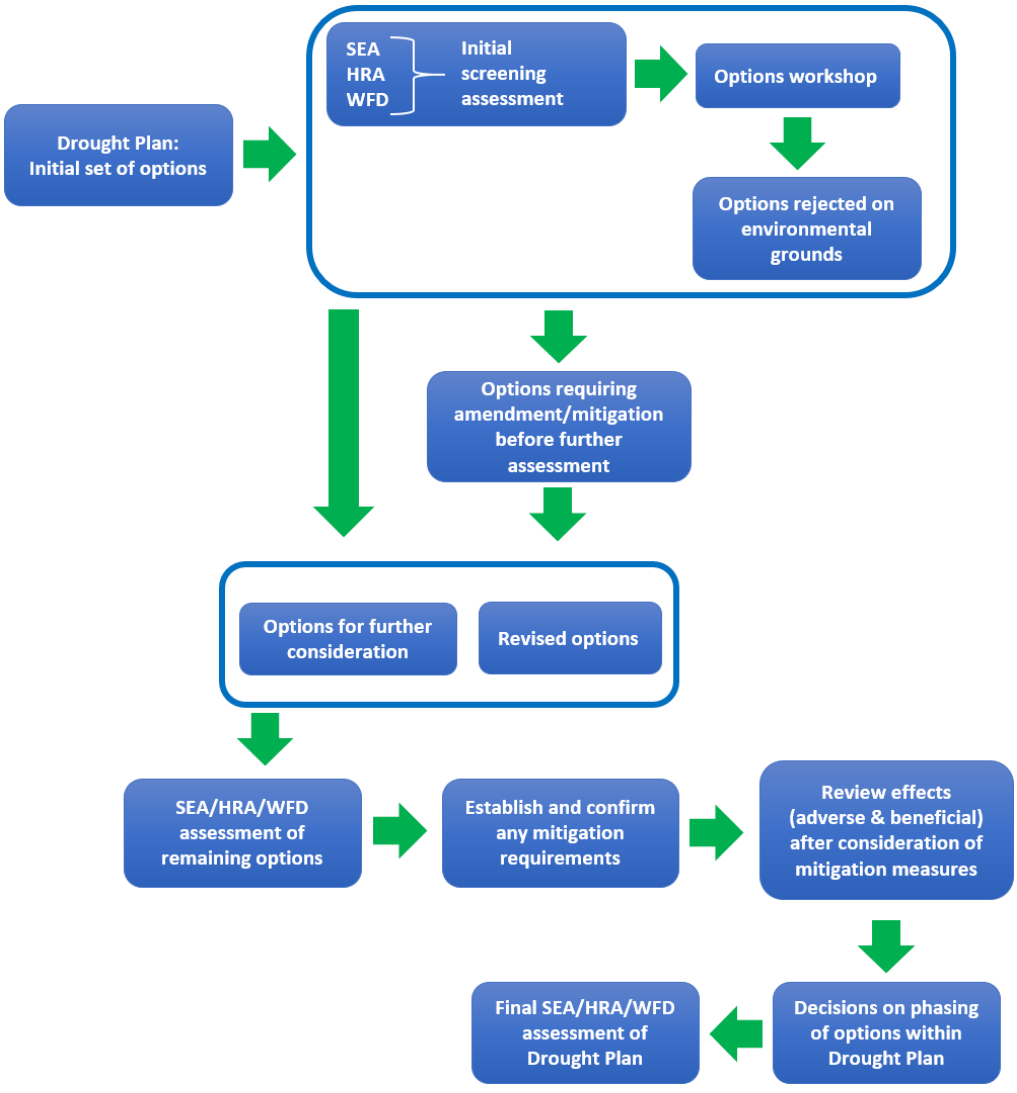
- SMP 9 The Medway Estuary and Swale
- SMP10 Isle of Grain to South Foreland.
- SMP 11 Beachy Head to South Foreland
- SMP 12 Beachy Head to Selsey Bill (South Downs)
- SMP 13 Hurst Spit to Selsey Bill (North Solent)
- SMP 14 Isle of Wight
- SMP 15 Durlston Head to Hurst Spit (Poole & Christchurch Bays)

The assessments for any potential in-combination impacts between these plans and the measures contained Southern Water's Drought Plan (2019-2022) were considered with regards to spatial proximity and/or hydrological and/or hydrographical connectivity. No in-combination likely significant effects were identified in respect of the policies set out in the plans. Measures put forward in the Isle of Wight Shoreline Management Plan included the proposed creation of a 30.9Ha compensatory habitat of coastal grazing marsh for the Solent and Southampton Water Ramsar site. Such a measure could be considered to have a minor beneficial in-combination effect. The potential for in-combination effects would need to be reviewed again for an application-specific HRA against the latest version of the relevant Shoreline Management Plan if any options with the potential to affect the coastal zone were needed in a future drought event, in dialogue with the Environment Agency, local planning authority and/or other relevant statutory bodies and stakeholders.

7 Role of the SEA in developing the draft Drought Plan

The SEA, along with the findings of the HRA and WFD assessment, have been used to help inform the development of the Drought Plan, and enable the consideration of reasonable alternative options for inclusion in the plan and/or alternative phasing of implementing the different options. The process followed is summarised in **Figure 7-1.**

Figure 7.1 Option assessment process with SEA, HRA and WFD considerations



In summary, the application of these processes, together with the development of Environmental Assessment Reports (EARs) for Drought Permits and Orders, has:

- Informed dialogue with the Environment Agency and Natural England as to the options to be included in the Drought Plan and their sequencing in relation to the Drought Plan to reflect their environmental or social effects (see Annex 4 of the Drought Plan for the sequencing of Drought Permit and Drought Order implementation)

- Identified a small number of options that have been excluded from the Drought Plan where this is feasible (taking account of our supply duties) due to environmental concerns, including some drought management options on the Isle of Wight (for example, a Drought Permit for the Rookley source) and in Hampshire (for example, options to develop new satellite boreholes associated with existing licensed sources)
- Identified a number of HRA risks with which has either led to:
    a) the option being modified and/or additional mitigation measures being included to address these risks to ensure no adverse effects on any designated European sites (for example, the provision of mitigation measures for the Caul Bourne, Shalcombe, Eastern Yar augmentation scheme Drought Orders and Darwell Drought Order as described in Annex 11 – HRA Report).
    b) the option being retained in the Drought Plan with consideration of Imperative Reasons of Over-riding Public Interest (IROPI) after demonstrating there are no other feasible alternative options available in severe drought: Candover Augmentation Scheme and the Lower Itchen sources Drought Orders only
- Identified risks in relation to temporary deterioration to WFD status for some of the water supply augmentation options and consideration of mitigation measures (for example, for the Bewl Water reservoir / River Medway Scheme Stage 4 Drought Permit)
- Identified various environmental impacts through the SEA process for some of the supply-side options (including Drought Permit / Order options), mainly on the water environment and associated aquatic habitats, flora and fauna
- Identified where additional environmental baseline monitoring, studies or data are required to better understand the potential environmental risks relating to implementation of various drought plan measures, both to support future drought management planning and during an actual drought event (see Annex 5 of the Drought Plan)
- Identified potential mitigation measures to address identified environmental effects of various Drought Plan measures to reduce the risks of the effects arising during a drought (see Annex 5 of the Drought Plan)
- Identified no impacts of the demand-side measures sufficient to exclude any options on environmental grounds, but noting that two options are likely to have major adverse effects on human health and safety, economic activity and livelihoods:
    a) those water use restrictions to be implemented under the Phase 2 Temporary Use Ban powers and Phases 1 and 2 of the Non-Essential Use Ban Drought Order that impact on small businesses that are entirely dependent on using water; and
    b) an Emergency Drought Order to ration essential supplies by use of standpipes or rota cuts.

  Consequently, the more onerous water use restrictions are only planned to be introduced when the Severe Drought stages are reached, whilst the Emergency Drought Order is only included as a 'last resort' option in a civil emergency (i.e. in conditions that are worse than a 1 in 500 year drought), as set out in Annex 1. Conversely, the Phase 1 Temporary Use Ban would normally be implemented before the implementation of Drought Permits/Orders, although this may not be the case for a winter Drought Permit/Order given the negligible demand savings that would be achieved.

In particular, the phasing of some of the Drought Permits and Orders was modified during the development of the plan due to the findings from the environmental assessments:

- The reduced MRF drought permit options for Darwell were amended to be set against the Severe Drought stage trigger for Sussex Hastings WRZ. The MRF reduction options would also be phased such that the option with the greatest environmental impact is phased last.
- For the Pulborough surface water Drought Permit/Order options, the MRF reductions on the River Rother have been phased according to environmental impact, with the 10Ml/d MRF

reduction option set against the Drought stage trigger and the other two options set against the Severe Drought stage trigger.

- The Drought Permit for Powdermill reservoir to reduce the MRF for the River Brede abstraction has been changed from the Drought stage to the Severe Drought stage trigger in view of the assessed scale of the environmental effects.
- Bewl Water reservoir / River Medway Scheme Drought Permits / Order have been separated into different stages linked to different drought severity triggers to reflect the differences in environmental impact. A first stage of the Drought Permit with the least adverse environmental effects has been set against the Drought stage trigger. The remaining three stages of this option were amended so that they are triggered in the Severe Drought stage and phased such that the stage with the greatest environmental effects is only considered in the most severe droughts.
- The East Worthing Drought Permit trigger was amended to the Drought stage rather than Severe Drought stage so as to help minimise the need for the North Arundel Drought Order (Severe Drought stage trigger) in Sussex Worthing WRZ which has greater environmental effects.
- Environmental assessment of the temporary emergency desalination measures was used to determine the phasing of these measures relative to the Drought Order/Permit measures under the Severe Drought Conditions triggers taking account of the relative environmental impact. The Sheerness emergency desalination plant has the greatest environmental risks of the three desalination options and would be phased for introduction only after implementation of the River Medway Drought Permits (Stages 1 to 3), but before the River Medway Drought Order (Stage 4).
- The Lower Itchen sources Drought Order and Candover Augmentation Scheme Drought Order are only to be used in a severe drought and only after all other options for providing additional water supplies to the Hampshire Southampton East WRZ have been implemented.
- The Emergency Drought Order to supply water by rota cuts or standpipes has been shown to have major adverse effects on population and human health and is only considered for use in very extreme drought conditions under civil emergency measures.

Overall, the main principle in phasing the drought plan measures is to minimise the environmental and social effects as identified by the SEA, HRA and WFD assessments and Environmental Assessment Reports for each Drought Permit/Order option. The precise phasing during a drought will take into account the prevailing environmental conditions informed by the in-drought monitoring activities set out in Annex 5 of the Drought Plan. These principles are reflected in Annex 1 to the Section 20 Operating Agreement between the Environment Agency and Southern Water signed on 29 March 2018 in relation to the implementation of the Test surface water Drought Permit and Drought Order, Candover Augmentation Scheme Drought Order and Lower Itchen sources Drought Order. Aquatic environmental monitoring of prevailing drought conditions in the River Test and River Itchen will be used to help inform the final sequencing of Drought Order implementation in any future drought event, as well taking account of Southern Water's supply duties.

The S 20 Agreement also sets out the required sequencing of water use restrictions relative to the Drought Permit and Drought Orders and their environmental effects. Level 1 and Level 2 (Temporary Use Ban Phase 1) water use restrictions are required to be in place before implementation of the Test Surface Water Drought Permit. A Drought Order application must be made to the Secretary of State to authorise partial Non-Essential Use Ban (NEUB) restrictions (Level 3, Phase 1 NEUB restrictions) before implementing any of the supply side Drought Orders. Level 3, Phase 2 restrictions (for Temporary Use Bans and NEUB) are to be implemented when river flows in the River Itchen fall below 200Ml/d at Allbrook & Highbridge (subject to the Drought Order authorising the NEUB restrictions having been granted).

We have therefore taken the environmental assessments into account in selecting the drought plan options in order to seek to minimise the likelihood of significant adverse environmental effects. However, the Drought Plan must also ensure that essential water supplies can be maintained to customers in line with our statutory supply duties. Wherever feasible, we have either excluded measures that may have significant adverse environmental effects or have phased these measures so that they would only be implemented in a severe drought. However, the Drought Plan has included two Drought Orders where it is not possible to rule out adverse effects on the River Itchen SAC: the Candover Augmentation Scheme and Lower Itchen sources Drought Orders. These are necessary measures to include in the Drought Plan due to recent agreed changes to the abstraction licence conditions for the River Test and River Itchen water sources, which reduce the reliable volume of supply available in drought. Specific environmental mitigation and compensation packages have been agreed for each of these Drought Orders. Southern Water's recent draft WRMP19 includes a strategy to reduce the need for these Drought Orders in the medium term by developing new water resources in parallel with continuing the actions to reduce leakage and customer water consumption.

Mitigation measures are also set out for other drought plan measures to reduce the residual effects on the environment where adverse effects have been identified.

8 Mitigation and Monitoring

8.1 Overview

Key stages of the SEA process include Task B5: Mitigating adverse effects and Task B6: Proposing measures to monitor the environmental effects of implementing a plan or programme, as well as Stage E: Monitoring the significant effects of the plan or programme on the environment. The sections below describe how these tasks have been or will be addressed, as applicable, and how Southern Water intends to ensure that monitoring of potential effects is carried out and the appropriate mitigation measures are implemented for any adverse effects identified.

The final Drought Plan includes specific monitoring and mitigation packages and implementation timetables for the Test Surface Water Drought Permit and Drought Order, Candover Augmentation Scheme Drought Order and Lower Itchen sources Drought Order which have been developed and agreed with the Environment Agency and Natural England as part of the Hampshire Abstraction Licences Public Inquiry process. The agreed monitoring and mitigation packages are incorporated into the S 20 Agreement and have been included in Annex 5 of the final Drought Plan. The S20 Agreement forms an integral component of the statutory Drought Plan, with cross-referencing to the Drought Plan throughout the S 20 Agreement. All relevant provisions have informed the final Drought Plan and they have been assessed in an integrated manner within this SEA Environmental Report, and accompanying HRA and WFD Assessment Reports (Annex 11 and 13, respectively).

8.2 Mitigation Measures

Mitigation may be defined as a measure to limit the effect of an identified significant impact or, where possible, to avoid the adverse impact altogether.

Consideration of mitigation measures has been an integral part of the SEA process and has informed development of the final Drought Plan. The SEA appraisals set out in Sections 5 and 6 above have been based on the assessment of residual impacts, i.e. those impacts likely to remain after the implementation of identified mitigation measures. Certain assumptions have been made regarding mitigation in carrying out the assessments, notably:

- Where suitable specific mitigation measures have been identified (e.g. as informed through the Environmental Assessment Reports for Drought Order/permit options and other assessments of drought management measures), these have been taken into account, such that the resultant residual impact has been determined in this SEA;
- In line with recommendations made in the UKWIR SEA Guidance[21], the SEA appraisals have assumed the implementation of reasonable mitigation measures, such as the use of good construction practice (where this is relevant) and operation of water sources in line with regulatory requirements.

During implementation of a specific drought management measure, appropriate monitoring will be undertaken to track any potential environmental and/or social effects which will, in turn, trigger deployment of suitable and practicable mitigation measures as may be available.

For supply-side management measures, the likely mitigation measures are summarised in the final Drought Plan at Annex 5: Environmental Monitoring Plan. In some cases, for example derogation to

21 UKWIR (2012) Strategic Environmental Assessment and Habitats Regulations Assessment of Drought Plans (UKWIR Project WR/02/A).

water abstraction rights, the Water Resources Act 1991 (as amended) provides for compensation where mitigation of adverse effects cannot be achieved. For the Candover Augmentation Scheme Drought Order, Lower Itchen sources Drought Order and Test Surface Water Drought Permit and Order, specific mitigation packages have been developed and agreed with the Environment Agency and Natural England for delivery in advance of Drought Permit / Order implementation to improve the drought resilience of the River Test and River Itchen, reflecting the environmental sensitivity of these important chalk rivers. Further details are provided in Annex 5 of the Drought Plan. Compensation measures, as defined under the Habitats Directive, have also been developed for the Lower Itchen sources and Candover Augmentation Scheme Drought Orders, as set out in Annex 11 of the Drought Plan.

In relation to the potential impacts of demand-side measures, more detail is provided in the final Drought Plan at Annex 3: Demand interventions which has incorporated details from the Water UK and UK Water Industry Research Code of Practice for water companies and stakeholders on the use of water restrictions[22]. The code of practice sets out the statutory and universal exemptions offered by all companies to Temporary Use Bans and Drought Orders. The company has a policy defining which exemptions it will offer in addition to this and this is included in Annex 3 of the final Drought Plan. It should be noted that Southern Water's customers are not legally entitled to compensation in respect of loss or damage sustained as a result of the implementation of Temporary Use Bans or a Non-Essential Use ban Drought Order.

8.3 Monitoring Requirements

Monitoring is required to track the environmental effects to show whether they are as predicted, to help identify any adverse impacts and trigger deployment of mitigation measures.

The final Drought Plan includes a basket of measures that will only be implemented if and when required depending on the occurrence of a drought event over the 5-year life of the plan; consequently, the actual impact of the plan is subject to some uncertainties. Monitoring of the impact from implementation of any of the measures included in the plan will be focused on those measures where moderate or greater environmental or social effects have been identified in this SEA and associated HRA, WFD and environmental assessment reports (as applicable).

For supply-side measures, an Environmental Monitoring Plan (EMP) has been produced to accompany the final Drought Plan (Annex 5; Environmental Monitoring Plan), setting out the monitoring requirements for each measure during the onset of drought, during implementation of drought plan measures and post-drought. This includes appropriately targeted monitoring of ecological, physical environment, heritage, recreational, navigation and landscape features. The EMP also sets out various baseline monitoring requirements to improve the environmental evidence for future assessment and to compare any drought plan impacts against. This additional baseline evidence will, in turn, help inform the SEA of the next Drought Plan.

For the Candover Augmentation Scheme Drought Order, Lower Itchen sources Drought Order and Test Surface Water Drought Permit and Order, the specific baseline monitoring measures developed and agreed with the Environment Agency and Natural England will aid further understanding of the potential effects of these drought plan measures on the sensitive environments of the River Test and River Itchen. This will help target the mitigation measures referenced earlier and reduce the uncertainties surrounding the assessment of environmental effects of the Drought Permit and Drought Order options for these two important chalk rivers. Further details are provided in Annex 5 of the Drought Plan.

[22] Water UK/UKWIR (2014) Managing Through Drought: Code of Practice and Guidance for Water Companies on Water Use Restrictions - 2013 (UKWIR Project14/WR/33/6)

Monitoring for the Test Surface Water Drought Permit and Drought Order will help reduce the uncertainty about possible risks of WFD status deterioration risks from implementing these measures. Should the monitoring indicate that WFD status deterioration may arise, Article 4(6) of the Directive details the circumstances in which temporary deteriorations do not amount to breaches of the requirements of the Directive. Within the S20 Agreement, the Environment Agency agreed that:

(a) Article 4(6) of the Water Framework Directive can be used in principle to enable the grant of a Test Surface Water Drought Permit authorising abstraction; and

(b) Low flows on the River Test of between 355Ml/d and 265Ml/d are capable of constituting exceptional circumstances for the purposes of Article 4(6) of the Water Framework Directive.

Drought Orders are determined by the Secretary of State, and while not wanting to fetter the Environment Agency's discretion, it is presumed by Southern Water that on the basis of this principle having been agreed with the Environment Agency for a Drought Permit application, the Environment Agency would support (or at least not oppose) this principle being presented by Southern Water in any Test Drought Order application to the Secretary of State; and that low flows on the River Test of between 265Ml/d and 200Ml/d may equally be capable of constituting exceptional circumstances for the purposes of Article 4(6) of the Water Framework Directive.

It is acknowledged that acceptance of this principle in a Test Surface Water Drought Order application would be at the discretion of the Secretary of State. Southern Water would seek to secure the support of the Environment Agency prior to submission of a Test Drought Order as part of its pre-application consultations.

In relation to demand management measures, it is recommended that monitoring of customer impacts is carried out during and after the implementation of any demand management measures to assess their effectiveness and confirm the effects predicted in this Environmental Report. This is likely to take the form of structured surveys with a statistically valid sample of household and/or non-household customers, as applicable. UK Water Industry Research (UKWIR) guidance[23] is available on assessing the effectiveness and impact of water use restrictions on customers.

[23] UKWIR (2014) Understanding the Impacts of Drought Restrictions (UKWIR Report 14/WR/01/13)

9 Quality Assurance

ODPM Guidance on SEA contains a Quality Assurance checklist to help ensure that the requirements of the SEA Directive are met. The checklist is reproduced in **Appendix E**, demonstrating how this Environmental Report meets the requirements.