

Anglian Water - Water Resources Management Plan

Habitats Regulations Assessment - Task I:
Screening

December 2019

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Issue and revision record

Revision	Date	Originator	Checker	Approver	Description
A	11.07.17	Roisin Ni Mhathuna Laura Kor Charlotte Johnson	Iain Bray	Sally Watson	First Draft for Client Comment <i>draft</i> WRMP
B(i)	27.07.17	Roisin Ni Mhathuna	Nicola Levy	Sally Watson	For Consultation (incorporating client comments) <i>draft</i> WRMP
B(ii)	18.09.17	Roisin Ni Mhathuna	Iain Bray	N/A	First Draft (after NE/EA comments) <i>draft</i> WRMP
B(iii)	30.10.17	Roisin Ni Mhathuna	Iain Bray		Rev C Draft (after full stakeholder consultation) <i>draft</i> WRMP
C	12.12.17	Laura Kor	Iain Bray Roisin Ni Mhathuna	Sally Watson	First Issue for submission with <i>draft</i> WRMP (including 18 new options since Rev B(ii)) DRAFT for EA Audit Purposes Only
D	20.12.17	Ben Shields	Nicola Levy	Sally Watson	Final for Issue <i>draft</i> WRMP
E	09.03.18	Ben Shields	Nicola Levy	Sally Watson	Final for Publication <i>draft</i> WRMP
F	14.08.18	Roisin Ni Mhathuna Amy Anderson	Celia Figueira Nicola Levy Alison Carruthers	Sally Watson	Issue following consultation for final client review final WRMP
G	07.09.18	Roisin Ni Mhathuna Amy Anderson	Nicola Levy	Sally Watson	Final for Publication Final WRMP
H	02.12.19	Kirsty McConnell	Paul Renshaw	Nicola Levy	Final for Publication for client updates

Document reference: 374161 | 001 | H

Information class: Standard

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Abbreviations

Acronym

AA	Appropriate Assessment
ASR	Aquifer Storage Recovery
DCLG	Department for Communities and Local Government
EA	Environment Agency
EBSD	Economics of Balancing Supply and Demand
HRA	Habitats Regulations Assessment
IROPI	Imperative Reasons for Overriding Public Interest
LA	Local Authority
LDF	Local Development Framework
LNR	Local Nature Reserve
LPA	Local Planning Authority
LSE	Likely Significant Effects
NE	Natural England
NEP	National Environment Programme
RoC	Review of Consents
RZ	Resource Zone
SAC	Special Area of Conservation
SCI	Site of Community Importance
SEA	Strategic Environmental Assessment
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
ToLS	Test of Likely Significance
UK	United Kingdom
UKWIR	United Kingdom Water Industry Research
WFD	Water Framework Directive
WR	Water Resource
WRC	Water Recycling Centre
WRMP	Water Resource Management Plan
WRPG	Water Resource Planning Guidelines
WRTW	Water Reuse Treatment Works

Non-Technical Summary

Anglian Water Services (Anglian Water) is required to prepare and publish a Water Resources Management Plan (WRMP). The purpose of the WRMP is to set out a minimum 25-year strategy for managing water supply and demand within the Anglian Water region.

In accordance with European Directive 2001/42/EC on the conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive') and the resulting Conservation of Habitats and Species Regulations 2017, a Habitats Regulations Assessment (HRA) is required to assess the potential impact of plans and programmes to ensure that there will not be any 'likely significant effects' (LSE) on sites of European nature conservation importance. This report presents the results of the first task of the HRA process, the Task I: Screening (or Test of Likely Significance).

Development of the WRMP

As part of the WRMP development process Anglian Water undertook modelling to identify areas with a surplus or deficit of water supply. For areas with deficits, Anglian Water developed a range of options for maintaining the supply demand balance: demand management options – options that will reduce the demand for water including metering, water efficiency, and leakage reduction and supply options – options that will provide a water supply to customers including transfers, maximising existing resources, trading, and new resources. The WRMP is a mix of these two broad categories. The WRMP also includes National Environmental Programme options. The NEP is a list of environmental improvement schemes that ensure that water companies meet European and national targets related to water.

Mott MacDonald undertook a high-level environmental screening exercise of the 'unconstrained' options list, which included a high-level assessment of potential effects on European sites and resulted in the rejection or amendment of certain options to produce the WRMP 'constrained' options list. The constrained list was then subject to a feasibility study to produce a set of options considered to be suitable to take forward for assessment as part of the draft WRMP called the 'feasible list' of options. A HRA Task I: Screening assessment (March 2018) identified 56 of the feasible list options with potential to result in Likely Significant Effects.

WRMP Development

Anglian Water has adopted a planning approach that uses least-cost optimisation as well as broader criteria to develop a Best Value Plan (Preferred Plan) which takes account of 'best value' decision making criteria:

- Cost to build and operate the plan
- Adaptability and flexibility of the plan to cope with uncertain future needs
- Alignment to the Water Resource East regional strategy
- Resilience of the plan to severe and extreme drought and other hazards, and the residual risks
- Deliverability of the plan with timescales needed to manage risks
- Alignment to customer preferences
- Environmental and social impacts of the plan, including net environmental benefit

Demand management is a priority for Anglian Water. In developing the WRMP, Anglian Water has first considered what risk could be offset from demand management, before seeking to develop supply-side options. Despite the ambitious demand management strategy, the scale of the challenge is such that carefully targeted investment in supply-side capacity is still required. The supply-side options considered for inclusion in the WRMP have been developed following industry and regulator guidance.

The Preferred Plan provides the best value for customers in the long term. The strategy:

- Prioritises demand management, which aligns with customers' expectations
- Recognises the environmental benefits of demand management, such as offsetting treatment and pumping costs and carbon
- Challenges Anglian Water and its customers to push the boundaries of what is achievable, with respect to levels of future consumption
- Maximises the use of existing resources before developing new ones
- Provides future flexibility over the location and type of new resource inputs
- Delivers significant additional resilience across the region both to drought and non-drought events (e.g. freeze-thaw)
- Delivers environmental benefits, by reducing abstraction from the environment and ensuring no deterioration in the ecological status of water bodies in the region

The WRMP include an adaptive strategy to deal with uncertainties and future scenarios that will mean further investment is required (e.g. further future sustainability reductions). In some cases, there may not be a long lead time to implement schemes and therefore Anglian Water need to develop a plan which identifies thresholds beyond which they need to take further action. The potential options identified as part of the adaptive strategy have been assessed as part of the SEA. It should be noted that at this stage these are strategic supply side options that may be required in the future. They do not form a definitive list of options.

WRMP

The WRMP is likely to have an overall positive effect on delivering reliable and sustainable water supplies that are flexible to cope with future changing growth and demand. Two options within the WRMP were assessed as having Likely Significant Effects on European sites: ESU1 Felixstowe Desalination and SHB2 Pyewipe Water Reuse for non-potable use. These options will be assessed further at the Task II: Appropriate Assessment stage for their potential residual effects on the integrity of the Outer Thames Estuary, the Stour and Orwell Estuaries, the Deben Estuary SPA (ESU1) and the Humber Estuary (SHB2).

Option ref.	Option name	WRZ	Potential for Significant Effects on a European Site?
-	Demand Management Strategy Extended Plus	All	No
BHV5	Newmarket RZ to Bury Haverhill RZ Transfer (20Ml/d)	Bury Haverhill	No
CLN13a	South Humber Bank RZ to Central Lincolnshire RZ Transfer (31Ml/d)	Central Lincolnshire	No
CLN14	South Humber Bank RZ to Central Lincolnshire RZ Transfer (6Ml/d)	Central Lincolnshire	No
CLN15	South Humber Bank RZ to Central Lincolnshire RZ Transfer (Existing)	Central Lincolnshire	No
CLN16	South Humber Bank RZ to Central Lincolnshire RZ Transfer	Central Lincolnshire	No
ELY9	North Fenland RZ to Ely RZ Transfer (20Ml/d)	Ely	No
CVY1	Newmarket RZ to Cheveley RZ Transfer	Cheveley	No
ESU1	Felixstowe Desalination	East Suffolk	Yes – Stour and Orwell Estuaries SPA Deben Estuary SPA
ESU8	Bury Haverhill RZ to East Suffolk RZ transfer (20Ml/d)	East Suffolk	No
HPB1	Norwich & the Broads RZ to Happisburgh RZ Transfer	Happisburgh	No

Option ref.	Option name	WRZ	Potential for Significant Effects on a European Site?
HPB2	Norwich & the Broads WRZ to Happisburgh Transfer (East Ruston/Witton)	Happisburgh	No
NFN4	South Fenland RZ to North Fenland RZ Transfer (20MI/d)	North Fenland	No
NNR8	Norwich & the Broads RZ to Norfolk Rural North RZ Transfer (5MI/d)	Norfolk Rural North	No
NWM6	Ely RZ to Newmarket RZ Transfer (20MI/d)	Newmarket	No
NTM1	Central Lincolnshire RZ to Nottinghamshire RZ Transfer	Nottinghamshire	No
RTC2	Ruthamford South RZ to Ruthamford Central RZ Transfer	Ruthamford Central	No
RTN27	South Lincolnshire RZ to Ruthamford North RZ (67MI/d)	Ruthamford North	No
SEX4	East Suffolk RZ to South Essex RZ transfer (15MI/d)	South Essex	No
SFN4	Ruthamford North RZ to South Fenland RZ Transfer (40 MI/d)	South Fenland	No
SHB2	Pyewipe Water Reuse for non-potable use	South Humber Bank	Yes – Humber Estuary SPA/Ramsar site/SAC
SLN6	Central Lincolnshire RZ to South Lincolnshire RZ Transfer (63MI/d)	South Lincolnshire	No
THT1	Bury Haverhill to Thetford transfer	Thetford	No
-	Birchmoor WTW Resilience	Ruthamford South	No
-	Meppershall WTW Resilience	Ruthamford South	No
-	Diddlington WTW Resilience	Norfolk Rural North	No
-	Great Wratting WTW Resilience	Bury Haverhill	No

Adaptive Strategy

Five options included in the adaptive strategy were assessed as having Likely Significant Effects on European sites. These are ESU1 Felixstowe and NFN1 Kings Lynn desalination schemes; ESU2 Ipswich and NFN2 Kings Lynn water reuse schemes and NFN3 Fenland new reservoir. These options will be assessed further at the Task II: Appropriate Assessment stage for their potential residual effects on the integrity of the European sites listed in the table below.

Option ref.	Option name	WRZ	Potential for Significant Effects on a European site?
ESU1	Felixstowe Desalination	East Suffolk	Yes – Stour and Orwell Estuaries SPA Deben Estuary SPA
ESU2	Ipswich Water Reuse	East Suffolk	Stour and Orwell Estuaries SPA Stour and Orwell Estuaries Ramsar site
NFN1	Kings Lynn Desalination	North Fenland	Yes – The Wash SPA/Ramsar site The Wash and North Norfolk Coast SAC
NFN2	Kings Lynn Water Reuse	North Fenland	Yes – The Wash SPA/Ramsar site The Wash and North Norfolk Coast SAC
NFN3	Fenland Reservoir	North Fenland	Yes – Ouse Washes SPA/Ramsar site/SAC Norfolk Valley Fens SAC Breckland SPA/SAC Barnack Hills and Holes SAC
RTN1	South Lincolnshire Reservoir (unsupported)	Ruthamford North	No

Option ref.	Option name	WRZ	Potential for Significant Effects on a European site?
RTN2	South Lincolnshire Reservoir (supported)	Ruthamford North	No
RTN7	Severn Trent Water Import	Ruthamford North	No

In-Combination Effects Assessment

A detailed in-combination assessment was not undertaken at the Task I: Screening stage in accordance with current guidance. The report has however given a preliminary assessment of the potential intra-plan in-combination effects of the WRMP.

The assessment did not identify any options in the WRMP which could combine to result in potential cumulative effects on European sites. The implementation of the adaptive strategy however, has the potential to result in cumulative effects on:

- The Wash SPA/Ramsar site/SAC, should the King's Lynn desalination and water reuse schemes be implemented; and
- Stour and Orwell Estuaries SPA/Ramsar site should the Felixstowe desalination and Ipswich water reuse scheme be implemented.

This will be explored further in the Task II: Appropriate Assessment after these options have been assessed further.

The potential for cumulative effects of the WRMP in-combination with neighbouring Water Company's WRMPs has also been identified for the Deben Estuary, the Ouse Washes and the Stour an Orwell Estuaries. This can only be explored when neighbouring WRMPs become available.

1 Introduction

Water companies have a statutory obligation to produce a Water Resources Management Plan (WRMP), which sets out how a company intends to maintain the balance between supply and demand for water over a minimum 25-year period. In the development of a WRMP, companies must follow the Water Resource Planning Guidelines¹ and have regard to broader government policy objectives, as set out in Defra's Guiding Principles², for example. WRMPs should ensure a secure and sustainable supply of water and focus on efficiently delivering customer outcomes while reflecting the value that society places on the environment.

Mott MacDonald was commissioned by Anglian Water Services (Anglian Water) to undertake a Habitats Regulations Assessment (HRA) of its WRMP. Under the European Directive 2001/42/EC on the conservation of natural habitats and of wild fauna and flora (also known as the 'Habitats Directive') and the resulting Conservation of Habitats and Species Regulations 2017, competent authorities are required to assess the potential impact of plans and programmes to ensure that there will not be any Likely Significant Effects (LSE) on sites of European nature conservation importance ('European sites'). The process by which the impacts of a plan or programme are assessed against the conservation objectives of a European site is called a Habitat Regulations Assessment.

This report presents the results of the first task of the HRA process, the Task I: Screening (sometimes called the Test of Likely Significance (ToLS)). A Strategic Environmental Assessment (SEA) is also being undertaken and the HRA and SEA processes are interlinked. The results of the SEA are presented in a separate report to the HRA to comply with legislative requirements.

1.1 The Purpose of Habitats Regulations Assessment

In accordance with Article 6(3) of the Habitats Directive, 'Article 6 Assessments' are required where a plan not directly connected with or necessary to the management of a European site(s), may give rise to significant effects upon a European site(s). The requirement for Article 6 Assessments has been transposed into UK law under Regulation 61(2) of the Conservation of Habitats and Species Regulations 2010 ('Habitats Regulations') (S.I. 2010/490) and is commonly referred to as a 'Habitats Regulations Assessment' (HRA) or an 'Appropriate Assessment' (AA). 'Appropriate Assessment' is taken to mean an assessment which is 'appropriate to its purpose under the Habitats Directive and Habitats Regulations' and is not to be confused with the second of the Article 6 Assessments with the same name³.

It should be noted that WRMPs are not explicitly included within Regulation 61 of the Habitats Regulations, but it is suggested that all WRMPs should be subject to HRA screening to determine whether they could have LSE on one or more European sites (alone and in combination with other plans). The Environment Agency confirms this position in Section 2.7.2 of the draft Water Resources Planning Guideline (WRPG)⁴, stating that the requirement for HRA should extend to such draft plans or similar developmental stages. As with the process of SEA, it is accepted best-practice for HRA of strategic planning documents to run as an iterative process alongside the plan, with the possible options continually assessed for their possible effects on sites of European nature conservation

¹ Environment Agency, Natural Resources Wales, Defra & OFWAT (2016). *Final Water Resources Planning Guideline*.

² Defra's Guiding Principles set out the government objective 'to deliver secure, reliable, sustainable and affordable supplies of water, value nature in decision-making and connect people with the environment'². They encourage water companies to act as 'leaders' and 'stewards' of the natural environment, to use the WRMP process as an opportunity to connect communities to their local environment and to reflect the value of the environment in decision making by using natural capital (and ecosystems services) approaches². Defra (May 2016). *Guiding Principles for Water Resource Planning*. Page 1&4

³ Department for Communities and Local Government (DCLG) (2006). *Planning for the Protection of European Sites: Appropriate Assessment Under The Conservation (Natural Habitats, &C) (Amendment) (England and Wales) Regulations 2006*. Guidance For Regional Spatial Strategies. [online] Available at: <http://www.communities.gov.uk/documents/planningandbuilding/pdf/160442.pdf> [Accessed 6th June 2017].

⁴ Environment Agency (2011). *Draft Water Resources Planning Guideline*. February 24, 2012.

importance. This allows options to be scoped out or modified as necessary to ensure that the WRMP is not likely to result in significant adverse effects on any European sites (alone and in combination with other plans).

European sites of nature conservation importance include Special Protection Areas (SPAs), Special Areas for Conservation (SACs), candidate SACs and proposed SPAs, as well as Sites of Community Importance (SCIs) which have been adopted by the EC, but not yet formally designated by the government of a Member State. In the UK, Ramsar wetland sites of international importance are also required to undergo an assessment when a plan is considered likely to have a significant effect upon them⁵. For the purposes of this assessment, European sites of nature conservation importance and Ramsar wetland sites of international importance will be collectively referred to as 'European sites' in this report. It should be noted that conservation areas designated at a national or local level (such as Sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNRs) and Local Nature Reserves (LNRs)) do not fall under the scope of a HRA, and any potential impacts on these sites will be assessed in the SEA.

Before deciding to undertake a plan that may give rise to significant effects upon a European site (that is not directly connected with or necessary to the management of that site), a Competent Authority must make an assessment of the implications for that site in view of its conservation objectives. The Habitats Regulations require every Competent Authority, in the exercise of any of its functions, to have regard to the requirements of the Habitats Directive. Water Companies have a statutory duty to prepare WRMPs; therefore, Anglian Water are considered to be the Competent Authority under Part 6 of the Habitats Regulations. The Competent Authority must also consult with the appropriate nature conservation body (i.e. Natural England (NE)) and have regard to any representations made by that body.

1.2 The Process of Habitats Regulations Assessment

The HRA for the assessment of a plan is undertaken in a series of tasks⁶ (see Figure 1). These tasks correspond with the Article 6 Assessments prescribed by the Habitats Directive. Each task determines whether further tasks in the process are required.

Task I is the screening stage (hereafter called 'Task I: Screening') and identifies the components of the plan that have *the potential* to result in LSE on European sites. Plan components are screened in using a precautionary approach – i.e. if reasonable impact pathways⁷ are identified to a European site then it is considered there is potential for the plan to result in LSE and the screening does not take into account any mitigation that will be applied thereafter. If the conclusion of Task I: Screening is that there will be no potential LSE on the European site, there is no requirement to undertake further tasks. If the conclusion of Task I: Screening is that the plan has potential to result in LSE, then the plan is brought forward to Task II.

Task II (Appropriate Assessment) will be applied to the options which are considered for the Preferred Plan. Where a preferred option has been screened in as having potential to give rise to LSE on the European site, an assessment must be made of the implications on the integrity of that in view of that site's structure, function, and conservation objectives. Furthermore, where there are adverse impacts, an assessment of potential mitigation measures will also be required in Task II.

If it is concluded that adverse impacts are likely to remain after mitigation, there must be an examination of alternative ways to complete the plan that avoids adverse impacts on the integrity of the site (**Task III**). Where alternatives exist, these should be subjected to Task I and/or Task II

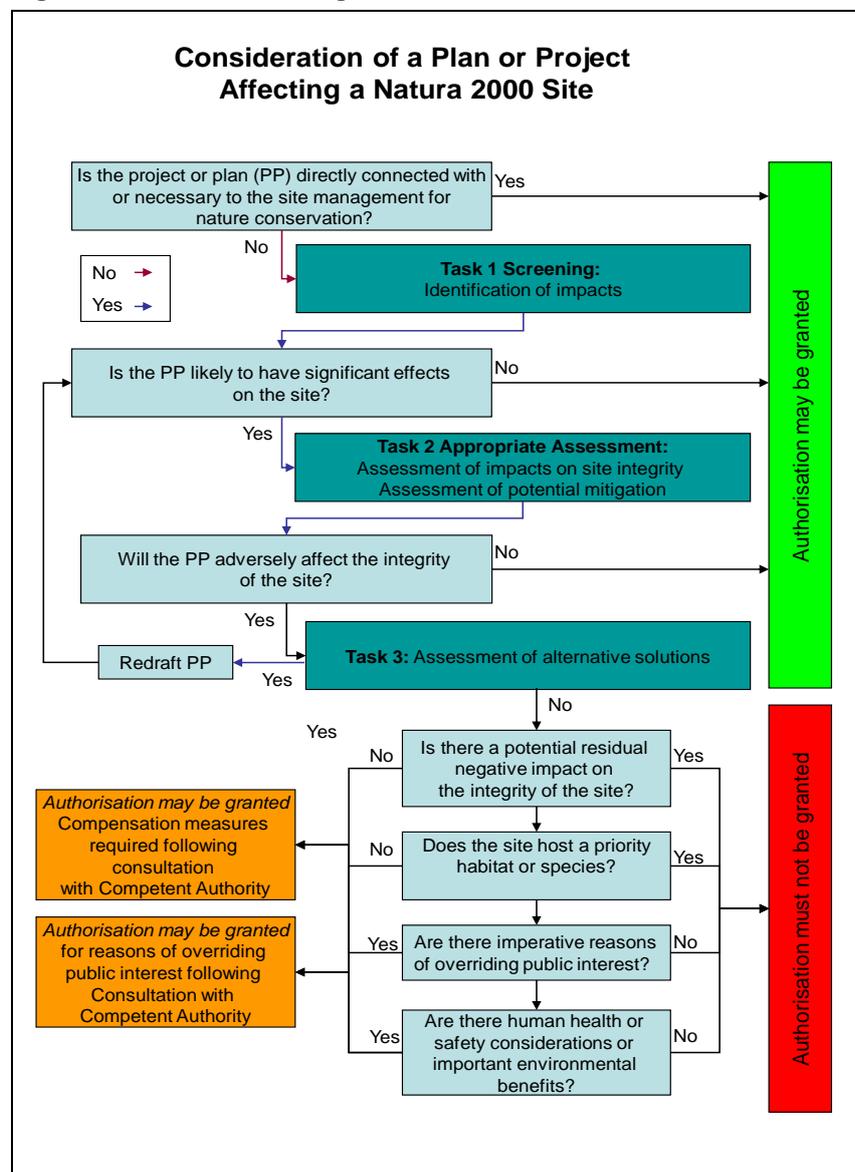
⁵ Department for Environment, Food and Rural Affairs (Defra) (2006). *Ramsar sites in England – A policy statement*. [online] Available at: <http://archive.defra.gov.uk/rural/documents/protected/ramsar-policy.pdf> [Accessed 6th June 2017].

⁶ Department for Communities and Local Government (DCLG) (2006). *Planning for the Protection of European Sites: Appropriate Assessment Under The Conservation (Natural Habitats, &C) (Amendment) (England and Wales) Regulations 2006*. Guidance For Regional Spatial Strategies. [online] Available at: <http://www.communities.gov.uk/documents/planningandbuilding/pdf/160442.pdf> [Accessed 6th June 2017]

⁷ Briefly defined, an impact pathway is considered any route by which a change in activity as a result of the implementation of the option can lead to an effect upon a European site.

assessments. Where no alternatives exist, it is necessary under Article 6(4) of the Habitats Directive to identify if there are, or are not, imperative reasons for overriding public interest (IROPI). If there are IROPI then compensatory measures must be assessed (**Task IV**). In making this assessment, it is important to recognise that it should be appropriate to the likely scale, importance, and impact of the plan.

Figure 1: The Habitats Regulations Assessment Process



NB: The term 'Task' is used in reference to an assessment of a plan⁸.

1.3 Study Area

The area covered by the Anglian Water WRMP is the East Anglia region west from Chipping Warden, north to Hull, South to Chelmsford and east to the coast. It supports large proportions of England's wetland and coastal habitats as well some of the UK's rarest habitats and species, including

⁸ Department for Communities and Local Government (DCLG) (2006). *Planning for the Protection of European Sites: Appropriate Assessment Under The Conservation (Natural Habitats, &C) (Amendment) (England and Wales) Regulations 2006*. Guidance For Regional Spatial Strategies. [online] Available at: <http://www.communities.gov.uk/documents/planningandbuilding/pdf/160442.pdf> [Accessed 6th June 2017].

agricultural landscapes, ancient woodland, heathlands, rivers, and low-lying coasts. The area includes 45% of England's reedbeds (concentrated across Norfolk and Suffolk), 40% of England's inter-tidal mudflat area (which are important staging posts for migrating birds and feeding sites for large numbers of internationally important waders and wildfowl), 1200km (25%) of the UK's chalk rivers, and 20% of England's grazing marshes⁹.

Within the WRMP area (and a surrounding 10km buffer), there are 40 SACs, 28 SPAs and 28 Ramsar wetlands of International importance. These are listed and shown on a corresponding map in Appendix A. Each European site is classified upon the qualifying features it supports, and these are described in Appendix B.

⁹ Department for Communities and Local Government (2012). Strategic environmental assessment about revoking the East of England regional strategy: environmental report. Appendix E: SEA of the Revocation of the East of England Regional Strategy. July 2012. Available at: <https://www.gov.uk/government/consultations/strategic-environmental-assessment-of-revoking-the-east-of-england-regional-strategy> [Accessed 8th November 2017]

2 Methodology

2.1 Guidance

Water Resources Management Plans are not explicitly required to undergo a HRA under the Habitats Regulations, therefore specific guidance for this is limited. The HRA Task I: Screening assessment was undertaken with regard to the guidance document 'Strategic Environmental Assessment and Habitats Regulations Assessment - Guidance for Water Resources Management Plans and Drought Plans (12/WR/02/7)' (UK Water Industry Research, 2012).

The following guidance was also used in the preparation of this assessment:

- English Nature (1997-2001). Habitats Regulations Guidance Notes 1-9, Natural England, Peterborough;
- European Commission (2002). Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC. European Commission, Brussels;
- European Commission (2001). Assessment of plans and projects significantly affecting European sites. European Commission, Brussels; and
- European Communities (2007). Managing European sites: The provisions of Article 6 of the Habitats Directive 92/433/EEC. European Commission, Brussels.

2.2 Constrained Options Screening and the 'Feasible' List

As a precursor to the HRA and SEA, Mott MacDonald undertook a high-level environmental screening exercise of the 'unconstrained' options list, refined from a generic list of potential measures to meet water demand provided by Anglian Water. The screening process highlighted environmental risks and constraints, including a high-level assessment of potential effects on European sites as well as a number of other receptors, and resulted in the rejection or amendment of certain options to produce the WRMP 'constrained' options list¹⁰ (see the WRMP 2019 SEA Scoping Report¹¹ for further details about the high-level environmental screening process).

The constrained list was then subject to a feasibility study to produce a set of options considered to be suitable to take forward for assessment as part of the WRMP development called the 'feasible list' of options¹². The HRA Task I: Screening was undertaken on the feasible list of options.

2.3 The Task I: Screening Process

A HRA determines whether there will be any 'likely significant effects' (LSE) on any European site as a result of a plan's implementation (either on its own or 'in combination' with other plans or projects) and, if so, whether these effects will result in any potential adverse effects on the site's integrity. The Task I: Screening process is the first step of the HRA and gives an assessment of *the potential* for a component of the plan (i.e. the individual options) to affect a European site. The process identifies any viable pathway from an option to a European site and makes an assessment of the potential for at pathways to result in impacts on the integrity of the conservation objectives and qualifying features of that European site.

¹⁰ The WRMP process generally starts with a generic of potential types of measures to meet water demand which is refined into an 'unconstrained list'. The unconstrained list is then screened using professional judgement to remove impractical options, leaving the 'constrained list' (UKWIR, 2012, 'Strategic Environmental Assessment and Habitats Regulations Assessment – Guidance for Water Resources Management Plans and Drought Plans', Page 26).

¹¹ Mott MacDonald (2017). *Anglian Water WRMP 2019 SEA Scoping Report*. Mott MacDonald, April 2017

¹² The 'feasible list' is a sub-set of the 'constrained list' following options feasibility studies. It is a set of options considered to be suitable to take forward for assessment as part of the preferred programme options. As such it should not include options with unalterable constraints that make them unsuitable for promotion e.g. unacceptable environmental impacts that cannot be overcome. (EA, NRW, Defra and Ofwat, 2016, 'Final Water Resources Planning Guideline', Page 29).

This HRA Task I: Screening was undertaken in two parts:

- Assessment of the feasible options list for the draft WRMP as of June 2017 (Chapter 4).
- Assessment of all options that were included in the WRMP (Chapter 5). The WRMP includes some options that were included in the draft WRMP but had been changed through the options design process. For example, by re-routing pipelines, agreement of the use of directional drilling under sensitive sites and rivers; or investigated further through the SEA and WFD processes. The draft WRMP assessments for these options have been superseded, and the original assessments can be found in Appendix C.

Task I: Screening uses the ‘precautionary approach’ – i.e. if there is doubt and further information is required, it is concluded that there is potential for LSE to occur. An effect is considered to have potential LSE if there is a possibility for adverse impacts on the qualifying features of the European site, or if it undermines its integrity. Mitigation is not considered at the Task I: Screening stage, as per the recent Court of Justice of the European Union ruling in the matter of People Over Wind and Sweetman v Coillte Teoranta (C-323/17) in relation to the application of avoid or reduction measures (mitigation) and Article 6(3) of the Habitats Directive, which concluded that measures to avoid or reduce the harmful effects of a plan or project must only be made at the Task II: Appropriate Assessment stage.

2.3.1 Identifying a Zone of Influence (Zol)

WRMP options were screened using electronic maps of assets provided by Anglian Water and developed by Mott MacDonald through GIS. The variation in the potential impacts between different types of options within the WRMP can be significant. Such variation is related to the geographic and temporal scale of construction phases, the degree of hydrological connectivity with European sites and the sensitivity of features within the European sites. As a result of this potential variation, option specific buffers (or Zones of Influence (Zols)) were created around the option types, in which European sites have the potential to be affected. These buffers are based on past experience and best practice advice from the Environment Agency and Natural England on previous projects and are given in Table 1:

Table 1: Zone of Influence defined for each option type

Option Type	Zone of Influence	
Aquifer storage and recovery	where aquifer is in or partially in European site (assumes a neutral cycle and that aquifer would be recharged in winter)	
Desalination	5km	
Reservoirs	New reservoir	500m
	Increase capacity raising/dredging	500m
	Increase yield/intakes/improve efficiency	5km from source
Water (effluent) reuse from discharge	5km	
Transfers	Construction of	500m
	Changes in abstraction regime	Downstream to where watercourse enters estuarine or coastal waters

It should be noted that these Zols were not explicitly adhered to and in practice, all European sites that were within 15km or directly downstream of an option were looked at, with sites beyond this considered on an option-by-option basis depending on the site interest features and how the option would function. This is considered to be a suitably precautionary approach. It was appropriate to use a larger Zol than defined above, for example, where increased abstraction has the potential to affect downstream sites in the catchment, or where an affected waterbody feeds into a European site

downstream of the Zol. Where a larger Zol is considered, this is described in the assessment tables relating to that specific option in Chapter 4 and Chapter 5.

It should be noted that for alterations to current abstractions, only effects on European sites downstream of *new* abstractions are considered as potential LSE. For increases to *current* abstraction volume it is assumed that the increased abstraction is still within the current licence limits and therefore unlikely to result in impacts on designated sites, as they are protected by the Environment Agency’s Review of Consents process. This is discussed further in Section 5.3.

2.3.2 Identifying Potential Impacts

Depending on the nature and magnitude of the proposed options and the sensitivity of the qualifying features of the European sites, the potential resulting impacts may vary. A summary of the potential impacts considered in this assessment is provided in Table 2.

Table 2: Potential Impacts considered in this assessment

Broad categories of potential impacts on European sites (with examples)	Examples of operations resulting in impacts
Physical loss Destruction (including offsite effects) e.g. foraging habitat, smothering	Development of built infrastructure associated with the option, e.g. pipelines, temporary weirs, access routes. Physical loss is only likely to be significant where the boundary of the option extends within the boundary of the European site, or within an offsite area of known foraging, roosting, breeding habitat (that supports species for which a European site is designated).
Physical damage Habitat degradation Erosion Trampling Fragmentation Severance/barrier effects Edge effects	Development of built infrastructure associated with the option, e.g. reservoir embankments, water treatment plants, pipelines, pumping stations. Recreation e.g. cycling, walking, horse-riding, water-sports associated with option benefits e.g. reservoirs. Physical damage is only likely to be significant where the boundary of the option extends within or is directly adjacent to the boundary of the European site, or within/adjacent to an offsite area of known foraging, roosting, breeding habitat (that supports species for which a European site is designated).
Non-physical disturbance Noise Visual presence Light pollution	Noise from vehicular traffic during construction of the option. Noise from construction traffic is only likely to be significant where the transport route to and from the option is within 500m of the boundary of the European site. Plant and personnel involved in construction and operation of the option e.g. for maintenance plus non-operational activities such as recreation associated with option e.g. reservoirs. These effects (noise visual /human presence) are only likely to be significant where the boundary of the option is within 500m of the boundary of the European site or within/adjacent to an offsite area of known foraging, roosting, breeding habitat (that supports species for which a European site is designated). Development of built infrastructure associated with the option, which includes artificial lighting. Effects from light pollution are only likely to be significant where the boundary of the option is within 500m of the boundary of the European site. From a review of Environment Agency internal guidance on HRA and various websites it is considered that effects of vibration and noise and light are more likely to be significant if development is within 500m of a European site.
Water table/ availability Drying Flooding/storm water Changes to surface water levels and flows Changes to groundwater level and flows Changes to coastal water movement	Change to water levels and flows due to water abstraction, storage and drainage interception associated with inland options. These effects are only likely to be significant where the boundary of the option extends within the same ground or surface water catchment as the European site. However, these effects are dependent on hydrological

Broad categories of potential impacts on European sites (with examples)

Examples of operations resulting in impacts

	continuity between the option and the European site, and sometimes, whether the option is up or downstream from the European site.
<p>Toxic contamination</p> <p>Water pollution</p> <p>Soil contamination</p> <p>Air pollution</p>	<p>Air emissions associated with vehicular traffic during construction of options. This effect is only likely to be significant where the transport route to and from the option is within 200 metres of the boundary of the European site.</p> <p>Water pollution is only likely to be significant where the boundary of the option extends within the same ground or surface water catchment as the European site. However, these effects are dependent on hydrological continuity between the option and the European site, and if applicable, whether the option is up or downstream from the European site.</p> <p>Soil contamination is only considered likely to be significant where the boundary of the option extends into the European site.</p>
<p>Non-toxic contamination</p> <p>Nutrient enrichment (e.g. of soils and water)</p> <p>Algal blooms</p> <p>Changes in salinity</p> <p>Changes in thermal regime</p> <p>Changes in turbidity</p> <p>Changes in sedimentation/silting</p> <p>Air pollution (dust)</p>	<p>Changes to water salinity, nutrient levels, turbidity, thermal regime due to water abstraction, storage, or inter-catchment transfers.</p> <p>These effects are only likely to be of significance where the boundary of the option extends within the same ground or surface water catchment as the European site. However, these effects are dependent on hydrological continuity between the option and the European site. This level of information is not available until data such as groundwater modelling is collected to accompany planning applications.</p> <p>Emissions of dust during the earthworks, construction of plant and tunnel/pipeline construction associated with options.</p>
<p>Biological Disturbances</p> <p>Direct mortality</p> <p>Changes to habitat availability</p> <p>Out-competition by non-native species</p> <p>Selective extraction of species</p> <p>Introduction of disease</p> <p>Introduction of invasive species</p> <p>Rapid population fluctuations</p> <p>Natural succession</p>	<p>Potential for changes to habitat availability, e.g. reductions in wetted width of rivers leading to desiccation of macrophyte beds due to changes in abstraction or reduced compensation flow.</p> <p>This effect is only likely to be significant where the receiving water for the option is the European site or a tributary of the European site.</p>

Source: Adapted from: UK Water Industry Research (2012)¹³.

The WRMP options could affect a European site through the construction process (for example new reservoir creation, construction of new pipelines, construction of new water sites) or operation of the option (e.g. permanent increase in disturbance, increase and/or new abstractions, permanent land-use changes). Both direct (activities that affect a European site directly; for example, construction of a new intake within an SPA reservoir; discharges to an SAC from a desalination plant; new or increased abstractions from an SAC river) and indirect (activities that affect a European site indirectly through an impact pathway; for example, construction affecting a downstream SAC through sediment release; new abstractions entraining SAC fish species away from the SAC itself) impacts are considered.

2.3.3 Dealing with Uncertainty

Due to its wide geographic scale and long-term outlook, there are inevitably a large number of uncertainties within the WRMP. With strategy-level HRAs, uncertainty is sometimes addressed by including caveats or mitigation as an assumption to the plan (and therefore all the plan components) to ensure that significant or adverse effects will not occur. This approach has been difficult to apply to the WRMP, because the strategic nature of the WRMP ensures that there is fundamental uncertainty

¹³ UK WIR (2012). *Strategic Environmental Assessment and Habitats Regulations Assessment - Guidance for Water Resources Management Plans and Drought Plans* (12/WR/02/7). UK Water Industry Research, 2012.

to the detailed scheme information and limited option development available at the time of the HRA. This means that *potential* effects on European sites have been much easier to predict (based on the known option information, i.e. the nature of the broad option type, the location of the option, the identification of a viable pathway, the known sensitivities of the interest features), but much harder to quantify and assess.

In order to minimise assumptions made on the back of uncertainty, the Task I: Screening has used a precautionary approach by screening all uncertainties as having potential to result in LSE and by not considering mitigation which could be applied to reduce the impact of the option. Where an option has been screened in as having potential LSE based on uncertainty over likely effects, then this option will be brought forward to Task II if considered for the preferred list of options. At the Task II: Appropriate Assessment stage, additional data will be obtained until that uncertainty can be resolved, or mitigation specified that will remove the uncertainty. If residual impacts remain after the application of appropriate mitigation, then it will be recommended that the option is abandoned and not included in the WRMP.

The Task I: Screening therefore aims to identify potential LSE and therefore makes use of typical screening terminology (e.g. the term 'LSE' in itself) to facilitate this, even if it is not reaching a formal conclusion regarding the option. Ultimately, the Task I: Screening is looking to highlight those options which have a risk of significant or adverse effects on a European site which will be assessed in more detail at Task II.

2.4 Assessing In-Combination Effects

The process of HRA requires that the potential effects of other projects, plans or options be considered 'in-combination' with the potential effects of the WRMP. In-combination effects refer to cumulative effects caused by the options that are currently under consideration together with the effects of any existing or proposed projects or plans, so that it can be established whether there may be an overall significant effect on the integrity of a European site.

The guidance is limited in its definition of an in-combination effect, therefore broadly it is considered that the WRMP could have the following in-combination effects:

1. Effects within the current plan - i.e. separate options within the WRMP affecting the same European site(s);
2. Effects between plans - i.e. effects with other abstractions, in association with or driven by other plans (for example, other water company WRMPs which border the Anglian Water region);
3. In-combination water resource effects from the Environment Agency Review of Consents process; and,
4. In-combination impacts with Local Planning Authority Local Plans or Local Development Frameworks (LDFs).

It should be noted that a detailed in-combination assessment was not undertaken at the Task I: Screening stage in accordance with current guidance¹⁴. An assessment of the potential intra-plan in-combination effects of the WRMP (and its potential cumulative adverse effects on the European sites, is provided in this Task I: Screening report.

2.5 Consultation

Consultation on the draft WRMP HRA Task I: Screening assessment has been sought from Natural England, the Environment Agency and the RSPB and responses were received in June 2018. Consultation results and comments were reviewed and the report updated as appropriate. Where relevant, consultation comments were taken forward and addressed in the next task of the HRA (the Task II Appropriate Assessment) if it is required (see below).

¹⁴ Such as UK Water Industry Research, 2012 'Strategic Environmental Assessment and Habitats Regulations Assessment - Guidance for Water Resources Management Plans and Drought Plans (12/WR/02/7)'

A consultation log of comments can be found in the WRMP Task II: Appropriate Assessment report (Mott MacDonald, 2018).

2.6 Scoping the Task II: Appropriate Assessment

Where the Task I: Screening process identified that an option will not lead to LSE on the qualifying features of a European site, this screening report forms the final assessment and will be issued for consultation alongside the WRMP.

Where the Task I: Screening identified options which have the potential to result in LSE on the qualifying features of a European site, this was fed back into the options appraisal for the WRMP and may have resulted in the option being withdrawn. Additional work to some options after the screening stage may also have avoided the need for Appropriate Assessment such as alterations to the option design to reduce environmental impacts by, for example, re-routing pipeline options or agreeing to the use of directional drilling to avoid impacts on sensitive sites where possible. The HRA screening assessment has thus contributed to the iterative process of the options appraisal.

Where, after the Task I: Screening process, options in the WRMP (have been assessed as having the potential to result in LSE on a European site, they have been assessed further in the Task II: Appropriate Assessment (Mott MacDonald, 2018).

3 The Water Resources Management Plan

3.1 WRMP Context

As already noted, water companies have a statutory obligation to produce a Water Resources Management Plan (WRMP), to comply with statutory requirements in the Water Resources Management Plan Regulations 2007 issued by the Secretary of State in exercise of the powers conferred by the Water Act, 2003. The purpose of the WRMP is to set out how a company intends to maintain the balance between supply and demand for water over a minimum 25-year period.

The WRMP process identifies potential shortages in the future availability of water and sets out potential options which may maintain the balance between water availability and future demand. The process begins with a generic list of potential measures to meet water demand which is refined into an 'unconstrained list'. The unconstrained list is screened to remove impractical options leaving the 'constrained list'. The constrained list is finally subject to a feasibility study to identify the 'feasible' options for each Water Resource Zone (WRZ) where deficits are predicted. The feasible options are put forward and reviewed according to industry standard methodology to identify 'preferred options' based on financial, environmental and social variables. This HRA Task I: Screening has been undertaken on the feasible options list as of June 2017.

New WRMPs are prepared every five years and reviewed annually as part of the WRMP Annual Review. This involves the production of a stand-alone report that is submitted to Defra as part of the statutory WRMP review process. The new WRMP is currently being prepared by Anglian Water and is due to be published in 2019. The preferred list of options included in the WRMP is based on standard methodologies set out in the WRMP, the SEA and is the subject of this HRA.

The most recent WRMP published by Anglian Water was in 2014¹⁵. It detailed options for balancing water supply and demand over the 25-year period from 2015 to 2040, with consideration for the longer-term challenges of population increase, climate change and growing environmental needs.

3.2 WRMP Region

Anglian Water is the largest water and wastewater company in England and Wales by geographic area and is divided into 28 Water Resource Zones¹⁶ (WRZs) (see Figure 2) including the South Humber Bank which is a non-potable WRZ that sits within Central Lincolnshire. It stretches from the Humber north of Grimsby, to the Thames estuary and then from Buckinghamshire to Lowestoft on the east coast. It also covers the Hartlepool area. It should be noted that Hartlepool is not covered in this SEA because no options are being considered for the Hartlepool area.

Anglian Water supply water and water recycling services to more than six million customers in the east of England and Hartlepool.¹⁷ The East of England is one of the driest regions in the UK, with low rainfall (71% of the UK average) and high evaporation losses¹⁸. Water supply is under pressure from population growth, climate change, sustainability reductions¹⁹ and the need to increase resilience of water supplies to severe drought.

¹⁵ Anglian Water (2014). *Water Resources Management Plan 2014*. Available at http://www.anglianwater.co.uk/_assets/media/WRMP_091213.pdf [Accessed 6th June 2017]

¹⁶ WRZs represent an area within which managing supply and demand for water resources is largely self-contained. The definition of a WRZ (from Water Resources Planning Tools (WR27), UKWIR, 2012) is: 'The largest possible zone in which all resources, including external transfers, can be shared and hence the zone in which all customers will experience the same risk of supply failure from a resource shortfall'.

¹⁷ Draft Water Resources Management Plan 2019 (Anglian Water, 2017)

¹⁸ Anglian Water, 2017 "Our Company" [webpage]

¹⁹ In some cases, water company abstractions have been found to cause, or the potential to cause, environmental harm. As a result, the company may be required to reduce the amount of water they can abstract from the environment. If this reduces the amount of water available to put into supply, then it is known as a sustainability reduction.

Figure 2: WRZs in the WRMP



Source: WRMP (Anglian Water, 2019)

3.3 WRMP Development

Anglian Water has adopted a planning approach that uses least-cost optimisation as well as broader criteria to develop a Best Value Plan (Preferred Plan) which takes account of 'best value' decision making criteria:

- Cost to build and operate the plan
- Adaptability and flexibility of the plan to cope with uncertain future needs
- Alignment to the Water Resource East regional strategy
- Resilience of the plan to severe and extreme drought and other hazards, and the residual risks
- Deliverability of the plan with timescales needed to manage risks

- Alignment to customer preferences
- Environmental and social impacts of the plan, including net environmental benefit

The HRA and other environmental studies undertaken were used as part of the decision-making criteria on environmental and social impacts of the plan to develop the Preferred Plan.

Demand management is a priority for Anglian Water. In developing the WRMP, Anglian Water has first considered what risk could be offset from demand management, before seeking to develop supply-side options. Despite the ambitious demand management strategy, the scale of the challenge is such that carefully targeted investment in supply-side capacity was still required. The supply-side options considered for inclusion in the WRMP have been developed following industry and regulator guidance.

The Preferred Plan provides the best value for customers in the long term. The strategy:

- Prioritises demand management, which aligns with customers' expectations
- Recognises the environmental benefits of demand management, such as offsetting treatment and pumping costs and carbon
- Challenges Anglian Water and its customers to push the boundaries of what is achievable, with respect to levels of future consumption
- Maximises the use of existing resources before developing new ones
- Provides future flexibility over the location and type of new resource inputs
- Delivers significant additional resilience across the region both to drought and non-drought events (e.g. freeze-thaw)
- Delivers environmental benefits, by reducing abstraction from the environment and ensuring no deterioration in the ecological status of water bodies in the region

The WRMP include an adaptive strategy to deal with uncertainties and future scenarios that will mean further investment is required (e.g. further future sustainability reductions). In some cases, there may not be a long lead time to implement schemes and therefore Anglian Water need to develop a plan which identifies thresholds beyond which they need to take further action. The potential options identified as part of the adaptive strategy have been assessed as part of the HRA. It should be noted that at this stage these are strategic supply side options that may be required in the future. They do not form a definitive list of options.

The Draft WRMP was published for consultation in March 2018, allowing interested stakeholders and customers to review and comment upon the proposals. The feedback received from the consultation process played a significant role in shaping the WRMP.

3.4 WRMP Option Types

The WRMP will include supply side options, demand management options, and National Environment Programme (NEP) options. The broad option types being considered are listed below. Full descriptions of these option types are given in Chapter 4.

- **Aquifer Storage and Recovery** - aquifer storage options involve abstracting water from a river or reservoir, treating and injecting it underground to be stored in natural aquifers.
- **Desalination** – desalination options involve pumping sea water or brackish water (from an estuary) for treatment and release into supply. The water will be blended before putting into supply, with the brine to be piped out to sea for disposal (in the case of sea desalination) or to a sewer (in the case of brackish water desalination).
- **Water Reuse** – effluent is treated and discharged into rivers or piped into supply.
- **Reservoirs** – reservoir options include dam raising (increasing the capacity of existing reservoirs), or creation of new reservoirs. It is likely that most of these will be bunded reservoirs (i.e. not within a valley) with piped transfers in and out of supply.

- **Tankering** - sea tankering options from abroad are being considered. Storage and offloading facilities will be required in the UK with water piped or tankered to WTWs or reservoirs. It should be noted that no tankering options were taken forward into the EBSD modelling and, therefore, no tankering options are presented in this report.
- **Transfers** (potable/raw water/canal) – transfers usually involve water being piped from one WRZ to another, or from one water company to another. However, they can also be a component of another option type such as a desalination plant. They will transfer water from the new asset to a suitable delivery point.
- **Conjunctive Use** – involves the co-ordinated use of surface water and groundwater and allows flexibility depending on the conditions e.g. surface water can be used in wet periods, and groundwater can be used in dry periods. It should be noted that no conjunctive use options were taken forward into the EBSD modelling and, therefore, no conjunctive use options are presented in this report.
- **Trading** – involves an agreement with another water company to trade water where there is a surplus.
- **Demand management options** – several demand management options are being considered including smart metering, leakage reduction, and water efficiency measures.

National Environment Programme (NEP) options - The NEP is a list of environmental improvement schemes that ensure that water companies meet European and national targets related to water. The NEP options included in the WRMP fall into five broad categories: river restoration schemes; river support schemes; pond support scheme; recirculation scheme; and source relocation.

3.5 Assessment of Potential Effects from Options

Each of the options that were considered for WRMP and were screened for their potential to result in effects on European sites. Where there is a pathway from an option or option component to a European site this has been identified, and an assessment of the potential for the option to result in Likely Significant Effects on the qualifying features of that European site has been provided.

The Task I screening assessments were undertaken on whole options i.e. all elements of an option that are dependent on each other, and not the individual parts. For example, the assessment of a reservoir option includes the reservoir works themselves plus any works that are related to it such as transfers in/out and treatment. Where there are several variations of an individual option, e.g. in the transfer capacity, the assessment considers these variations and assesses them as part of the one whole option.

It should be noted that this Task I screening assessment does not rely on detailed design information for each option, but rather is based on the level of detail available at the design feasibility stage, as set out in the Supply Options Development reports (July 2017). It is therefore considered a high-level screening assessment that identifies the potential for an option to result in impacts on European sites only. If the Task I screening results indicate that there is potential for effects on the European site or if there are significant knowledge gaps, the significance of the effect on the integrity of the conservation objectives of that site will only be assessed at the Task II Appropriate Assessment stage.

The HRA Task I: Screening assessments for all the feasible list options is given in Chapter 4. A summary of the Task I: Screening results for the WRMP is provided in Chapter 5.

4 HRA Task I: Screening assessments – Options Assessment

4.1 Introduction

This chapter presents the HRA Task I: Screening assessments of the draft WRMP options, i.e. the 'feasible' list of options, by broad option type.

It should be noted that between the Draft WRMP and the WRMP options were further developed by Anglian Water which included amended routes for pipelines. The updated options were assessed as part of the HRA Task I: Screening and the results are included in this chapter. The previous HRA Task I: Screening assessments for the superseded options are included in Appendix C.

4.2 Aquifer Storage and Recovery

Aquifer Storage and Recovery (ASR) utilises suitable hydrogeological settings to store water within an aquifer. Source water is treated to standards suitable for mixing with the in-situ groundwater before being injected into the aquifer through borehole infrastructure. Following storage, water is abstracted from the boreholes, treated, and distributed to the potable water network for use.

Injection will primarily be seasonal and operate in winter months when surface water availability is high and reservoirs are full. Water may be held in aquifers for up to several years before being abstracted from the same borehole(s).

Analysis of surface water and groundwater data is required to determine appropriate treatment options for each aquifer type with typical surface water quality data. Treatment is required to ensure the aquifer is not contaminated with constituents that would threaten the drinking water quality and to ensure water chemistries are not dissimilar.

The ASR options comprise the following components:

- Raw water transfer pipeline and surface water abstraction
- Treatment works (surface water and ground water)
- Borehole injection / abstraction
- Water collection pipework
- Treated water transfer pipeline(s)

Pumping stations will be used for the following activities:

- Pumping raw water from an intake and/or from a borehole abstraction
- As part of the treatment process for raw water
- Pumping treated water into the borehole injection site
- Pumping treated water to distribute it to the network

While ASR options result in no net abstraction of water, hydrological changes to local surface are likely to occur. Groundwater levels and flows in aquifers are also likely to be altered, with changes in groundwater through ASR therefore having the potential to impact the underlying processes of wet habitats. Additionally, some options will require new water treatment works and pipelines, leading to potential habitat loss and damage from built infrastructure as well as disturbance during construction. Abstraction can impact the flow regime of rivers, which may be the source for ASR options. Resultant changes in habitat availability could lead to physical loss of qualifying species and direct mortality.

The assessment of Likely Significant Effects from aquifer storage and recovery options on European sites is given in Table 3 below.

Table 3: Potential Effects from Proposed Aquifer Storage and Recovery Options

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
<p>ESU3 - East Suffolk RZ Aquifer Storage & Recharge</p> <p>This option involves taking water from the River Gipping or River Stour. Surface and groundwater will be treated at Bucklesham WTW and recharge will be abstracted using seven ASR boreholes. Water will be added to the network at Rushmere Water Reservoir.</p>	<p>Stour and Orwell Estuaries SPA Stour and Orwell Estuaries Ramsar site</p>	<p>This option proposes a new abstraction from either the River Gipping or the River Stour to recharge the aquifer. There are no European sites within the footprint of the option, however the Stour and Orwell Estuaries SPA/Ramsar sites are approximately 2km downstream. A new abstraction at the River Stour and River Gipping has the potential to result in a reduction to water flows and levels entering the SPA/Ramsar site situated downstream. New abstractions are not explicitly covered by the Review of Consents, therefore a reduction in water entering the site has the potential to result in adverse effects on the European site.</p> <p>The SPA and Ramsar site are protected for their important assemblages of overwintering birds and the saltmarsh and intertidal habitats present. A reduction in water flows entering the estuary has the potential to result in physical loss and/or degradation of qualifying habitat features, or suitable habitat for its overwintering and passage bird species. Reduction in water levels may also result in biological disturbance of bird species through changes in habitat availability. This has the potential to result in significant effects.</p>	<p>Yes</p>
	<p>Deben Estuary SPA Deben Estuary Ramsar site</p>	<p>This option proposes a new abstraction from either the River Gipping or the River Stour to recharge the aquifer. There are no European sites within the footprint of the option, however the proposed new boreholes are to be located adjacent to the Mill River which flows directly into the River Deben. The Deben Estuary SPA/Ramsar site is mainly protected for its assemblages of overwintering birds. There is a small chance that the option</p>	<p>No</p>

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
		may result in a reduction of groundwater levels and flows in this area, but given the qualifying birds are most likely using the intertidal habitats, it is unlikely the qualifying habitats of the designated sites will be affected by the option.	

4.3 Desalination

Desalination is the process of removing salt from saline water, producing two products: fresh water and concentrated brine. The desalination option type uses reverse osmosis desalination to treat saline water and inject potable water into the distribution network. Seawater options take water from the North Sea at various locations along the East coast of England.

Treated water is immediately suitable for distribution in the potable network. These options include intake and outfall of raw water and brine respectively, raw water treatment to potable standards, and transfer to suitable water reservoirs and demand hubs.

Desalination options produce a deployable output that is, in the case of seawater desalination, unaffected by drought and is not limited by raw water availability from conventional sources. Raw water salinity is a key variable in the design of desalination treatment works.

Desalination options comprise the following components:

- Raw water intake and brine outfall
- Desalination plant
- Treated water distribution transfer
- Wastewater direct sewer (Kings Lynn only)

Depending on the water resource requirement, desalination plants can be run continuously or may be operated in turndown or standby mode and brought online during times of drought. Seawater desalination plants abstract seawater continuously. The sizes of the desalination plants can be chosen based on supply-demand deficits and cost-benefit analysis.

The construction of desalination plants and offshore and inshore pipelines could cause physical loss and damage to marine and coastal habitats, with associated non-physical disturbance during construction. These impacts are only likely to be significant where the boundary of the option extends within the boundary of the European site or within an off-site area known to be used by qualifying species, with construction disturbance being temporary in nature. Increased vehicular traffic and construction activities may also cause air pollution and create the potential for water pollution events to occur.

Sea water abstraction may have a direct impact on marine life, with the potential for fish and other organisms to be killed on intake screens or during processing of the salt water.

The discharge of concentrated salt brine has the potential to change water quality and salinity as well as temperature. Sea desalination would take sea water and discharge to sea. While there is uncertainty surrounding the long-term impacts of brine disposal on the marine habitat, certain habitat groups and species are more likely to be affected due to their known sensitivities. The brine to be discharged at sea is not expected to affect coastal habitats.

The assessment of Likely Significant Effects from desalination options on European sites is given in Table 4 below.

Table 4: Potential Effects from Proposed Desalination Options

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
<p>SHB1 - South Humber Bank Desalination</p> <p>The proposed location is in the industrial zone between Immingham and Grimsby, requiring the construction of a seawater desalination plant and transfer pipeline. Intake and outfall points are to be located within the Humber Estuary and a desalination plant constructed on the south bank of the Estuary.</p>	<p>Humber Estuary SAC</p>	<p>The proposed seawater intake and brine discharge points are both located within the Humber Estuary. This has the potential to alter flow rates and may cause non-toxic contamination through impacts on water chemistry, salinity, and temperature at the discharge point and downstream of it.</p> <p>The Humber Estuary is already subject to human activity, with previously reported issues including impacts on the sediment budget, geomorphological structure and function of the estuary, changes in water quality and flows and pressure from additional built development. Construction and operation of this option may add to these pressures, potentially impacting qualifying habitats and species of this SAC through altering the underlying processes supporting them.</p> <p>The construction of associated infrastructure such as pipelines within the Estuary has the potential to cause physical damage which may lead to degradation of qualifying habitats. Non-physical disturbance is likely to occur, which may affect qualifying species such as river lamprey (<i>Lampetra fluviatilis</i>) and sea lamprey (<i>Petromyzon marinus</i>). Disturbance impacts are considered to be temporary but could be significant without appropriate mitigation.</p>	<p>Yes</p>
	<p>Humber Estuary SPA Humber Estuary Ramsar site</p>	<p>Disturbance impacts are likely to occur on qualifying bird species. As with the Humber Estuary SAC, this would be associated with the construction of the desalination plant and transfer pipeline.</p>	<p>Yes</p>

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
		<p>Disturbance impacts are considered to be temporary but could be significant without appropriate mitigation.</p> <p>Changes to water flow and chemistry may alter the wetland and coastal habitats which support the qualifying bird species of the SPA. These may additionally be impacted by physical disturbance through the construction of associated infrastructure if appropriate mitigation measures are not put in place.</p> <p>The Humber Estuary Ramsar information Sheet (RIS) highlights disturbance (recreational and to vegetation), pollution, water diversion and coastal squeeze as factors adversely affecting the site's ecological character. Construction of the desalination option has the potential to add to these pressures potentially impacting on the interest features of the designated site.</p>	
<p>NTB5 - Bacton Desalination</p> <p>This option is proposed to be located near Bacton Gas Terminal, with intake and outfall points within the North Sea, 250-500m from the shore. It would involve a seawater desalination plant and transfer pipeline components, with treated water to be added to the network at Heigham WTW.</p>	<p>Paston Great Barn SAC</p>	<p>The proposed location for the desalination plant is near Bacton Gas Terminal, which is less than 1km east of Paston Great Barn SAC. This site is designated for barbastelle bats, which typically forage 5-6km from their roosts and are considered to be sensitive to disturbance throughout their range. There is therefore potential for disturbance impacts on the qualifying species of this site. This is likely to be most significant during the construction phase but may also be caused by increased activity in the area during operation of the desalination plant.</p>	<p>Yes</p>
	<p>The Broads SAC</p>	<p>The water intake and brine discharge will be located at sea, over 250m from the coast. No likely significant effects are expected and no direct habitat loss is likely to occur. Adverse effects on The Broads SAC could result due to</p>	<p>Yes</p>

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
		disturbance as the pipeline runs along a road adjacent to western boundary of the site. The route also crosses the River Bure, at Coltishall, which feeds into The Broads SAC. There is potential for impacts during construction of the river crossing resulting in deterioration in water quality.	
	Broadland SPA Broadland Ramsar site	Disturbance impacts to qualifying bird species may be caused during construction of a pipeline adjacent to this site. These are likely to be temporary; however, may cause significant impacts to qualifying species if appropriate mitigation is not put in place.	Yes
	Southern North Sea cSAC	The intake and outfall points for the proposed desalination plant are located within this candidate SAC site. This site has been identified as an area of importance for harbour porpoise <i>Phocoena phocoena</i> , with direct disturbance impacts from construction therefore possible. Anthropogenic underwater sound can lead to physical and behavioural changes, thereby negatively impacting the proposed qualifying species of this site. Additionally, the discharge of brine is likely to change the water chemistry in the immediate location through changes in salinity levels and associated temperature increases. This may directly impact the suitability of the area for the harbour porpoise if changes exceed the species' natural variation limits and indirectly through impacting the suitability of the site for its prey species.	Yes
NFN1 Kings Lynn Desalination	The Wash & North Norfolk Coast SAC	The location of the desalination plant and proposed pipeline routes is outside the designated site. However, the River Great Ouse is one of four rivers which feeds The Wash, with anthropogenic use	Yes

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
		<p>of these rivers determining the volume and quality of water entering it. Impacts could result from reduced flows in the River Great Ouse and into The Wash through the uptake of brackish tidal river water. This could affect the quantity and type of sediments in the designated areas.</p> <p>The resulting brine will be piped to the existing Kings Lynn STW for treatment before discharge, minimising the increase in salinity during incoming tides when the brine will be drawn up the river towards the intake. While this will minimise changes to water quality from the brine discharged into the River Great Ouse, the potential for impacts will still exist. The mudflats and sandflats are considered to be at most risk due to potential changes in sediment transport and water quality changes.</p> <p>This site has been previously assessed as being threatened from changes in sediment budgets and coastal squeeze as a result of dredging, land-claim and coastal defence works. The desalination option therefore has the potential to amplify these threats to result in significant effects. It has been recommended in the Site Improvement Plan that a review of the water level management is undertaken on the freshwater marshes of the sites. Plans for the desalination option should therefore take this into consideration.</p>	
	<p>The Wash SPA The Wash Ramsar site</p>	<p>Changes to flows into The Wash are likely to affect habitats that support qualifying bird species, resulting in potential significant effects. The brine discharge into the River Great Ouse may also result in water quality deterioration affecting the SPA habitats and qualifying species that are supported by these.</p>	<p>Yes</p>

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
<p>ESU1 - Felixstowe Desalination The proposed location of this option is near the Port of Felixstowe, with intake and outfall points 250-500m from shore within the North Sea. Option components include desalination plants and a transfer pipeline, with treated water to enter the system at Sprites Hall WR.</p>	<p>Stour and Orwell Estuaries SPA Stour and Orwell Estuaries Ramsar site</p>	<p>Disturbance impacts are less likely due to the distance of the proposed plant from the designated site. Changes to water chemistry and flow which may be caused by the uptake of brackish water and discharge of brine may impact the inter-relationships between the various components of the site which currently qualify under Ramsar criterion 3.</p> <p>The proposed location of the desalination plant is within a residential area near the east coast of Felixstowe. The intake and outfall points will be within the North Sea, 250-500m from the shore and located at a minimum of 500m from each other.</p> <p>A pathway exists for noise disturbance during the construction phase to result in a change in the number and distribution of species within the Zol. It is considered that the rare and nationally scarce features which meet Ramsar Criterion 2 and the saltmarsh and intertidal mud flat sub-features for the SPA are present within the Zol, therefore there is potential for the qualifying bird species which depend on these habitats to be affected by non-physical disturbance such as noise, visual and light pollution through construction.</p> <p>During the construction period, materials and machinery are likely to be mobilised in the North Sea for the construction of the proposed intake and outfall pipelines. If a water pollution incident should occur, a pathway exists to impact the European sites through diffusion into the estuaries. This may cause adverse effects on the qualifying habitat features, with potential knock-on impacts on the qualifying bird species.</p> <p>The option includes an outfall point within the North Sea for the discharge of brine</p>	<p>Yes</p>

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
		<p>produced through the reverse osmosis process used in desalination. Depending on the concentration and volume to be discharged, brine may affect the salinity and temperature of water. The estuaries are hydrologically linked to the outfall point with a potential pathway for impact therefore existing which cannot be ruled out at this stage.</p>	
	<p>Deben Estuary SPA Deben Estuary Ramsar site</p>	<p>It is considered that the features which meet Ramsar Criterion 2 and the sub-features for the SPA for the Stour and Orwell Estuaries Ramsar site, and the sub-features listed for the Stour and Orwell Estuaries and Deben Estuary EMS, are present within the Zol (saltmarsh and intertidal mud flats).</p> <p>The desalination plant and associated pipelines are approximately 4km from the Deben Estuary SPA/Ramsar site. A pathway exists for noise disturbance during the construction phase to result in a change in the number and distribution of species within the Zol. It is considered that the features which meet Ramsar Criterion 2 (i.e. presence of the rare Annex II mollusc species <i>Vertigo angustior</i>) and the saltmarsh and intertidal mud flat sub-features for the SPA are present within the Zol, therefore there is potential for the qualifying bird species which depend on these habitats to be affected by non-physical disturbance such as noise, visual and light pollution through construction.</p> <p>During the construction period, materials and machinery are likely to be mobilised in the North Sea for the construction of the proposed intake and outfall pipelines. If a water pollution incident should occur, a pathway exists to impact the European sites through diffusion into the estuaries. This may cause adverse effects on the</p>	<p>Yes</p>

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
		<p>qualifying habitat features, with potential knock-on impacts on the qualifying bird species. Water quality has already been identified as a pressure in the Deben Estuary SPA and SAC sites, with any pollution impacts from the proposed scheme therefore having the potential to exacerbate this.</p> <p>The option includes an outfall point within the North Sea for the discharge of brine produced through the reverse osmosis process used in desalination. Depending on the concentration and volume to be discharged, brine may affect the salinity and temperature of water. The estuaries are hydrologically linked to the outfall point with a potential pathway for impact therefore existing which cannot be ruled out at this stage.</p>	
	Thames Estuary SPA	<p>A very small area of the Outer Thames Estuary SPA (c.0.3km²) overlaps with the 5km Zol around the proposed desalination plant. This represents less than 0.001% of the site's total area and is over 4km away from the proposed option. The qualifying features of this SPA have therefore been screened out of this assessment.</p> <p>It is considered that the proposed Felixstowe desalination option would have no significant impact on the integrity of the site or undermine its conservation objectives in relation to the red-throated diver, with the Outer Thames Estuary SPA therefore not further considered in this appropriate assessment.</p>	No

4.4 Reservoirs

The reservoir option type consists of increasing water supply by either constructing new reservoirs or increasing the capacity of existing reservoirs. The reservoir options fall under the following headings:

- **Increase yield/intakes/improve efficiency options** - involve increasing yield from existing reservoirs by increasing the capacity of the abstraction system (river intake, pumping station and pipe supplying the reservoir). The yield assessment takes into consideration existing limits posed by abstraction licenses.
- **Increase capacity – Raising / Dredging options** - involve increasing yield from existing reservoirs by increasing the volume stored by raising the current top water level. There are no feasible options to increase volume through the dredging of reservoirs. These were assessed at WRMP 2014 and the reduction in live volumes of major reservoirs due to siltation since commissioning was minimal. This is to be expected for reservoirs which are primarily supplied by pumped inflow and with minimal direct catchments.
- **New reservoir options** – involve creation of a new reservoir.

Some reservoir options have been assessed in conjunction with the associated raw water transfers to those reservoirs. The land take area associated with each reservoir option are unknown at this stage of the assessment and it is not known whether the new reservoirs are likely to be excavated or raised above ground.

Options focussing on creating new reservoirs, or increasing the volume of existing ones, will result in noise and visual disturbance during construction activities. Physical damage and loss may be caused by the flooding of additional land areas and building of associated infrastructure. Establishing new connections between sites poses the risk of creating pathways for the spread of invasive species and disease.

There is potential for changes in water flows to and from reservoirs during construction. There is also potential for longer term changes in flows downstream of any new or increased abstractions required to feed the reservoir. Changes in flow regimes as a result of new abstractions have the potential to impact on habitat availability and diversity in European sites located downstream. As discussed in Section 4.3. however, it is assumed that increases to existing abstractions will not result in any likely significant effects on European sites, as the Review of Consents process has assessed all current licences at their abstraction limits and ensures protection of these sites. Therefore, effects on European sites located downstream of current abstractions are not considered in the assessment of reservoir options, where abstraction licence increases are proposed.

The Likely Significant Effects from reservoir options on European sites is given in Table 5 below.

Table 5: Potential Effects from Reservoir Options

For the WRMP Reservoir options at Pitsford, Rutland, South Lincolnshire, and Fenland there are associated sub-options, which are assessed separately in the following table. Associated transfers are those water transfer options which would be required for the reservoir option where they are assessed only, and not considered as standalone transfers elsewhere for the purpose of the WRMP.

Option	Sub-option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
<p>RTN11 - Pitsford dam raising This option involves the raising of the reservoir by 3m, a new abstraction from the River Nene at Dunston Mill, a new transfer pipeline to Pitsford Reservoir and a new transfer pipeline to existing WTW (at various capacities). There will also be pumping station upgrades.</p>	<p>RTN11: Upgrade resulting in two transfers from River Nene (Dunston Mill) to Pitsford reservoir then to Pitsford WTW.</p> <p>RTN9: Receiving water from Severn Trent Water and transferring through the Grand Union Canal into the River Nene. Abstraction from River Nene (Dunston Mill) to Pitsford reservoir and then to Pitsford WTW.</p> <p>RTN10: Upgrade resulting in three transfers, one from the River Nene (Dunston Mill), one from the reservoir to Pitsford WTW and one via the Grand Union Canal (Minworth WTW) to the River Nene.</p>	<p>Upper Nene Valley Gravel Pits SPA Upper Nene Valley Gravel Pits Ramsar site</p>	<p>The crest raising works are unlikely to result in any physical damage, loss or habitat degradation that will affect qualifying features of a European site. The closest European site is ~12km from the reservoir.</p> <p>For transfer associated with RTN11, the River Nene feeds into the Upper Nene Valley Gravel Pits SPA/Ramsar site (Upper Nene Valley Gravel Pits SSSI Unit 1) approximately 6km downstream of the abstraction at Dunston Mill. There is potential for alterations to water levels or flows as a result of increased abstraction at this location which may result in physical damage, contamination, or biological disturbance at this site.</p> <p>The transfer options and associated works from Pitsford reservoir to Pitsford WTW are unlikely to result in any significant effects on European sites.</p>	Yes
<p>RTS2 - Grafham dam raising This option involves the raising of the existing reservoir by 3m which</p>	-	None within Zol	<p>The closest European site to the option is Portholme SAC, more than 6km upstream on the River Great Ouse from Grafham reservoir. The River Great Ouse is connected to the reservoir by a pump mechanism which allows the reservoir to be used as increased storage in the event of a</p>	No

Option	Sub-option	European Sites Within the Zol	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
		(Natura 2000/Ramsar)		
<p>will increase the yield by 16%. This will be achieved through modification of the spillway and draw-off and the incorporation of embankments to protect the road and rail. New infrastructure/pipelines and pumping stations less than 2km long will be required to transfer water from the reservoir to the existing WTW. The source of the reservoir is the River Great Ouse.</p>			<p>flood, therefore the hydrological connection to the Ouse is controlled. Given this, and the distance to the nearest European site, it is unlikely that any impact on the river and consequently the European site is likely as a result of the option. The associated transfer option is not likely to result in any significant effects.</p>	
<p>NFN3 - Fenland reservoir This option involves the creation of a new reservoir (approximately 60,000 MI) on Feltwell Fen. A transfer pipeline would be required for the abstraction of water at Blackdyke (River Great Ouse) to Fenland Reservoir which is approximately 24km in length. From the reservoir, water will then be transferred to Stoke WTW via a pipeline which is approximately 15km in length. Pumping stations will be required on all transfers.</p>	-	Ouse Washes SPA Ouse Washes Ramsar site	<p>The new reservoir will be filled by abstraction from the Cut Off channel. Increased abstraction from Denver sluice which feeds the Cut Off Channel will be required. The watercourse at Denver sluice is in direct hydrological connection with the Ouse Washes SPA/Ramsar site. The exact location of the abstraction is unknown, therefore taking a precautionary approach, impacts on this site must be considered. This site is vulnerable to hydrological changes which may affect the rare and scarce vegetative features listed under Criterion 2 and the washland habitat listed under Criterion 1. Changes to surface levels and volume in the Ouse Washes may lead to biological disturbances such as changes in habitat availability for the qualifying bird assemblages listed under Ramsar Criterion 5 and 6. Finally, hydrological changes may lead to changes in water quality such as increased sedimentation leading to siltation which may accelerate habitat availability and alter habitat availability for waterbirds utilising the Ouse Washes, as well as other species such as spined loach listed under Ramsar Criterion 2 which depends on sediment quality and water quality for its specialised feeding mechanism. Qualifying features of the Ouse Washes SPA are overwintering and breeding bird assemblages and species.</p>	Yes

Option	Sub-option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
			<p>Increasing abstraction may result in hydrological changes that result in changes to surface water levels within the SPA; habitat degradation or a reduction in habitat quality and availability for qualifying bird species; and/or changes in water quality such as increased sedimentation leading to siltation which may accelerate habitat availability and alter habitat availability for waterbirds.</p> <p>For the transfer, the exact location of the new pipeline is unknown, therefore as a precautionary approach it is assumed that this transfer has the potential to affect the Ouse Washes SPA/Ramsar site.</p>	
		Ouse Washes SAC	<p>Increased abstraction from Denver sluice which feeds the Cut Off Channel will be required. The watercourse at Denver sluice is in direct hydrological connection with the Ouse Washes Ramsar site. The exact location of the abstraction is unknown, therefore impacts on this site must be considered.</p> <p>The SAC is designated for its population of spined loach which depends on sediment quality for its specialised feeding mechanism and is sensitive to water quality and turbidity. Increased abstraction may lead to hydrological changes at this site, which has the potential to increase sedimentation, leading to siltation which may significantly alter habitat availability for this species.</p> <p>For the transfer, the exact location of the new pipeline is unknown, therefore using the precautionary approach, it is assumed to have the potential to affect the Ouse Washes SAC.</p>	Yes
		Norfolk Valley Fens SAC	<p>For the transfer, construction of new pipeline from Fenland reservoir to Heigham has potential to result in temporary disturbance within North Valley Fens SAC (depending on exact location of pipeline route). These alkaline fens are in discreet units and include sensitive habitat which are vulnerable to disruptions to the water table. Construction of new infrastructure within this site has the potential to result in habitat degradation or trampling from construction works, physical loss of habitat and temporary non-physical noise, pollution and/or air disturbance.</p>	Yes
		Breckland SAC	<p>For the transfer, new pipeline infrastructure required from Fenland reservoir to Heigham WTW will bisect Breckland SAC. The works have the potential to cause disturbance</p>	Yes

Option	Sub-option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
			<p>(noise, visual and/or pollution) through construction, which may reduce the number of birds using the site and result in habitat degradation or trampling of qualifying habitat features of the SAC.</p> <p>Likely effects are significant through construction only and could be mitigated through appropriate timing of works to avoid the breeding season and by rerouting the pipeline to avoid key habitat features within the designated site.</p>	
		Breckland SPA	<p>For the transfer, new pipeline infrastructure required from Fenland reservoir to Heigham WTW will bisect Breckland SPA. The interest features of the SPA are breeding assemblages of three key bird species. Construction of the new pipeline within this site has the potential to result in habitat degradation or trampling of key heathland and acid grassland habitat for these species. The works also have the potential to cause disturbance (noise, visual and/or pollution) through construction, which may reduce the number of birds using the site.</p> <p>Construction effects are temporary and could possibly be mitigated through appropriate timing of works to avoid the breeding season and by rerouting the pipeline to avoid key habitat features within the designated site.</p>	Yes
		Barnack Hills and Holes SAC	<p>For the transfer, the exact location of new pipeline is unknown, but has the potential to affect Barnack Hills and Holes SAC, This SAC is designated for its dry grassland and scrub facies. The construction of the new pipeline infrastructure has the potential to result in significant effects on this site if works are required in or adjacent to this site. Construction works may result in habitat degradation or physical damage through trampling.</p> <p>Construction effects are temporary but have the potential to be significant without the implementation of suitable mitigation.</p>	Yes
<p>RTS1 - New Ruthamford South RZ reservoir This option consists of the creation of a new 14,500 MI reservoir and new infrastructure/</p>	-	Portholme SAC	<p>Increased abstraction from the River Great Ouse at Offord has the potential to affect this SAC, located~4km downstream. The SAC interest features are alluvial hay meadows, part of the site being maintained as flood meadow. Increased abstraction may result in changes to water levels and flows downstream of the abstraction point subject to seasonal flooding. This is not likely to result in a</p>	No

Option	Sub-option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
<p>pipelines and pumping stations approximately 22km in length to transfer water from Offord (River Great Ouse) to the new reservoir. Water will then be transferred via a new pipeline to the existing Grafham. As part of this option, Grafham WTW will be upgraded.</p>			<p>significant effect on Portholme's <i>Sanguisorba officinalis</i> - <i>Alopecurus pratensis</i> (MG4) grassland community, as it is vulnerable to prolonged flood events which increase phosphate/sediment levels during winter.</p> <p>The construction of the new transfers is not likely to affect any European sites.</p>	
<p>SEX2 - Ardleigh reservoir extension</p> <p>This option consists of a 1500 Ml extension to the existing Ardleigh reservoir reusing an existing gravel quarry to provide the required water storage. The option abstracts water from East Mill on the River Colne and transfers water to Ardleigh Reservoir via an underground pipeline which is approximately 5km long. Water will then be transferred from the reservoir to the existing Ardleigh WTW.</p>	-	<p>Colne Estuary (Mid Essex Coast Phase 2) SPA Colne Estuary (Mid Essex Coast Phase 2) Ramsar site Essex Estuaries SAC</p>	<p>For the pipeline transfer, the abstraction point is approximately 7km upstream of the Colne Estuary (Mid Essex Coast Phase 2) SPA and Ramsar site and the Essex Estuaries SAC. It is expected that increased abstraction at East Mills will be supplemented by increased river augmentation upstream, therefore there will be no alteration in the flow regime downstream of the abstraction. Therefore, no likely significant effects on the downstream European sites are expected.</p>	No
<p>RTN5 - Raw water transfer from the River Trent to Rutland Reservoir</p> <p>This option involves raising the reservoir crest by 0.5m through</p>	-	<p>Rutland Water SPA Rutland Water Ramsar site</p>	<p>Rutland Water SPA is designated for its overwintering bird assemblages and for its internationally significant number of waterfowl. The reservoir crest raising works are wholly within the boundary of the SPA, therefore effects are likely to occur during construction such as habitat degradation, and non-physical disturbance impacts on the qualifying bird species. These effects are considered temporary during the construction phase. There may be permanent physical loss</p>	Yes

Option	Sub-option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
modifying dam and ancillary works.			<p>of habitat due to water quality changes and predicted increase in water storage proposed by this option.</p> <p>There is likely to be a requirement to lower the water level within Rutland reservoir during construction works to allow for the safe raising of the dam. Impacts on qualifying water-dependent habitats (namely inland water bodies, bogs, marshes, water fringed vegetation and fens) are likely during the construction and operational phase which may lead to habitat degradation and physical loss of habitat due to increased water storage permanently affecting surface water levels. Potential non-toxic contamination impacts such as degradation of water quality and increased sedimentation or silting pre- and post-construction</p> <p>Rutland Water Ramsar site is designated wholly for its bird interest of international concern, both over-wintering and spring/summer breeding. Therefore, the effects on Rutland Water Ramsar site are likely to be the same as those listed above for qualifying bird interest of Rutland Water SPA.</p> <p>None of the associated transfer options are likely to result in any significant effects.</p>	
		Humber Estuary SAC Humber Estuary SPA Humber Estuary Ramsar site	<p>The Humber Estuary designated site boundary is over 150 km downstream of the abstraction point at Shardlow on the River Trent. While a decrease in flow and water level is expected immediately downstream of the intake, it is highly unlikely that abstraction at Shardlow will have an impact on the hydrological or physico-chemical features of the Humber Estuary. Changes to freshwater flows will minimise with distance downstream from the abstraction point due to the input of additional flows from waste water treatment works and tributaries. Freshwater flows are also of low importance at the designated site relative to estuarine/marine processes. Freshwater input to the estuary is relatively low and the tidal limit occurs so far inland that at the point the rivers meet the designated area, considerable mixing with water of marine origins has already occurred.</p> <p>Therefore, there are no reasonably foreseeable likely significant effects on the Humber Estuary European sites.</p>	No
	RTN1: South Lincolnshire Reservoir	Baston Fen SAC	Baston Fen SAC is located ~4km downstream of the proposed new South Lincolnshire reservoir, on the counter drain of the River Glen. It is designated as it retains a high	No

Option	Sub-option	European Sites Within the Zol	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
RTN1 / RTN2 / RTN14 - South Lincolnshire Reservoir	(unsupported by the Trent) RTN2: South Lincolnshire Reservoir (supported 160ML Trent) RTN14: South Lincolnshire Reservoir (supported 300ML Trent)	(Natura 2000/Ramsar)	population of spined loach and a rich aquatic flora. Impacts on the SAC could result from the construction and operation of the reservoir, which will include filling of the reservoir and retaining a body of water close to the SAC, potentially affecting groundwater levels/flows. However, as the only direct source of water for the new reservoir will be a pumped water transfer from the River Witham, it is expected that the new reservoir will be sufficiently contained and not result in significant effects on groundwater. The presence of a permanent water body may have implications on the local presence of birds in the area, but given Baston Fen is designated for spined loach, it is not expected that the integrity of the site will be affected by the option. The associated transfer options are considered unlikely to result in any significant effects on European sites.	No
This option involves a new reservoir approximately 50,000 MI in size, new transfer pipeline (approx. 42km long) and pumping station from the River Witham at Langrick Bridge, and new transfer pipeline (approx. 25km long) and pumping station from the reservoir to the existing Kings Delph WTW. Kings Delph WTW will also be upgraded.		The Wash & North Norfolk Coast SAC The Wash SPA The Wash Ramsar site	The confluence of the River Witham with The Wash is approximately 14 km downstream of the proposed abstraction point at Langrick Bridge. Increased abstraction from the River Witham is expected to reduce flows and water levels immediately downstream of the intake. However, it can be reasonably judged that a reduction in freshwater flows is unlikely to have significant hydrological or physico-chemical consequences in The Wash. Key to this is the low importance of freshwater flows at the designated site relative to estuarine/marine processes. Freshwater input to the estuary is relatively low and the tidal limits occur so far inland that at the point the rivers meet the designated area, considerable mixing with water of marine origins has already occurred. Therefore, there are no reasonably foreseeable likely significant effects on The Wash European sites.	
RTW2 - Recommission Ruthamford West RZ reservoir Recommissioning of reservoir, WTW and intake, with new 90m pipeline.	-	None within Zol	Precise location of new/recommissioned infrastructure at Foxcote Reservoir not known. However, there are no European sites located within 20km of the existing Foxcote Reservoir. Abstraction from the River Great Ouse at Thornborough to supply the reservoir may affect flows in the river, which feeds into the Ouse Washes SAC/SPA/Ramsar site. However, the	No

Option	Sub-option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
			abstraction point is located over 100km upstream of the Ouse Washes, so a significant impact is unlikely. Therefore, there are no reasonably foreseeable likely significant effects on European sites.	

4.5 Water Reuse

Water Reuse or effluent reuse options treat final effluent from existing water recycling centres (WRCs) to a very high standard, suitable for discharge to a new location upstream of an abstraction point for an existing impounding reservoir or water treatment works (WTW)²⁰.

The treatment process has been selected to ensure that the following conditions have been met:

- The 'recycled' effluent is suitable for discharge to the proposed location.
- The operation and performance of the existing wastewater treatment plant isn't affected by returned wastewater flows from the water reuse plant.
- Final effluent quality (to the existing discharge location) is not materially deteriorated. This condition must be met to ensure that the concentrations of key consented and non-consented parameters in the existing discharge are not worsened.

The water reuse options considered fall into two categories:

- **Water Reuse options** that recycle treated wastewater from water recycling centres for indirect potable reuse or direct non-potable reuse:
 - Expansion of capacity of abstraction and WTW to increase supply output.
 - No expansion of WTW or abstraction, water reuse option to increase resilience of supply and output during drought periods.
- **Washwater Recovery options** reduce losses from water treatment works by recovering and recycling used washwater²¹. No wash water recovery options were included in the EBSD modelling and are therefore, not assessed.

Note that the non-potable option at Pyewipe provides direct reuse by South Humber Bank industrial area and has opportunities to provide customers with demineralised reverse osmosis (RO) permeate. This option may provide water resource benefits if it can make water available for potable production at other sites where non-potable water is produced.

Direct potable reuse is the recycling of wastewater immediately at source to produce potable water. Wastewater 'final effluent' can be treated all the way to potable quality using advanced treatment processes and this water added to the distribution network. However, there are concerns that adding recycled water directly to the distribution network could increase the water safety plan risk particularly as the effect of process failure could immediately affect potable water quality. Although technically feasible, there are strong concerns that the associated risks are not acceptable and would not be acceptable to consumers. Direct potable reuse options were therefore not considered further for the feasible options list and therefore, there were no options of this type to assess as part of the SEA.

Direct non-potable options do not have an equivalent public health or perception driver and so have been designed as direct reuse options whereby recycled water is treated immediately to the standard required for industrial non-potable use.

Indirect potable reuse is the preferred reuse option as it both provides an additional layer of protection for water safety and blends the highly treated recycled water with environmental flows. For this option type, indirect potable reuse options generally discharge recycled water into rivers at least two miles upstream of an existing Anglian Water abstraction to a WTW or impounding reservoir. The recycled water thus becomes a fraction of a WTW's raw water and is treated normally to potable standards.

An underlying assumption in this work is that a 'put-and-take' licence would be granted for discharges to and abstractions from intermediate waterbodies. This means that a licence for the same volume of water discharged to surface water would be available for abstraction, even at low flows when a river

²⁰ Water Reuse as described in 'Anglian Water WRMP19 Supply Option Development Task I2: Conjunctive Use' (Mott MacDonald, May 2017).

²¹ Also known as backwash, washwater comes from the process of pumping water backwards through the filters during the water treatment process, as a form of preventative maintenance of the filters. Spent backwash water can contain high levels of particulates and is either discharged without treatment to a sanitary sewer system or is treated and recycled within the plant. Historically, backwash water was discharged directly to surface water supplies.

may be below its “hands off flow”. Given the likely high quality of the effluent, ‘discharges’ are likely to improve rather than worsen river water qualities and so obtaining this type of licence is considered feasible.

The establishment of water reuse options would require new built infrastructure such as pipelines, which would cause disturbance during construction and potential physical loss and/or damage. Wastewater effluent currently makes up a large proportion of river flows in some areas. Alterations in effluent output through reuse may therefore cause changes to hydrology and water quality.

The Likely Significant Effects of water reuse options on European sites is given in Table 6 below.

Table 6: Potential Effects from Water Reuse Options

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
<p>SHB2 - Pyewipe Water Reuse for non-potable use</p> <p>This option proposes the construction of new treatment works to treat effluent from Pyewipe WRC, with outfall into the Humber Estuary and treated water to enter the supply at Grimsby Elsham NP.</p>	Humber Estuary SAC	<p>The planned Pyewipe Water Reuse Treatment Works (WRTW) and components of the associated pipelines are within 5km of the Humber Estuary SAC; the proposed WRTW being within 500m of the boundary of the SAC. The footprint of new infrastructure does not overlap with the site, with the outfall point within the Estuary already in place. However, there is the potential for disturbance impacts on the qualifying features to be caused during construction. Disturbance is likely to be significant during construction only but could remain significant without appropriate mitigation. Outfall into the Estuary already occurs from the Pyewipe WRC. However, a pathway for increased contamination may be created should discharge from the proposed Pyewipe WRTW be more concentrated or if the volume of outfall is increased. Construction and operation of this option may therefore add to the existing anthropogenic pressures on this site. This may potentially impact qualifying habitats and species of this SAC through altering the underlying processes supporting them.</p>	Yes
	Humber Estuary SPA Humber Estuary Ramsar site	<p>As with the Humber Estuary SAC, disturbance impacts associated with the construction of the WRTW and pipelines may be caused on the qualifying bird species. Disturbance is likely to be significant during construction only but could be significant without appropriate mitigation. Should changes to water chemistry occur as a result of increased</p>	Yes

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
<p>ESU2 - Ipswich Water Reuse</p> <p>This option proposes an increase in abstraction from the River Gipping to feed the Alton Reservoir for intake into supply. To facilitate this, it is proposed to treat the Cliff Quay effluent discharge into the River Gipping, upstream from the Alton Reservoir intake, providing the required feed water.</p>	<p>Stour and Orwell Estuaries SPA Stour and Orwell Estuaries Ramsar site</p>	<p>contamination from changes to the outfall discharge, this may alter the wetland and coastal habitats which support the qualifying bird species of the SPA.</p> <p>The proposed option would cross the River Orwell within the Stour and Orwell Estuary SPA and Ramsar sites. This has the potential to cause physical damage to habitat supporting the qualifying species of these sites. In particular, the relevant Ramsar Information Sheet (RIS) states that the site is currently suffering from erosion. The construction of the pipeline may exacerbate this problem in areas not currently affected.</p> <p>Construction of the pipeline and new treatment works has the potential to cause noise, visual and human disturbance impacts on the qualifying bird species of the site. Additionally, increased pollution during construction of the river crossing may occur, with potential impacts on the qualifying plant species of the Ramsar sites and the species they support. Disturbance is likely to be significant during construction only but could remain significant without appropriate mitigation.</p> <p>This option should result in no net change in water flow, with output from the effluent treatment balancing with increased abstraction upstream. However, there is the potential for localised changes in hydrology. For instance, redirection of effluent from Cliff Quay Water Reuse Works for discharge into the River Gipping may decrease outfall into the River Orwell. The impact of this change on qualifying habitats and species will be dependent on the significance of the change in outfall.</p>	<p>Yes</p>

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
<p>NFN2 - Kings Lynn Water Reuse This option involves the construction of a water reuse works for the treatment of effluent from Kings Lynn WRC. This will be transferred to the River Wissey to feed abstraction to Stoke Ferry WTW.</p>	The Wash & North Norfolk Coast SAC	<p>This option proposes the reuse of water from Kings Lynn WRC, less than 2km downstream of this site, with treated water to be discharged into the River Wissey to feed abstraction at Stoke Ferry. The Wissey feeds into the River Great Ouse, which in turns feeds the Wash, therefore the option has the potential to reduce flows entering this European site. Additionally, the construction of pipelines associated with the option would include a crossing of the river, with potential for increased pollution and disturbance during construction.</p>	Yes
	<p>The Wash SPA The Wash Ramsar site</p>	<p>Potential changes to water flow and water quality into the Wash are likely to impact habitats that support the qualifying bird species of these sites, resulting in potential significant effects. The proposed works are outside of the designated site; however, there is potential for disturbance impacts from construction of the new Kings Lynn WRTW and associated pipelines, should the qualifying species be present in the areas surrounding the proposed project footprint.</p>	Yes
	Norfolk Valley Fens SAC	<p>The proposed outfall location for treated water from Kings Lynn WRC is into the River Wissey, within approximately 2.7km of this SAC. This does not have any foreseeable significant impacts on the qualifying features of the site, which is located upstream of the outfall location and is not directly fed by the River.</p>	No
	Breckland SPA	<p>The proposed outfall location for treated water from Kings Lynn WRC is approximately 4.2km downstream of this SPA. This does not have any foreseeable significant impacts on the qualifying features of the site, which is</p>	No

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
NTB3 - Lowestoft Water Reuse This option has been designed to replace the loss of the Costessey pits abstraction. Construction of Lowestoft Water Reuse Works is proposed to treat effluent from Corton WRC to be transferred to Costessey.	River Wensum SAC	located upstream of the outfall location and is not directly fed by the River. This option proposes the discharge of treated effluent from Lowestoft WTW in the River Wensum at Hellesdon to feed increased abstraction. This should result in no net changes to water flow or quality within the SAC, with no foreseeable significant impacts on the qualifying features of the site. The proposed new Higham treatment works, adjacent to the existing Higham WTW, is beyond the SAC boundary with no likely significant impacts on the site.	No
	The Broads SAC	The proposed pipeline from Lowestoft WTW to Hellesdon would pass within 2km of this SAC and cross the River Waveney upstream of sections of this designated site. Given the distance of the SAC from the proposed pipeline, the qualifying species of this site are not considered likely to be disturbed. Therefore, no significant effects are considered likely.	No
	Broadland SPA Broadland Ramsar site	The proposed pipeline from Lowestoft WTW to Hellesdon would pass within 2km of this SPA and Ramsar site and cross the River Waveney upstream of sections of this site. Disturbance during construction of the pipeline is likely should it be constructed within 500m of habitat which supports qualifying bird species. No significant impacts are anticipated from changes in water flow.	Yes
NTB2 and NTB7 - Norwich Water Reuse This option proposes the treatment of effluent from Whitlingham WRC for discharge into Costessey Pits, feeding increased abstraction to Higham WTW.	River Wensum SAC	This option will include the construction of a new pipeline from the proposed Whitlingham WRW to Costessey Pits, which are adjacent to this SAC. The qualifying features of this SAC are white-clawed crayfish <i>Austropotamobius pallipes</i> , Desmoulin's whorl snail <i>Vertigo moulinsiana</i> , brook lamprey <i>Lampetra</i>	No

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
<p>RTN3 - Peterborough Water Reuse This option includes the construction of a new WRTW at Flag Fen close to the existing Flag Fen WRC, with a new pipeline between the existing WRC and new WRTW. The water treated at this new WRTW will be conveyed to a new outfall on the River Nene via a new transfer pipeline (approx. 16km long). The flow will then be abstracted from a new intake downstream on the River Nene and transferred to Rutland reservoir via a new transfer pipeline (approx. 17k long). Also included is an increase of capacity at Wing WTW, with a new pipeline to convey water to this WTW from Rutland reservoir, and then directly to existing supply pipelines.</p>	Nene Washes SAC	<p><i>planeri</i> and bullhead <i>Cottus gobio</i>are. The route of the transfer pipeline is designed to avoid bisecting the boundary of the designated site, therefore the construction is unlikely to result in any degradation or loss of suitable habitat for these species. With the application of good practice measures in noise, pollution, and vibrational control during construction, it is unlikely that the construction of the pipeline will result in any significant disturbance to these species. Therefore, no likely significant effects on this designated site are considered likely.</p>	Yes
	Nene Washes SPA Nene Washes Ramsar site	<p>Construction of the proposed Flag Fen WRW and associated pipeline adjacent to the Nene Washes has the potential to cause disturbance impacts on the qualifying bird species of this designated site. Additionally, there is the potential that the divergence of treated effluent causes changes in water flow and quality, impacting habitat supporting these qualifying species. Low water supplies have already been identified as an issue in the site's RIS.</p>	Yes
	Orton Pit SAC	<p>The proposed pipeline connecting Flag Fen WRW and the outfall point is within</p>	No

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
		5km of this site. There are no reasonably foreseeable significant impacts from construction or operation that have the potential to impact on the qualifying features of this SAC.	
	Barnack Hills & Holes SAC	The proposed pipeline connecting Flag Fen WRW and the outfall point is within 5km of this site. There are no reasonably foreseeable significant impacts from construction or operation that have the potential to impact on the qualifying features of this SAC.	No
	Rutland Water SPA Rutland Water Ramsar site	This option includes a pipeline for intake from the River Nene to Rutland Reservoir and the construction of a new treatment works for increased abstraction from the Reservoir into supply. Assuming that increased inflow from the river and outflow into supply will be balanced, no significant impacts on water levels and hydrology are reasonably foreseeable. Given a new transfer pipeline to Rutland reservoir will be required, disturbance during construction has the potential to result in significant impacts to the qualifying bird species of the designated site without the application of appropriate mitigation. Additionally, given the construction of the pipeline will require works within the boundary of the designated site, physical damage to the supporting habitat of qualifying species may occur.	Yes
SEX1 - Colchester Water Reuse This option proposes a new water reuse works for the treatment of effluent from Colchester WRC. This will be transferred further upstream in the River Colne to feed abstraction to Ardleigh Reservoir.	Colne Estuary (Mid-Essex Coast Phase 2) SPA Colne Estuary (Mid-Essex Coast Phase 2) Ramsar site	The designated area is located approximately 3km downstream of the outfall from the proposed Colchester Water Reuse Works and existing intake to Ardleigh Reservoir. Assuming that outflow from the reuse works will balance with any increases in intake to the	Yes

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
		<p>reservoir, no significant impacts from changes in water flow are anticipated.</p> <p>Impacts on habitats supporting the qualifying species may be caused through changes in water quality due to the discharge of reverse osmosis concentrate together with the STW usual discharge. Additionally, the proposed pipeline route will cross the River Colne, with potential for water quality deterioration during crossing construction. Changes to flows and water quality in the River Colne, if significant, could affect the Colne Estuary SPA habitats and species that they support which are the reason for the SPA designation.</p>	

4.6 Transfers

The water transfer options are generally not a component of any other option type (i.e. desalination, water reuse, sea tankering, which are assessed within the relevant option). They are divided into the following sub categories; internal potable transfers and raw water transfers.

All internal potable water transfers are deficit alleviation options between water supply hubs assigned within water resource zones (WRZ). Exceptions to this are the Affinity Water trading transfers for raw and potable water.

The raw water transfer options bring new resource to the existing network to relieve WRZ deficit. They are relatively few in number, with most raw water transfers being a component of reservoir options.

All transfer options involve the following components:

- A transfer pipeline
- One or more pumping stations either as part of a river or reservoir abstraction, or a forwarding pump station, or a further booster pump station
- 'Site services' (facilities related to each main option component)

Each transfer option has been correlated with existing Anglian Water assets which can accommodate and utilise the transfer volumes. Regarding associated site services infrastructure, the pump station model will be dependent on the water source. One telemetry station will be installed at each pumping station. Other associated infrastructure will include kiosks, buildings, boundary fencing, and landscaping, the scale of which will depend on the option size.

Canal options could be used as raw water transfer options, however using canals to transfer raw water present several technical challenges to be overcome, which include:

- Restrictions on flow, water quality and their ecological impact are often restricting factors. However, transfer could put flow into canals under low flow scenarios
- Many of the WTWs benefiting from the transfers, currently treat groundwater. Routing canal transfers to such a WTW would require retro-fitting to adequately treat the new (likely decreased) water quality.

The construction of new pipelines and channels or canals to connect water bodies has the potential to cause disturbance during construction. There is also the possibility for physical loss of habitat (most likely temporary) if new pipelines overlap the footprint of European sites.

Changes to water flow may be caused if water levels are decreased in donor sites and increased in recipient sites. Water flow change has the potential to alter the physical habitat with repercussions for qualifying bird and fish species and is likely to be significant where the boundary of the option extends within the same ground or surface water catchment as relevant European sites or is hydrologically linked. Establishing new connections between two sites may enable the introduction and spread of invasive species.

The Likely Significant Effects of transfer options on European sites are given in Table 7 (potable water) and Table 8 (raw water) below.

Table 7: Potential Effects from Transfer (Potable Water) Options

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
CEX2 - South Essex RZ to Central Essex RZ Transfer	None within Zol.	No potential impacts on European sites	No
ESU7 - Sudbury RZ to East Suffolk RZ transfer	Stour and Orwell Estuaries SPA Stour and Orwell Estuaries Ramsar site	The eastern end of the proposed pipeline route at Wherstead is located approximately 2km away from the Stour Estuary and the associated river crossings do not feed into this designated site. No likely significant effects are therefore anticipated from this option.	No
BHV4 - Sudbury RZ to Bury Haverhill RZ Transfer	None within Zol.	No potential impacts on European sites	No
CVY2 - Bury Haverhill RZ to Cheveley RZ Transfer	None within Zol.	No potential impacts on European sites	No
NNR3 - Thetford RZ to Norfolk Rural North RZ Transfer	Norfolk Valley Fens SAC	The Thompson Water, Carr and Common SSSI unit of this SAC is less than 1km to the west of the proposed pipeline route. However, the route does not cross any rivers which feed into this site and is unlikely to cause any significant impacts on its qualifying species or habitats.	No
	Breckland SAC	The proposed pipeline runs adjacent to several eastern sections of this designated site and includes crossings of the River Thet and Little Ouse River, which feed into this SAC. Although the footprint of the route is not within the designated site, there is potential to impact the qualifying habitats of this site through physical damage and degradation during the construction phase, should functionally linked habitat be present on the proposed route, and if related site services cross the site boundary. Additionally, there is potential for changes in water quality in the water courses during construction of river crossings.	Yes

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
	Breckland SPA	The proposed pipeline runs adjacent to several eastern sections of this designated site. There is potential to impact the qualifying bird species through noise, visual and human disturbance during the construction phase. The vicinity of the option to the designated site creates the potential for physical loss or degradation of functionally linked habitat, thereby decreasing the supporting habitat of qualifying species.	Yes
SLN3 – Central Lincolnshire RZ to South Lincolnshire RZ (CLTM) Maximising capacity within existing transfer	N/A – use of existing infrastructure with no change to abstraction or discharge.	No potential impacts on European sites	No
RTN6 and RTN7 – Severn Trent Water Import (18MI/d / 36MI/d) Existing trade	N/A – use of existing infrastructure with no change to abstraction or discharge.	No potential impacts on European sites	No
RTS8 - Ruthamford North RZ to Ruthamford South RZ transfer Maximising capacity within existing transfer	N/A – use of existing infrastructure with no change to abstraction or discharge.	No potential impacts on European sites	No
RTN22 - Bourne RZ to Ruthamford North RZ via existing infrastructure Maximising capacity within existing transfer	N/A – use of existing infrastructure with no change to abstraction or discharge.	No potential impacts on European sites	No
ESU5 / ESU8 / ESU9 Bury Haverhill RZ to East Suffolk RZ (25MI/d, 20MI/d & 10MI/d) and the reverse BHV2 / BHV7 (25MI/d & 10MI/d)	Stour & Orwell Estuaries SPA Stour & Orwell Estuaries Ramsar site	The end of the proposed pipeline route at Wherstead is located approximately 2km west of the Stour and Orwell Estuaries European sites. Given the distance, there are no reasonably foreseeable noise, visual or human impacts on qualifying bird species during pipeline construction. The proposed route does cross several tributaries of the River Orwell. Consequently, there is potential for pollution and water quality change during the construction phase, however this is assumed avoided through the application of directional drilling at river crossings. The impacted tributaries are likely only to contribute a small proportion of the total hydrological load to Orwell Estuary. Therefore, regardless of the construction techniques employed, any water quality changes are expected to be imperceptible	No

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
BHV1 / BHV5 / BHV6 Newmarket RV to Bury Haverhill RZ (31MI/d, 20MI/d & 10MI/d) and the reverse NWM2 / NWM7 (9MI/d & 20MI/d)	None within Zol	within the designated sites and are not foreseen to result in habitat loss. No potential impacts on European sites	No
NTM1 Central Lincolnshire RZ to Nottinghamshire RZ (3.5MI/d)	Humber Estuary SAC Humber Estuary Ramsar site Humber Estuary SPA	The proposed pipeline route crosses the River Trent approximately 35km upstream of the Humber Estuary SAC/Ramsar site boundary. Construction of the river crossing has the potential to result in water quality changes downstream, including in the Humber Estuary. Assuming directional drilling is employed to avoid any impacts on the River Trent, no impact on the qualifying species and habitats of the Humber estuary are reasonably foreseeable.	No
SLN1 / SLN5 / SLN6 Central Lincolnshire RZ to South Lincolnshire RZ (35MI/d /30MI/d / 63MI/d)	None within Zol	No potential impacts on European sites	No
SEX4 /SEX8 / LCP12 - East Suffolk RZ to South Essex RZ transfer (15MI/d / 6.5MI/d / 12MI/d) and reverse ESU6	None within Zol	No potential impacts on European sites	No
NWM1 / NWM6 / NWM10 Ely RZ to Newmarket RZ (35MI/d, 20MI/d & 10MI/d) and the reverse (ELY2 4MI/d)	Fenland SAC Chippenham Fen Ramsar site	Fenland SAC and Chippenham Fen Ramsar site are located approximately 0.5km from the mid-point of the proposed pipeline, near Chippenham. The proximity of the construction corridor to the designated sites during pipeline installation could lead to temporary impacts on qualifying bird species due to noise and visual disturbance. The vicinity of the option to the European site also creates the potential for physical loss of habitat to occur; although outside the boundary of the European sites, it may be used as supporting habitat by qualifying species. Further options development re-routed the pipeline over 500m (outside the Zol) of the	No (following assessment of updated option)

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
ELY1 / ELY9 / ELY10 Ely RZ to North Fenland RZ (39MI/d, 20MI/d & 10MI/d) and the reverse NFN6 (22MI/d)	Fenland SAC Chippenham Fen Ramsar site	boundary of the designated site and therefore, effects were avoided.	No
	Breckland SPA	The proposed pipeline route runs to the west of this designated site, with the closest point approximately 1.4km from the site boundary. Construction of the pipeline at this location is unlikely to cause visual or noise disturbance that will impact the qualifying bird species of this SPA.	No
	The Wash SAC The Wash SPA The Wash Ramsar site	The proposed pipeline route crosses the River Great Ouse approximately 20km upstream of where it joins The Wash. Given the distance between the designated sites and pipeline it is highly unlikely that qualifying bird species will be disturbed during the construction phase. However, construction of the river crossing has the potential to result in water quality changes downstream, including in The Wash European designated sites. Assuming directional drilling is employed to avoid any impacts on the River Great Ouse, no impact on the qualifying species and habitats of the Wash are reasonably foreseeable.	No
CVY1 Newmarket RZ to Cheveley RZ	None within Zol	No potential impacts on European sites	No
NTB6 / NTB8 Norfolk Rural North RZ to Norwich & The Broads RZ (20MI/d & 10MI/d) and the reverse NNR1 / NNR7 (20MI/d & 10MI/d)	Norfolk Valley fens SAC	The proposed route is located approximately 1.4km south of a section of this SAC and crosses the River Tud at two points (approximately 2km and 2.4km) upstream of the site. There is potential for water quality change in these water courses during construction of river crossings, however assuming directional drilling is employed at the River Tud crossing, no potential impacts on water quality as a result of this river	No

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
		<p>crossing are foreseen. Therefore, no impacts on the qualifying features of the SAC which are sensitive to such changes are likely (e.g. Northern Atlantic wet heaths with <i>Erica tetralix</i>).</p>	
	<p>River Wensum SAC</p>	<p>The proposed pipeline crosses this designated site four times, with additional crossings of the River Wensum downstream of the site boundary. There is the potential for pollution during the construction phase, however assuming directional drilling is employed to avoid impacts at these river crossings, adverse impacts as a result of pollution events are considered unlikely. Given construction works will be within 500m of the River Wensum at these river crossings, there is potential to cause physical loss and degradation of habitat and any associated infrastructure however. There may also be temporary and permanent habitat loss of the emergent bank-side vegetation favoured by the qualifying species of Desmoulin's whorl snail and white-clawed crayfish. The impacts will be temporary during construction only but may result in likely significant impacts on the qualifying features of the River Wensum SAC that will require an appropriate assessment.</p> <p>Impacts could be avoided if directional drilling techniques could be employed to leave a 500m buffer undisturbed around the River Wensum, or if the pipeline could be rerouted to avoid the buffer zone altogether.</p>	<p>Yes</p>
<p>NNR1, NNR7 and NNR8 - Norwich & the Broads RZ to Norfolk Rural North RZ Transfer (20MI/d / 10MI/d / 5MI/d)</p>	<p>Norfolk Valley Fens SAC</p>	<p>The closest point of proposed pipeline runs approximately 2.2km from this SAC and crosses the River Yare approximately 2.8km downstream from the point where the river runs adjacent to the site. There are no reasonably foreseeable significant impacts on the qualifying features of the SAC from this option.</p>	<p>No</p>

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
	River Wensum SAC	<p>The western end of the proposed pipeline at Heigham WTW is adjacent to the River Wensum, approximately 1.5km south of the SAC border (Euclidean distance). The route crosses the river at two locations shortly before this point, with the closest crossing approximately 900m from the designated site. This is downstream of the site and therefore unlikely to have significant pollution or physical impacts on the qualifying habitat of the site within its boundaries. However, biological disturbance during construction may impact the qualifying species of the site (white-clawed crayfish, Desmoulin's whorl snail, brook lamprey, bullhead), which are likely to use the areas beyond the site boundary for passage. Directional drilling under rivers is proposed, therefore, there are no reasonably foreseeable significant impacts on this European site.</p>	No (following updated assessment of updated option)
<p>NNR2 / NNR6 Norfolk Rural North RZ to North Fenland RZ (20MI/d & 11MI/d) and the reverse NFN5 (20MI/d)</p>	Norfolk Valley Fens SAC	<p>The western end of the option is located at the existing Stoke Ferry WTW, approximately 5km east of this designated site. The closest river crossing to the site is over 3km away with no direct flow to the site. Consequently, there are no reasonably foreseeable significant impacts to qualifying features of Norfolk Valley Fens SAC.</p>	No
	Breckland SAC	<p>The closest point of the proposed pipeline to the designated site is approximately 2km. None of the rivers crossed by the route feed directly into the site. Therefore, there are no reasonably foreseeable significant impacts on this European site.</p>	No
	Breckland SPA	<p>The proposed pipeline route runs between sections of this SPA. At certain points the distance between the option and sections of the designated site is less than 0.1km. Potential impacts on qualifying bird species are noise, visual and human disturbance during the construction phase. The vicinity of the option to the designated site also creates the potential for physical loss of supporting habitat to occur, although outside the</p>	No

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
		<p>boundary of the designated site this may decrease the supporting habitat available to qualifying species. Breckland heathlands and acid grasslands, which support the qualifying species of stone-curlew, nightjar, and woodlark, are fragile in terms of the background levels of air pollution and may therefore be further impacted by any dust or other pollution caused by construction activities. Although the impacts will be temporary during construction only, they may result in likely significant effects on these qualifying features that will require an appropriate assessment.</p> <p>Further options development re-routed the pipeline over 500m (outside the Zol) of the designated site. Therefore, effects were avoided.</p>	
<p>NFN4 / NFN7 / NFN8 / LCP9 North Fenland RZ to South Fenland RZ (20MI/d, 60MI/d 11MI/d & 12.1MI/d) and reverse SFN2 (22MI/d)</p>	<p>The Wash SAC The Wash SPA The Wash Ramsar site</p>	<p>The proposed pipeline route crosses the River Great Ouse approximately 20km upstream of where it joins The Wash. Given the distance between the designated sites and pipeline it is highly unlikely that qualifying bird species will be disturbed during the construction phase. Construction of the river crossing has the potential to result in water quality changes downstream, including in The Wash European designated sites, but assuming directional drilling will be employed to avoid any impacts on the River Great Ouse, nod impacts on the qualifying species and habitats of The Wash are reasonably foreseeable.</p>	<p>No</p>
	<p>Ouse Washes SPA Ouse Washes Ramsar site</p>	<p>The proposed route runs approximately 2.5km north of the Ouse Washes European sites. Given the distance, it is not considered that there will be any significant impact on the qualifying species or habitats due to noise or visual disturbance during construction of the pipeline. Although the proposed route crosses the River Great Ouse, which is in hydrological continuity with the Ouse Washes, it is downstream of the site. Therefore, it is not</p>	<p>No</p>

Option	European Sites Within the ZoI (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
HPB1 Norwich & the Boards RZ to Happisburgh RZ Transfer	Broadland SPA Broadland Ramsar site The Broads SAC	<p>expected that pollution of water courses during construction will have a significant effect on features of the designated sites.</p> <p>The proposed pipeline runs approximately 0.1km to the east of areas of the Broadland SPA/Ramsar site and The Broads SAC. Potential impacts on qualifying bird species are noise, visual and human disturbance during the construction phase. The vicinity of the option to these designated sites also creates the potential for physical loss of habitat to occur; although outside the boundary of the designated site, this could decrease the supporting habitat available to qualifying species. The pipeline crosses at least one water course feeding into the Broads. There is potential for construction activity to result in changes in water quality, but assuming directional drilling is employed to avoid impacts at river crossings, no consequent water quality impacts are reasonably foreseeable.</p> <p>Further options development re-routed the pipeline over 500m (outside the ZoI) from the designated site and therefore, potential for habitat loss and disturbance was avoided.</p>	No
HPB2 Norwich & the Broads WRZ to Happisburgh Transfer (East Ruston/Witton)	Broadland SPA Broadland Ramsar Site The Broads SAC	<p>The majority of the proposed pipeline will be constructed over 500m from the designated sites and therefore potential for habitat loss and disturbance will be avoided. One small section within the southern extent of the route will be constructed approximately 515m from the Broadland SPA / Ramsar Site and The Broads SAC and as such the is potential for disturbance and habitat loss has been considered. The works within 515m of the designated sites will involve open cut methods within existing agricultural fields and as such are not considered likely to result in the loss of areas of habitat suitable to support qualifying features. Furthermore, disturbance impacts are not considered to have a likely significant effect on qualifying features given the small</p>	No

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
		<p>section of pipeline required to be installed within 515m of the designated site.</p> <p>The pipeline will involve crossings of drainage ditches which are connected to the Broadland SPA / Ramsar Site and The Broads SAC, located 730m downstream. Crossing of ditches will be undertaken via directional drilling at a depth of 3m below the ditch. As such no consequent water quality impacts are foreseeable therefore no impacts to the designated sites are predicted. The pipeline will also involve a crossing of the North Walsham and Dilham Canal which connects to the Broadland SPA / Ramsar Site and the Broads SAC 3.7km from the pipeline. The canal will be crossed via directional drilling at 8m below the watercourse. As such no water quality impacts are foreseeable therefore no impacts to the designated sites are predicted</p>	
	Paston Great Barn SAC	<p>The proposed pipeline is located 3km south of the Paston Great Barn SAC. Given the distance separating the works from the SAC significant disturbance impacts to qualifying features are not foreseeable. Furthermore, the pipeline will not sever any potential commuting routes to or from the SAC for barbastelle bats <i>Barbastella barbastellus</i>. Where areas of woodland are required to be crossed directional drilling will be employed to avoid habitat loss.</p>	No
	Winterton-Horsey Dunes SAC	<p>The proposed pipeline is located 12.5km west of Winterton-Horsey Dunes SAC. The pipeline does not cross any watercourses hydrologically linked to the designated site and as such no impacts are predicted as a result of this pipeline route.</p>	No
	Norfolk Valley Fens SAC	<p>The proposed pipeline is located 14km east of Norfolk Valley Fens SAC. The pipeline does not cross any watercourses hydrologically linked to the designated site and as such no impacts are predicted as a result of this pipeline route.</p>	No

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
RTC2 Ruthamford South RZ to Ruthamford Central RZ (12MI/d & 70MI/d) and the reverse RTC5 (70MI/d)	None within Zol	No potential impacts on European sites	No
RTS9 / RTS11 / RT12 Ruthamford North RZ to Ruthamford South RZ (80MI/d, 55MI/d & 10MI/d)	Upper Nene Valley Gravel Pits SPA Upper Nene Valley Gravel Pits Ramsar site	The proposed pipeline crosses the River Nene over 5km downstream from this designated site. Significant disturbance impacts to the qualifying features species are not foreseeable at this distance. There is the potential for pollution to occur during the construction of the river crossing, however due to the distance from the SPA and the fact that the river does not feed directly into the gravel pits, impacts on the qualifying bird species are not considered likely to occur.	No
	Rutland Water SPA Rutland Water Ramsar site	This designated site is located approximately 3km from the northern end of the proposed route. Significant disturbance impacts to the qualifying features are not foreseeable at this distance. The proposed pipeline does not cross any of rivers feeding into this site. Therefore, impacts on the qualifying features of this SPA are not considered likely.	No
RTW1 / RTW3 Ruthamford North RZ to Ruthamford West RZ (10MI/d & 70MI/d)	Upper Nene Valley Gravel Pits SPA Upper Nene Valley Gravel Pits Ramsar site	The proposed pipeline route is not within the designated gravel pits but crosses the River Nene and other standing water habitats between two units of the site. The River Nene runs adjacent to the gravel pits and is likely to be functionally linked, both physically through a range of wet habitat types and ditches and through supporting a similar species range. Assuming directional drilling will be employed to avoid impacts at river crossings, no adverse impacts as a result of construction works at the river crossing are envisioned. Given the European site is at least 1.5km from the pipeline corridor, no impacts such as disturbance, physical damage or degradation to the qualifying bird or habitat features of the Upper Nene Valley Gravel Pits Spa/Ramsar site.	No
SFN1 / SFN3 / SFN4 / LCP13 – Ruthamford North RZ to South Fenland RZ Transfer	Nene Washes SPA	The proposed pipeline route runs adjacent to the southern edge of the Nene Washes for	No

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
(80MI/d, 22MI/d 35MI/d & 32 MI/d) and reverse option RTN17	Nene Washes Ramsar site Nene Washes SAC	<p>approximately 12km. At one point the distance between the boundary of the designated site and the proposed pipeline route is approximately 0.1km. Potential impacts on qualifying bird species of the Nene Washes SPA and Ramsar sites are noise and visual disturbance during the construction phase. Due to the proximity to the proposed construction site, there is also potential for physical loss of habitat to occur to the Nene Washes SAC, SPA and Ramsar sites. Although outside the boundary of the European site, there may be a decrease in the supporting habitat of qualifying species. Additionally, the proposed pipeline route crosses several water courses that are in hydrological continuity with the designated sites, however assuming directional drilling techniques are employed at river crossings, no changes in water quality within the water course feeding into the Nene Washes and its wetland habitats are envisioned.</p> <p>Further options development re-routed the pipeline over 500m (outside the Zol) of the designated sites. Therefore, the potential for habitat loss and disturbance was avoided.</p>	
CEX1 South Essex RZ to Central Essex RZ	None within Zol	No potential impacts on European sites	No
CLN11 / CLN12 / CLN13 South Humber Bank RZ to Central Lincolnshire RZ (10MI/d, 50MI/d & 31MI/d)	None within Zol	No potential impacts on European sites	No
RTN18 / RTN24 / RTN27 South Lincolnshire RZ to Ruthamford North RZ (30MI/d, 25MI/d & 60MI/d)	Rutland Water SPA Rutland Water Ramsar site	<p>At its southern end the proposed pipeline route passes the east side of Rutland Water SPA/Ramsar site at distances of approximately 0.15km to 0.6km. Potential impacts on qualifying bird species of Rutland Water SPA and Ramsar sites are noise and visual disturbance during the construction phase.</p> <p>Further options development re-routed the pipeline over 500m (outside the Zol) of the</p>	No

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
		designated sites and therefore, effects were avoided.	
CVY3 Bury Haverhill RZ to Cheveley RZ	None within Zol	No potential impacts on European sites	No
ELY3 / ELY11 / ELY12 Ruthamford North RZ to Ely RZ (10MI/d, 20MI/d & 10 MI/d)	Ouse Washes SAC Ouse Washes SPA Ouse Washes Ramsar site	The proposed pipeline route crosses the Ouse Washes for approximately 0.5km. Potential impacts on qualifying bird species for the Ouse Washes SPA and Ramsar sites are noise and visual disturbance during the construction phase. There is potential for physical loss of habitat to occur to the Ouse Washes SAC, SPA and Ramsar sites from the proposed construction, thereby decreasing the supporting habitat of qualifying species. Additionally, construction activities may result in changes in water quality within the water courses feeding into the Ouse Washes and as a result of construction across the Ouse Washes itself, but it is assumed this impact will be avoided through the application of directional drilling. Direct impacts of construction on qualifying species and habitats could be avoided by rerouting the pipeline so that it doesn't cross the designated site and is located at least 500m from the boundary.	Yes
NWM3 / NWM8 / NWM9 Ruthamford South RZ to Newmarket RZ (35MI/d, 20MI/d & 10MI/d)	None within Zol	No potential impacts on European sites	No
RTC1 / RTC3 RZ to RTC RZ Ruthamford West RZ to Ruthamford Central RZ	None within Zol	No potential impacts on European sites	No
PR19 SD Resilience to Didlington WTW	None within Zol	No potential impacts on European sites	No
BHV Intra RZ Bury Haverhill Transfers (Great Wrattling WTW Resilience)	None within Zol	No potential impacts on European sites	No
RTS Intra RZ to Meppershall PZ (4.86MI/d)	None within Zol	No potential impacts on European sites	No

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
RTS Intra RZ to Woburn Sands PZ to Bow Brickhill WR (Birchmoor WTW Resilience) (5.1Ml/d)	None within Zol	No potential impacts on European sites	No
THT1 Bury Haverhill to Ixworth to Thetford Transfer (Existing) (3Ml/d & 1.54Ml/d)	Breckland SAC Breckland SPA	The northern end of the pipeline at Thetford is likely situated within 1km of the Breckland SAC/SPA boundary and the proposed route will likely cross the designated site(s) between Thetford and Ixworth. However, it is proposed that existing pipeline infrastructure will be utilised. Therefore, it is not expected that qualifying bird species or habitats of the European designated sites will be disturbed or otherwise impacted due to pipeline construction activities.	No
BRN2 Ruthamford North to Bourne Transfer (Existing)	None within Zol	No potential impacts on European sites	No

Table 8: Potential Effects from Transfer (Raw Water) Options

Option	European Sites Within the ZoI (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
RTN4 - Raw water transfer from the River Trent to Rutland WTW	Humber Estuary SAC Humber Estuary SPA Humber Estuary Ramsar site	<p>The Humber Estuary designated site boundary is over 150km downstream of the abstraction point at Shardlow on the River Trent. While a decrease in flow and water level is expected immediately downstream of the intake, it is highly unlikely that abstraction at Shardlow will have an impact on the hydrological or physico-chemical features of the Humber Estuary. Changes to freshwater flows will minimise with distance downstream from the abstraction point due to the input of additional flows from waste water treatment works and tributaries. Freshwater flows are also of low importance at the designated site relative to estuarine/marine processes. Freshwater input to the estuary is relatively low and the tidal limit occurs so far inland that at the point the rivers meet the designated area, considerable mixing with water of marine origins has already occurred.</p> <p>Therefore, there are no reasonably foreseeable likely significant effects on the Humber Estuary European sites.</p>	No

5 WRMP– HRA Task I: Screening assessments

5.1 Development of the WRMP

Traditionally, companies have used the EBSD approach to guide decision making. EBSD allows planners to meet a supply-demand deficit with the lowest overall cost, or 'least cost' solution. The Anglian Water WRMP 2010 and WRMP 2015 were both based on least cost option appraisal.

The limitations of a least cost planning approach are now widely recognised, and there is support from regulators, stakeholders and customers, to develop best value plans which take account of a wider range of factors such as environmental impacts of programmes, resilience, and customer preferences, in addition to cost.

When moving from the Least Cost Plan to the Best Value Plan a number of factors were evaluated including: cost; adaptability and flexibility; alignment to WRE; risk and resilience; customer preferences; and environmental and social impacts. The Least Cost Plan performs better in terms of cost as it has lower overall capital and operating costs. The Preferred Plan performs similar or better in all of the other factors:

- It allows greater flexibility for development and sharing of new resource options beyond 2025
- It delivers better alignment with the WRE strategy due to an increase in the capacity of strategic transfers across the region
- It performs better when compared with customer preferences as it makes best use of existing resources and defers the development of desalination which is less favourable to customers than transfers
- Both plans perform equally when considering the % reduction of single supply population but the Preferred Plan performs better in stress testing
- Both plans deliver similar environmental benefits by aiming to reduce abstraction through demand management, keeping more water available in the natural environment, and using supply side options where environmental risks can be mitigated.

The WRMP include an adaptive strategy to deal with uncertainties and future scenarios that will mean further investment is required (e.g. further future sustainability reductions). In some cases, there may not be a long lead time to implement schemes and therefore Anglian Water need to develop a plan which identifies thresholds beyond which they need to take further action. It should be noted that at this stage these are strategic supply side options that may be required in the future. They do not form a definitive list of options.

5.2 Preferred Plan

The options for the Preferred Plan are presented in Table 9 and were chosen based on a number of factors including economic modelling, feasibility, capacity to meet deficit, environmental effects (from the HRA, SEA, ESA, and WFD assessment) and capacity to meet long-term supply demand objectives

Table 9: Preferred Plan

Option ref.	Option name	WRZ
-	Demand Management Strategy Extended Plus	All
BHV5	Newmarket RZ to Bury Haverhill RZ Transfer (20MI/d)	Bury Haverhill
CLN13a	South Humber Bank RZ to Central Lincolnshire RZ Transfer (31MI/d)	Central Lincolnshire
CLN14	South Humber Bank RZ to Central Lincolnshire RZ Transfer (6MI/d)	Central Lincolnshire

Option ref.	Option name	WRZ
CLN15	South Humber Bank RZ to Central Lincolnshire RZ Transfer (Existing)	Central Lincolnshire
CLN16	South Humber Bank RZ to Central Lincolnshire RZ Transfer	Central Lincolnshire
ELY9	North Fenland RZ to Ely RZ Transfer (20MI/d)	Ely
CVY1	Newmarket RZ to Cheveley RZ Transfer	Cheveley
ESU1	Felixstowe Desalination	East Suffolk
ESU8	Bury Haverhill RZ to East Suffolk RZ transfer (20MI/d)	East Suffolk
HPB1	Norwich & the Broads RZ to Happisburgh RZ Transfer	Happisburgh
HPB2	Norwich & the Broads WRZ to Happisburgh Transfer (East Ruston/Witton)	Happisburgh
NFN4	South Fenland RZ to North Fenland RZ Transfer (20MI/d)	North Fenland
NNR8	Norwich & the Broads RZ to Norfolk Rural North RZ Transfer (5MI/d)	Norfolk Rural North
NTM1	Central Lincolnshire RZ to Nottinghamshire RZ Transfer	Nottinghamshire
NWM6	Ely RZ to Newmarket RZ Transfer (20MI/d)	Newmarket
RTC2	Ruthamford South RZ to Ruthamford Central RZ Transfer	Ruthamford Central
RTN27	South Lincolnshire RZ to Ruthamford North RZ (67MI/d)	Ruthamford North
SEX4	East Suffolk RZ to South Essex RZ transfer (15MI/d)	South Essex
SFN4	Ruthamford North RZ to South Fenland RZ Transfer (40 MI/d)	South Fenland
SHB2	Pyewipe Water Reuse for non-potable use	South Humber Bank
SLN6	Central Lincolnshire RZ to South Lincolnshire RZ Transfer (63MI/d)	South Lincolnshire
THT1	Bury Haverhill WRZ to Thetford WRZ Transfer	Thetford
-	Birchmoor WTW Resilience	Ruthamford South
-	Meppershall WTW Resilience	Ruthamford South
-	Diddlington WTW Resilience	Norfolk Rural North
-	Great Wratting WTW Resilience	Bury Haverhill

The results of the HRA Task I: Screening assessment for the Preferred Plan are presented in Table 10. Where the option was assessed for the draft WRMP and potential effects were identified, these have been altered through the options design process where possible; by re-routing pipelines or by using directional drilling under sensitive sites and rivers as a design feature. The use of best practice construction methods will also be utilised to minimise any effects during the construction phase such as pollution prevention control.

Table 10: HRA Task I: Screening assessment of the Preferred Plan

Option	Water Resource Zone	European site(s) within the ZoI (Natura 2000/Ramsar)	Potential pathway for impact on the European Site(s)	Does the option require a Task II: Appropriate Assessment?
Demand Management Strategy Extended Plus	All	N/A	N/A	No
BHV5 Newmarket RZ to Bury Haverhill RZ Transfer (20MI/d)	Bury Haverhill	None within ZoI	No potential impacts on European sites	No
CLN13a South Humber Bank RZ to Central Lincolnshire RZ Transfer (31MI/d)	Central Lincolnshire	None within ZoI	No potential impacts on European sites	No
CLN14 South Humber Bank RZ to Central Lincolnshire RZ Transfer (6MI/d)	Central Lincolnshire	None within ZoI	No potential impacts on European sites	No
CLN15 South Humber Bank RZ to Central Lincolnshire RZ Transfer (Existing)	Central Lincolnshire	N/A – use of existing infrastructure	No potential impacts on European sites	No
CLN16 South Humber Bank RZ to Central Lincolnshire RZ Transfer	Central Lincolnshire	None within ZoI	No potential impacts on European sites	No
ELY9 North Fenland RZ to Ely RZ Transfer (20MI/d)	Ely	Fenland SAC Chippenham Fen Ramsar site	The southern end of the proposed option is located approximately 3 km from Fenland SAC and Chippenham Fen Ramsar site. No significant impacts are foreseen as the proposed option does not cross any rivers that are in hydrological contact with the sites.	No
		Breckland SPA	The proposed pipeline route runs to the west of this designated site, with the closest point approximately 1.4 km from the site boundary. Construction of the pipeline at this location is unlikely to cause visual or noise disturbance that will impact the qualifying bird species of this SPA.	No

Option	Water Resource Zone	European site(s) within the Zol (Natura 2000/Ramsar)	Potential pathway for impact on the European Site(s)	Does the option require a Task II: Appropriate Assessment?
		The Wash SAC The Wash SPA The Wash Ramsar site	The proposed pipeline route crosses the River Great Ouse approximately 20 km upstream of where it joins The Wash. Given the distance between the designated sites and pipeline it is highly unlikely that qualifying bird species will be disturbed during the construction phase. However, construction of the river crossing has the potential to result in water quality changes downstream, including in The Wash European designated sites. Assuming directional drilling is employed to avoid any impacts on the River Great Ouse, no impact on the qualifying species and habitats of the Wash are reasonably foreseeable.	No
CVY1 Newmarket RZ to Cheveley RZ	Cheveley	None within Zol	No potential impacts on European sites	No
ESU1 Felixstowe Desalination	East Suffolk	Stour and Orwell Estuaries SPA Stour and Orwell Estuaries Ramsar site	<p>The proposed location of the desalination plant is within a residential area near the east coast of Felixstowe. The intake and outfall points will be within the North Sea, 250-500m from the shore and located at a minimum of 500m from each other.</p> <p>A pathway exists for noise disturbance during the construction phase to result in a change in the number and distribution of species within the Zol. It is considered that the rare and nationally scarce features which meet Ramsar Criterion 2 and the saltmarsh and intertidal mud flat sub-features for the SPA are present within the Zol, therefore there is potential for the qualifying bird species which depend on these habitats to be affected by non-physical disturbance such as noise, visual and light pollution through construction.</p> <p>During the construction period, materials and machinery are likely to be mobilised in the North Sea for the construction of the proposed intake and outfall pipelines. If a water pollution incident should occur, a pathway exists to impact the European sites through diffusion into the estuaries. This may cause adverse effects on the qualifying habitat features, with potential knock-on impacts on the qualifying bird species.</p>	Yes

Option	Water Resource Zone	European site(s) within the Zol (Natura 2000/Ramsar)	Potential pathway for impact on the European Site(s)	Does the option require a Task II: Appropriate Assessment?
			<p>The option includes an outfall point within the North Sea for the discharge of brine produced through the reverse osmosis process used in desalination. Depending on the concentration and volume to be discharged, brine may affect the salinity and temperature of water. The estuaries are hydrologically linked to the outfall point with a potential pathway for impact therefore existing which cannot be ruled out at this stage.</p>	
		<p>Deben Estuary SPA Deben Estuary Ramsar site</p>	<p>It is considered that the features which meet Ramsar Criterion 2 and the sub-features for the SPA for the Stour and Orwell Estuaries Ramsar site, and the sub-features listed for the Stour and Orwell Estuaries and Deben Estuary EMS, are present within the Zol (saltmarsh and intertidal mud flats). The desalination plant and associated pipelines are approximately 4km from the Deben Estuary SPA/Ramsar site. A pathway exists for noise disturbance during the construction phase to result in a change in the number and distribution of species within the Zol. It is considered that the features which meet Ramsar Criterion 2 (i.e. presence of the rare Annex II mollusc species <i>Vertigo angustior</i>) and the saltmarsh and intertidal mud flat sub-features for the SPA are present within the Zol, therefore there is potential for the qualifying bird species which depend on these habitats to be affected by non-physical disturbance such as noise, visual and light pollution through construction. During the construction period, materials and machinery are likely to be mobilised in the North Sea for the construction of the proposed intake and outfall pipelines. If a water pollution incident should occur, a pathway exists to impact the European sites through diffusion into the estuaries. This may cause adverse effects on the qualifying habitat features, with potential knock-on impacts on the qualifying bird species. Water quality has already been identified as a pressure in the Deben Estuary SPA and SAC sites, with any pollution impacts from the proposed scheme therefore having the potential to exacerbate this.</p>	<p>Yes</p>

Option	Water Resource Zone	European site(s) within the Zol (Natura 2000/Ramsar)	Potential pathway for impact on the European Site(s)	Does the option require a Task II: Appropriate Assessment?
ESU8 Bury Haverhill RZ to East Suffolk RZ transfer (20MI/d)	East Suffolk	Outer Thames Estuary SPA	The option includes an outfall point within the North Sea for the discharge of brine produced through the reverse osmosis process used in desalination. Depending on the concentration and volume to be discharged, brine may affect the salinity and temperature of water. The estuaries are hydrologically linked to the outfall point with a potential pathway for impact therefore existing which cannot be ruled out at this stage.	No
		Stour & Orwell Estuaries SPA Stour & Orwell Estuaries Ramsar site	A very small area of the Outer Thames Estuary SPA (c.0.3km ²) overlaps with the 5km Zol around the proposed desalination plant. This represents less than 0.001% of the site's total area and is over 4km away from the proposed option. The qualifying features of this SPA have therefore been screened out of this assessment. It is considered that the proposed Felixstowe desalination option would have no significant impact on the integrity of the site or undermine its conservation objectives in relation to the red-throated diver, with the Outer Thames Estuary SPA therefore not further considered in this appropriate assessment	No
		Stour & Orwell Estuaries SPA Stour & Orwell Estuaries Ramsar site	The end of the proposed pipeline route at Wherstead is located approximately 2 km west of the Stour and Orwell Estuaries European sites. Given the distance, there are no reasonably foreseeable noise, visual or human impacts on qualifying bird species during pipeline construction. The proposed route does cross several tributaries of the River Orwell. Consequently, there is potential for pollution and water quality change during the construction phase, however this is assumed avoided through the application of directional drilling at river crossings. The impacted tributaries are likely only to contribute a small proportion of the total hydrological load to Orwell Estuary. Therefore, regardless of the construction techniques employed, any water quality changes are expected to be imperceptible within the designated sites and are not foreseen to result in habitat loss.	No

Option	Water Resource Zone	European site(s) within the Zol (Natura 2000/Ramsar)	Potential pathway for impact on the European Site(s)	Does the option require a Task II: Appropriate Assessment?
HPB1 Norwich & the Boards RZ to Happisburgh RZ Transfer	Happisburgh	None within Zol	No potential impacts on European sites	No
HPB2 Norwich & the Broads WRZ to Happisburgh Transfer (East Ruston/Witton)	Happisburgh	Broadland SPA Broadland Ramsar Site The Broads SAC Paston Great Barn SAC Winterton-Horsey Dunes SAC Norfolk Valley Fens SAC	<p>The majority of the proposed pipeline will be constructed over 500m from the designated sites and therefore potential for habitat loss and disturbance will be avoided. One small section within the southern extent of the route will be constructed approximately 515m from the Broadland SPA / Ramsar Site and The Broads SAC and as such the is potential for disturbance and habitat loss has been considered. The works within 515m of the designated sites will involve open cut methods within existing agricultural fields and as such are not considered likely to result in the loss of areas of habitat suitable to support qualifying features. Furthermore, disturbance impacts are not considered to have a likely significant effect on qualifying features given the small section of pipeline required to be installed within 515m of the designated site.</p> <p>The pipeline will involve crossings of drainage ditches which are connected to the Broadland SPA / Ramsar Site and The Broads SAC, located 730m downstream. Crossing of ditches will be undertaken via directional drilling at a depth of 3m below the ditch. As such no consequent water quality impacts are foreseeable therefore no impacts to the designated sites are predicted. The pipeline will also involve a crossing of the North Walsham and Dilham Canal which connects to the Broadland SPA / Ramsar Site and the Broads SAC 3.7km from the pipeline. The canal will be crossed via directional drilling at 8m below the watercourse. As such no water quality impacts are foreseeable therefore no impacts to the designated sites are predicted</p> <p>The proposed pipeline is located 3km south of the Paston Great Barn SAC. Given the distance separating the works from the SAC significant disturbance impacts to qualifying features are not</p>	No

Option	Water Resource Zone	European site(s) within the Zol (Natura 2000/Ramsar)	Potential pathway for impact on the European Site(s)	Does the option require a Task II: Appropriate Assessment?
			<p>foreseeable. Furthermore, the pipeline will not sever any potential commuting routes to or from the SAC for barbastelle bats <i>Barbastella barbastellus</i>. Where areas of woodland are required to be crossed directional drilling will be employed to avoid habitat loss.</p> <p>The proposed pipeline is located 12.5km west of Winterton-Horseley Dunes SAC. The pipeline does not cross any watercourses hydrologically linked to the designated site and as such no impacts are predicted as a result of this pipeline route.</p> <p>The proposed pipeline is located 14km east of Norfolk Valley Fens SAC. The pipeline does not cross any watercourses hydrologically linked to the designated site and as such no impacts are predicted as a result of this pipeline route.</p>	
<p>NFN4 South Fenland RZ to North Fenland RZ Transfer (20MI/d)</p>	<p>North Fenland</p>	<p>The Wash SAC The Wash SPA The Wash Ramsar site</p>	<p>The proposed pipeline route crosses the River Great Ouse approximately 20 km upstream of where it joins The Wash. Given the distance between the designated sites and pipeline it is highly unlikely that qualifying bird species will be disturbed during the construction phase. Construction of the river crossing has the potential to result in water quality changes downstream, including in The Wash European designated sites, but assuming directional drilling will be employed to avoid any impacts in the River Great Ouse, no impacts on the qualifying species and habitats of The Wash are reasonably foreseeable.</p>	<p>No</p>
		<p>Ouse Washes SPA Ouse Washes Ramsar site Ouse Washes SAC</p>	<p>The proposed route runs approximately 2.5 km north of the Ouse Washes European sites. Given the distance, it is not considered that there will be any significant impact on the qualifying species or habitats due to noise or visual disturbance during construction of the pipeline. Although the proposed route crosses the River Great Ouse, which is in hydrological continuity with the Ouse Washes, it is downstream of the site. Therefore, it is not expected that pollution of water courses during construction will have a significant effect on features of the designated sites.</p>	<p>No</p>

Option	Water Resource Zone	European site(s) within the Zol (Natura 2000/Ramsar)	Potential pathway for impact on the European Site(s)	Does the option require a Task II: Appropriate Assessment?
NTM1 Central Lincolnshire RZ to Nottinghamshire RZ	Nottinghamshire	Humber Estuary SAC Humber Estuary Ramsar site Humber Estuary SPA	The proposed pipeline route crosses the River Trent approximately 35 km upstream of the Humber Estuary SAC/Ramsar site boundary. Construction of the river crossing has the potential to result in water quality changes downstream, including in the Humber Estuary. Assuming directional drilling is employed to avoid any impacts on the River Trent, no impact on the qualifying species and habitats of the Humber estuary are reasonably foreseeable.	No
NNR8 Norwich & the Broads RZ to Norfolk Rural North RZ Transfer (5MI/d)	Norfolk Rural North	Norfolk Valley Fens SAC	The closest point of proposed pipeline runs approximately 2.2km from this SAC and crosses the River Yare approximately 2.8km downstream from the point where the river runs adjacent to the site. There are no reasonably foreseeable significant impacts on the qualifying features of the SAC from this option.	No
		River Wensum SAC	The western end of the proposed pipeline at Heigham WTW is adjacent to the River Wensum, approximately 1.5km south of the SAC border (Euclidean distance). The route crosses the river at two locations shortly before this point, with the closest crossing approximately 900m from the designated site. This is downstream of the site and therefore unlikely to have significant pollution or physical impacts on the qualifying habitat of the site within its boundaries. However, biological disturbance during construction may impact the qualifying species of the site (white-clawed crayfish, Desmoulin's whorl snail, brook lamprey, bullhead), which are likely to use the areas beyond the site boundary for passage. Directional drilling under rivers is proposed, therefore, there are no reasonably foreseeable significant impacts on this European site.	No
NWM6 Ely RZ to Newmarket RZ Transfer (20MI/d)	Newmarket	None within Zol	No potential impacts on European sites	No
RTC2 Ruthamford South RZ to Ruthamford Central RZ	Ruthamford Central	None within Zol	No potential impacts on European sites	No

Option	Water Resource Zone	European site(s) within the Zol (Natura 2000/Ramsar)	Potential pathway for impact on the European Site(s)	Does the option require a Task II: Appropriate Assessment?
RTN27 South Lincolnshire RZ to Ruthamford North RZ (67MI/d)	Ruthamford North	None within Zol	No potential impacts on European sites	No
SEX4 East Suffolk RZ to South Essex RZ transfer (15MI/d)	South Essex	None within Zol	No potential impacts on European sites	No
SFN4 Ruthamford North RZ to South Fenland RZ Transfer (40 MI/d)	South Fenland	None within Zol	No potential impacts on European sites	No
SHB2 Pyewipe Water Reuse for non-potable use	South Humber Bank	Humber Estuary SAC	<p>The planned Pyewipe Water Reuse Treatment Works (WRTW) and components of the associated pipelines are within 5km of the Humber Estuary SAC; the proposed WRTW being within 500m of the boundary of the SAC. The footprint of new infrastructure does not overlap with the site, with the outfall point within the Estuary already in place. However, there is the potential for disturbance impacts on the qualifying features to be caused during construction. Disturbance is likely to be significant during construction only but could remain significant without appropriate mitigation. Outfall into the Estuary already occurs from the Pyewipe WRC. However, a pathway for increased contamination may be created should discharge from the proposed Pyewipe WRTW be more concentrated or if the volume of outfall is increased.</p> <p>Construction and operation of this option may therefore add to the existing anthropogenic pressures on this site. This may potentially impact qualifying habitats and species of this SAC through altering the underlying processes supporting them.</p>	Yes
		Humber Estuary SPA Humber Estuary Ramsar site	<p>As with the Humber Estuary SAC, disturbance impacts associated with the construction of the WRTW and pipelines may be caused on the qualifying bird species. Disturbance is likely to be significant during construction only but could be significant without appropriate mitigation. Should changes to water chemistry occur as a result of</p>	Yes

Option	Water Resource Zone	European site(s) within the ZoI (Natura 2000/Ramsar)	Potential pathway for impact on the European Site(s)	Does the option require a Task II: Appropriate Assessment?
			increased contamination from changes to the outfall discharge, this may alter the wetland and coastal habitats which support the qualifying bird species of the SPA.	
SLN6 Central Lincolnshire RZ to South Lincolnshire RZ Transfer (63M/d)	South Lincolnshire	None within ZoI	No potential impacts on European sites	No
THT1 Bury Haverhill to Thetford transfer	Thetford	N/A – use of existing infrastructure	No potential impacts on European sites	No
Birchmoor WTW Resilience	Ruthamford South	None within ZoI	No potential impacts on European sites	No
Meppershall WTW Resilience	Ruthamford South	None within ZoI	No potential impacts on European sites	No
Didlington WTW Resilience	Norfolk Rural North	None within ZoI	No potential impacts on European sites	No
Great Wratting WTW Resilience	Bury Haverhill	None within ZoI	No potential impacts on European sites	No

5.3 Adaptive Strategy

The options for the adaptive strategy are presented in Table 11.

Table 11: Adaptive strategy

Option ref.	Option name	WRZ
ESU1	Felixstowe Desalination	East Suffolk
ESU2	Ipswich Water Reuse	East Suffolk
NFN1	Kings Lynn Desalination	North Fenland
NFN2	Kings Lynn Water Reuse	North Fenland
NFN3	Fenland Reservoir	North Fenland
RTN1	South Lincolnshire Reservoir (unsupported)	Ruthamford North
RTN2	South Lincolnshire Reservoir (supported)	Ruthamford North
RTN7	Severn Trent Water Import	Ruthamford North

The results of the HRA Task I: Screening assessment for the adaptive strategy are presented in Table 12. Where the option was assessed for the draft WRMP and potential effects were identified, these have been altered through the options design process where possible; by re-routing pipelines or by using directional drilling under sensitive sites and rivers as a design feature. The use of best practice construction methods will also be utilised to minimise any effects during the construction phase such as pollution prevention control.

Table 12: HRA Task I: Screening assessment of the WRMP adaptive strategy options

Option	Water Resource Zone	European site(s) within the Zol (Natura 2000/Ramsar)	Potential pathway for impact on the European Site(s)	Does the option require a Task II: Appropriate Assessment?
ESU1 Felixstowe Desalination	East Suffolk	Stour and Orwell Estuaries SPA Stour and Orwell Estuaries Ramsar site	<p>The proposed location of the desalination plant is within a residential area near Felixstowe on the east coast. The intake and outfall points will be within the North Sea, 250-500m from the shore and located at a minimum of 500m from each other.</p> <p>A pathway exists for noise disturbance during the construction phase to result in a change in the number and distribution of species within the Zol. It is considered that the rare and nationally scarce features which meet Ramsar Criterion 2 and the saltmarsh and intertidal mud flat sub-features for the SPA are present within the Zol, therefore there is potential for the qualifying bird species which depend on these habitats to be affected by non-physical disturbance such as noise, visual and light pollution through construction. During the construction period, materials and machinery are likely to be mobilised in the North Sea for the construction of the proposed intake and outfall pipelines. If a water pollution incident should occur, a pathway exists to impact the European sites through diffusion into the estuaries. This may cause adverse effects on the qualifying habitat features, with potential knock-on impacts on the qualifying bird species.</p> <p>The option includes an outfall point within the North Sea for the discharge of brine produced through the reverse osmosis process used in desalination. Depending on the concentration and volume to be discharged, brine may affect the salinity and temperature of water. The estuaries are hydrologically linked to the outfall point with a potential pathway for impact therefore existing which cannot be ruled out at this stage.</p>	Yes
		Deben Estuary SPA Deben Estuary Ramsar site	<p>It is considered that the features which meet Ramsar Criterion 2 and the sub-features for the SPA for the Stour and Orwell Estuaries Ramsar site, and the sub-features listed for the Stour and Orwell Estuaries and Deben Estuary EMS, are present within the Zol (saltmarsh and intertidal mud flats).</p> <p>The desalination plant and associated pipelines are approximately 4km from the Deben Estuary SPA/Ramsar site. A pathway exists for noise disturbance during the construction phase to result in a change in the number and</p>	Yes

Option	Water Resource Zone	European site(s) within the ZoI (Natura 2000/Ramsar)	Potential pathway for impact on the European Site(s)	Does the option require a Task II: Appropriate Assessment?
			<p>distribution of species within the ZoI. It is considered that the features which meet Ramsar Criterion 2 (i.e. presence of the rare Annex II mollusc species <i>Vertigo angustior</i>) and the saltmarsh and intertidal mud flat sub-features for the SPA are present within the ZoI, therefore there is potential for the qualifying bird species which depend on these habitats to be affected by non-physical disturbance such as noise, visual and light pollution through construction.</p> <p>During the construction period, materials and machinery are likely to be mobilised in the North Sea for the construction of the proposed intake and outfall pipelines. If a water pollution incident should occur, a pathway exists to impact the European sites through diffusion into the estuaries. This may cause adverse effects on the qualifying habitat features, with potential knock-on impacts on the qualifying bird species. Water quality has already been identified as a pressure in the Deben Estuary SPA and SAC sites, with any pollution impacts from the proposed scheme therefore having the potential to exacerbate this.</p> <p>The option includes an outfall point within the North Sea for the discharge of brine produced through the reverse osmosis process used in desalination. Depending on the concentration and volume to be discharged, brine may affect the salinity and temperature of water. The estuaries are hydrologically linked to the outfall point with a potential pathway for impact therefore existing which cannot be ruled out at this stage.</p>	
		Thames Estuary SPA	<p>A very small area of the Outer Thames Estuary SPA (c.0.3km²) overlaps with the 5km ZoI around the proposed desalination plant. This represents less than 0.001% of the site's total area and is over 4km away from the proposed option. The qualifying features of this SPA have therefore been screened out of this assessment.</p> <p>It is considered that the proposed Felixstowe desalination option would have no significant impact on the integrity of the site or undermine its conservation objectives in relation to the red-throated diver, with the Outer Thames Estuary SPA therefore not further considered in this appropriate assessment.</p>	No
ESU2 Ipswich Water Reuse	East Suffolk	Stour and Orwell Estuaries SPA	The proposed option would cross the River Orwell within the Stour and Orwell Estuary SPA and Ramsar sites. This has	Yes

Option	Water Resource Zone	European site(s) within the Zol (Natura 2000/Ramsar)	Potential pathway for impact on the European Site(s)	Does the option require a Task II: Appropriate Assessment?
		Stour and Orwell Estuaries Ramsar site	<p>the potential to cause physical damage to habitat supporting the qualifying species of these sites. In particular, the relevant Ramsar Information Sheet (RIS) states that the site is currently suffering from erosion. The construction of the pipeline may exacerbate this problem in areas not currently affected.</p> <p>Construction of the pipeline and new treatment works has the potential to cause noise, visual and human disturbance impacts on the qualifying bird species of the site. Additionally, increased pollution during construction of the river crossing may occur, with potential impacts on the qualifying plant species of the Ramsar sites and the species they support. Disturbance is likely to be significant during construction only but could remain significant without appropriate mitigation.</p> <p>This option should result in no net change in water flow, with output from the effluent treatment balancing with increased abstraction upstream. However, there is the potential for localised changes in hydrology. For instance, redirection of effluent from Cliff Quay Water Reuse Works for discharge into the River Gipping may decrease outfall into the River Orwell. The impact of this change on qualifying habitats and species will be dependent on the significance of the change in outfall.</p>	
<p>NFN1 Kings Lynn Desalination North Fenland</p>		The Wash & North Norfolk Coast SAC	<p>The location of the desalination plant and proposed pipeline routes is outside the designated site. However, the River Great Ouse is one of four rivers which feeds The Wash, with anthropogenic use of these rivers determining the volume and quality of water entering it. Impacts could result from reduced flows in the River Great Ouse and into The Wash through the uptake of brackish tidal river water. This could affect the quantity and type of sediments in the designated areas.</p> <p>The resulting brine will be piped to the existing Kings Lynn STW for treatment before discharge, minimising the increase in salinity during incoming tides when the brine will be drawn up the river towards the intake. While this will minimise changes to water quality from the brine discharged into the River Great Ouse, the potential for impacts will still exist. The mudflats and sandflats are considered to be at most risk due to potential changes in sediment transport and water quality changes.</p>	Yes

Option	Water Resource Zone	European site(s) within the Zol (Natura 2000/Ramsar)	Potential pathway for impact on the European Site(s)	Does the option require a Task II: Appropriate Assessment?
			<p>This site has been previously assessed as being threatened from changes in sediment budgets and coastal squeeze as a result of dredging, land-claim and coastal defence works. The desalination option therefore has the potential to amplify these threats to result in significant effects. It has been recommended in the Site Improvement Plan that a review of the water level management is undertaken on the freshwater marshes of the sites. Plans for the desalination option should therefore take this into consideration.</p>	
		<p>The Wash SPA The Wash Ramsar site</p>	<p>Changes to flows into The Wash are likely to affect habitats that support qualifying bird species, resulting in potential significant effects. The brine discharge into the River Great Ouse may also result in water quality deterioration affecting the SPA habitats and qualifying species that are supported by these.</p> <p>Disturbance impacts are less likely due to the distance of the proposed plant from the designated site. Changes to water chemistry and flow which may be caused by the uptake of brackish water and discharge of brine may impact the inter-relationships between the various components of the site which currently qualify under Ramsar criterion 3.</p>	<p>Yes</p>
<p>NFN2 Kings Lynn Water Reuse</p>	<p>North Fenland</p>	<p>The Wash & North Norfolk Coast SAC</p> <p>The Wash SPA The Wash Ramsar site</p> <p>Norfolk Valley Fens SAC</p>	<p>This option proposes the reuse of water from Kings Lynn WRC, less than 2km downstream of this site, with treated water to be discharged into the River Wissey to feed abstraction at Stoke Ferry. The Wissey feeds into the River Great Ouse, which in turns feeds the Wash, therefore the option has the potential to reduce flows entering this European site. Additionally, the construction of pipelines associated with the option would include a crossing of the river, with potential for increased pollution and disturbance during construction.</p> <p>Potential changes to water flow and water quality into the Wash are likely to impact habitats that support the qualifying bird species of these sites, resulting in potential significant effects. The proposed works are outside of the designated site; however, there is potential for disturbance impacts from construction of the new Kings Lynn WRTW and associated pipelines, should the qualifying species be present in the areas surrounding the proposed project footprint.</p> <p>The proposed outfall location for treated water from Kings Lynn WRC is into the River Wissey, within approximately</p>	<p>Yes</p> <p>Yes</p> <p>No</p>

Option	Water Resource Zone	European site(s) within the Zol (Natura 2000/Ramsar)	Potential pathway for impact on the European Site(s)	Does the option require a Task II: Appropriate Assessment?
		Breckland SPA	<p>2.7km of this SAC. This does not have any foreseeable significant impacts on the qualifying features of the site, which is located upstream of the outfall location and is not directly fed by the River.</p> <p>The proposed outfall location for treated water from Kings Lynn WRC is approximately 4.2km downstream of this SPA. This does not have any foreseeable significant impacts on the qualifying features of the site, which is located upstream of the outfall location and is not directly fed by the River.</p>	No
<p>NFN3 Fenland Reservoir</p>	North Fenland	<p>Ouse Washes SPA Ouse Washes Ramsar site</p>	<p>The new reservoir will be filled by abstraction from the Cut Off channel. Increased abstraction from Denver sluice which feeds the Cut Off Channel will be required. The watercourse at Denver sluice is in direct hydrological connection with the Ouse Washes SPA/Ramsar site. The exact location of the abstraction is unknown, therefore taking a precautionary approach, impacts on this site must be considered.</p> <p>This site is vulnerable to hydrological changes which may affect the rare and scarce vegetative features listed under Criterion 2 and the washland habitat listed under Criterion 1. Changes to surface levels and volume in the Ouse Washes may lead to biological disturbances such as changes in habitat availability for the qualifying bird assemblages listed under Ramsar Criterion 5 and 6. Finally, hydrological changes may lead to changes in water quality such as increased sedimentation leading to siltation which may accelerate habitat availability and alter habitat availability for waterbirds utilising the Ouse Washes, as well as other species such as spined loach listed under Ramsar Criterion 2 which depends on sediment quality and water quality for its specialised feeding mechanism.</p> <p>Qualifying features of the Ouse Washes SPA are overwintering and breeding bird assemblages and species. Increasing abstraction may result in hydrological changes that result in changes to surface water levels within the SPA; habitat degradation or a reduction in habitat quality and availability for qualifying bird species; and/or changes in water quality such as increased sedimentation leading to siltation which may accelerate habitat availability and alter habitat availability for waterbirds.</p> <p>For the transfer, the exact location of the new pipeline is unknown, therefore as a precautionary approach it is</p>	Yes

Option	Water Resource Zone	European site(s) within the Zol (Natura 2000/Ramsar)	Potential pathway for impact on the European Site(s)	Does the option require a Task II: Appropriate Assessment?
		Ouse Washes SAC	<p>assumed that this transfer has the potential to affect the Ouse Washes SPA/Ramsar site.</p> <p>Increased abstraction from Denver sluice which feeds the Cut Off Channel will be required. The watercourse at Denver sluice is in direct hydrological connection with the Ouse Washes Ramsar site. The exact location of the abstraction is unknown, therefore impacts on this site must be considered.</p> <p>The SAC is designated for its population of spined loach which depends on sediment quality for its specialised feeding mechanism and is sensitive to water quality and turbidity. Increased abstraction may lead to hydrological changes at this site, which has the potential to increase sedimentation, leading to siltation which may significantly alter habitat availability for this species.</p> <p>For the transfer, the exact location of the new pipeline is unknown, therefore using the precautionary approach, it is assumed to have the potential to affect the Ouse Washes SAC.</p>	Yes
		Norfolk Valley Fens SAC	<p>For the transfer, construction of new pipeline from Fenland reservoir to Heigham has potential to result in temporary disturbance within North Valley Fens SAC (depending on exact location of pipeline route). These alkaline fens are in discreet units and include sensitive habitat which are vulnerable to disruptions to the water table. Construction of new infrastructure within this site has the potential to result in habitat degradation or trampling from construction works, physical loss of habitat and temporary non-physical noise, pollution and/or air disturbance.</p>	Yes
		Breckland SAC	<p>For the transfer, new pipeline infrastructure required from Fenland reservoir to Heigham WTW will bisect Breckland SAC. The works have the potential to cause disturbance (noise, visual and/or pollution) through construction, which may reduce the number of birds using the site and result in habitat degradation or trampling of qualifying habitat features of the SAC.</p> <p>Likely effects are significant through construction only and could be mitigated through appropriate timing of works to avoid the breeding season and by rerouting the pipeline to avoid key habitat features within the designated site.</p>	Yes

Option	Water Resource Zone	European site(s) within the Zol (Natura 2000/Ramsar)	Potential pathway for impact on the European Site(s)	Does the option require a Task II: Appropriate Assessment?
		Breckland SPA	<p>For the transfer, new pipeline infrastructure required from Fenland reservoir to Heigham WTW will bisect Breckland SPA. The interest features of the SPA are breeding assemblages of three key bird species. Construction of the new pipeline within this site has the potential to result in habitat degradation or trampling of key heathland and acid grassland habitat for these species. The works also have the potential to cause disturbance (noise, visual and/or pollution) through construction, which may reduce the number of birds using the site.</p> <p>Construction effects are temporary and could possibly be mitigated through appropriate timing of works to avoid the breeding season and by rerouting the pipeline to avoid key habitat features within the designated site.</p>	Yes
		Barnack Hills and Holes SAC	<p>For the transfer, the exact location of new pipeline is unknown, but has the potential to affect Barnack Hills and Holes SAC, This SAC is designated for its dry grassland and scrub facies. The construction of the new pipeline infrastructure has the potential to result in significant effects on this site if works are required in or adjacent to this site. Construction works may result in habitat degradation or physical damage through trampling.</p> <p>Construction effects are temporary but have the potential to be significant without the implementation of suitable mitigation.</p>	Yes
<p>RTN1 South Lincolnshire Reservoir (unsupported)</p>	Ruthamford North	Baston Fen SAC	<p>Baston Fen SAC is located ~4km downstream of the proposed new South Lincolnshire reservoir, on the counter drain of the River Glen. It is designated as it retains a high population of spined loach and a rich aquatic flora. Impacts on the SAC could result from the construction and operation of the reservoir, which will include filling of the reservoir and retaining a body of water close to the SAC, potentially affecting groundwater levels/flows.</p> <p>However, as the only direct source of water for the new reservoir will be a pumped water transfer from the River Witham, it is expected that the new reservoir will be sufficiently contained and not result in significant effects on groundwater. The presence of a permanent water body may have implications on the local presence of birds in the area, but given Baston Fen is designated for spined loach, it is not</p>	No

Option	Water Resource Zone	European site(s) within the Zol (Natura 2000/Ramsar)	Potential pathway for impact on the European Site(s)	Does the option require a Task II: Appropriate Assessment?
			<p>expected that the integrity of the site will be affected by the option.</p> <p>The associated transfer options are considered unlikely to result in any significant effects on European sites.</p>	
<p>RTN2 South Lincolnshire Reservoir (supported)</p>	<p>Ruthamford North</p>	<p>Baston Fen SAC</p>	<p>The confluence of the River Witham with The Wash is approximately 14 km downstream of the proposed abstraction point at Langrick Bridge. Increased abstraction from the River Witham is expected to reduce flows and water levels immediately downstream of the intake.</p> <p>However, it can be reasonably judged that a reduction in freshwater flows is unlikely to have significant hydrological or physico-chemical consequences in The Wash. Key to this is the low importance of freshwater flows at the designated site relative to estuarine/marine processes. Freshwater input to the estuary is relatively low and the tidal limits occur so far inland that at the point the rivers meet the designated area, considerable mixing with water of marine origins has already occurred.</p> <p>Therefore, there are no reasonably foreseeable likely significant effects on The Wash European sites.</p> <p>Baston Fen SAC is located ~4km downstream of the proposed new South Lincolnshire reservoir, on the counter drain of the River Glen. It is designated as it retains a high population of spined loach and a rich aquatic flora. Impacts on the SAC could result from the construction and operation of the reservoir, which will include filling of the reservoir and retaining a body of water close to the SAC, potentially affecting groundwater levels/flows.</p> <p>However, as the only direct source of water for the new reservoir will be a pumped water transfer from the River Witham, it is expected that the new reservoir will be sufficiently contained and not result in significant effects on groundwater. The presence of a permanent water body may have implications on the local presence of birds in the area, but given Baston Fen is designated for spined loach, it is not expected that the integrity of the site will be affected by the option.</p> <p>The associated transfer options are considered unlikely to result in any significant effects on European sites.</p>	<p>No</p>

Option	Water Resource Zone	European site(s) within the Zol (Natura 2000/Ramsar)	Potential pathway for impact on the European Site(s)	Does the option require a Task II: Appropriate Assessment?
		The Wash & North Norfolk Coast SAC The Wash SPA The Wash Ramsar site	<p>The confluence of the River Witham with The Wash is approximately 14 km downstream of the proposed abstraction point at Langrick Bridge. Increased abstraction from the River Witham is expected to reduce flows and water levels immediately downstream of the intake.</p> <p>However, it can be reasonably judged that a reduction in freshwater flows is unlikely to have significant hydrological or physico-chemical consequences in The Wash. Key to this is the low importance of freshwater flows at the designated site relative to estuarine/marine processes. Freshwater input to the estuary is relatively low and the tidal limits occur so far inland that at the point the rivers meet the designated area, considerable mixing with water of marine origins has already occurred.</p> <p>Therefore, there are no reasonably foreseeable likely significant effects on The Wash European sites.</p>	No
RTN7 Severn Trent Water Import	Ruthamford North	N/A – use of existing infrastructure	No potential impacts on European sites	No

6 In-Combination Effects Preliminary Assessment

6.1 In-Combination Effects Assessment of WRMP

The Task I: Screening stage of the HRA has considered any European sites that could be affected by the implementation of the WRMP. To determine the final impact of the plan, it is necessary to consider potential in-combination and cumulative effects. This includes assessing both the combined impacts of the options on European sites, and their impact in conjunction with other existing or proposed plans and projects²².

This section aims to provide a preliminary assessment of the potential cumulative effects of options included in the WRMP. Table 13, and Table 14 present the intra-plan cumulative-effects assessment for the Preferred Plan, and the adaptive strategy, i.e. highlighting the European sites which could be affected by multiple options by the implementation of the WRMP.

The assessment did not identify any WRMP options which could combine to result in potential cumulative effects on European sites. The implementation of the adaptive strategy however has the potential to result in cumulative effects on The Wash SPA/Ramsar site/SAC, should the King's Lynn desalination and water reuse schemes be implemented and the Stour and Orwell Estuaries SPA/Ramsar site should the Felixstowe desalination and Ipswich water reuse options be implemented. This will be explored further in the Task II: Appropriate Assessment after these options have been assessed further.

The WRMP and its options have been assessed at a high strategic level, and the options that form the WRMP will be subject to the formal planning process and may require an Environmental Impact Assessment under the Town and Country Planning (Environmental Impact Assessment) Regulations 2011 (as amended), which will include a project-level HRA assessment. Requirements for EIA will be determined on an option by option basis. The large supply options proposed under the adaptive strategy (e.g. new reservoirs and desalination plants) may be classified as 'Nationally Significant Infrastructure' and would therefore be required to go through the Development Consent Order planning route, which would itself require its own project-level HRA assessment. As part of these processes more detailed option specific mitigation measures will be developed and it is assumed that any potential significant effects on European sites due to individual options, or in-combination effects will be avoided as far as reasonably possible, and ultimately no options that will result in residual effects (either alone or in-combination) will be implemented as part of the WRMP implementation.

²² Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC (EC 2002).

Table 13: Summary of the cumulative effects of the Preferred Plan on European sites

Option ref.	Option name	Potential Likely Significant Effects on designated sites			
		Deben Estuary	Humber Estuary	River Wensum	Stour and Orwell Estuaries
-	Demand Management Strategy Extended Plus				
BHV5	Newmarket RZ to Bury Haverhill RZ Transfer (20MI/d)				
CLN13a	South Humber Bank RZ to Central Lincolnshire RZ Transfer (31MI/d)				
CLN14	South Humber Bank RZ to Central Lincolnshire RZ Transfer (6MI/d)				
CLN15	South Humber Bank RZ to Central Lincolnshire RZ Transfer (Existing)				
CLN16	South Humber Bank RZ to Central Lincolnshire RZ Transfer				
ELY9	North Fenland RZ to Ely RZ Transfer (20MI/d)				
CVY1	Newmarket RZ to Cheveley RZ Transfer				
ESU1	Felixstowe Desalination	✓			✓
ESU8	Bury Haverhill RZ to East Suffolk RZ transfer (20MI/d)				
HPB1	Norwich & the Broads RZ to Happisburgh RZ Transfer				
HPB2	Norwich and the Broads WRZ to Happisburgh Transfer (East Ruston/Witton)				
NFN4	South Fenland RZ to North Fenland RZ Transfer (20MI/d)				
NNR8	Norwich & the Boards RZ to Norfolk Rural North RZ Transfer (5MI/d)				
NTM1	Central Lincolnshire RZ to Nottinghamshire RZ Transfer				
NWM6	Ely RZ to Newmarket RZ Transfer (20MI/d)				
RTC2	Ruthamford South RZ to Ruthamford Central RZ Transfer (
RTN27	South Lincolnshire RZ to Ruthamford North RZ (67MI/d)				
SEX4	East Suffolk RZ to South Essex RZ transfer (15MI/d)				
SFN4	Ruthamford North RZ to South Fenland RZ Transfer (40 MI/d)				
SHB2	Pyewipe Water Reuse for non-potable use		✓		
SLN6	Central Lincolnshire RZ to South Lincolnshire RZ Transfer (63MI/d)				
THT1a/b	Bury Haverhill WRZ to Thetford WRZ Transfer (existing)				
-	Birchmoor WTW Resilience				
-	Meppershall WTW Resilience				
-	Diddlington WTW Resilience				
-	Great Wratting WTW Resilience				

Option ref.	Option name	Potential Likely Significant Effects on designated sites			
	Total number of options potentially affecting the European site	1	1	1	1
	Does the Preferred Plan have the potential for cumulative impacts on the European site?	No	No	No	No

Table 14: Summary of the cumulative effects of the adaptive strategy options on European sites

Option ref.	Option name	Potential Likely Significant Effects on designated sites							
		Barnack Hills and Holes	Breckland	Deben Estuary	Norfolk Valley Fens	Ouse Washes	Stour and Orwell Estuaries	The Wash	The Wash & North Norfolk Coast
ESU1	Felixstowe Desalination			✓			✓		
ESU2	Ipswich Water Reuse								
NFN1	Kings Lynn Desalination						✓	✓	
NFN2	Kings Lynn Water Reuse						✓	✓	
NFN3	Fenland Reservoir	✓	✓		✓	✓			
RTN1	South Lincolnshire Reservoir (unsupported)								
RTN2	South Lincolnshire Reservoir (supported)								
RTN7	Severn Trent Water Import								
	Total number of options potentially affecting the European site		1	1	1	1	1	2	2
	Does the adaptive strategy have the potential for cumulative impacts on the European site?		No	No	No	No	No	Yes	Yes

6.2 Environment Agency Review of Consents

The Environment Agency Review of Consents (RoC) is an evidence-led examination that examines individual consents and assesses the potential impacts of existing and proposed abstraction licences and discharges on European sites. It is used as a basis for establishing mitigation to protect these sites from adverse environmental effects and the WRMP will take account of the RoC process so that sustainability reductions can be included within the proposed options. Where individual consents have been identified as requiring changes, the EA will advise Anglian Water and any required changes would be incorporated in the WRMP.

The WRMP options that involve abstractions will all be within current abstraction licence limits and the RoC process has already completed an in-combination assessment for all currently licensed abstractions. This means that potential in-combination effects in respect of water-resource demands associated with other plans or projects are generally unlikely, since these demands are considered during the WRMP development process. This also implies that where abstractions are proposed to be increased as part of the proposed WRMP, the increase in abstraction will never exceed the current licence limits, and therefore will not result in any significant effects of European sites downstream, as the integrity of European sites has already been protected under the RoC process.

New abstractions are not included in the RoC process, therefore new abstractions proposed as part of WRMP must be considered in having potential effects on European sites; this is not the case with any of the options included on the WRMP, however. Therefore in-combination effects with the RoC process is not considered further in this assessment

6.3 Links to other tiers of Plans, Programmes, and the Project Level

The WRMP supports several local, regional, and national plans and programmes and will have a direct link to water resources and water supply plans and policies, for example in Local Plans. The development of WRMP has taken future population growth into account and as such will support Local Plan policies on housing and development; therefore, Local Plans have not been considered further in this assessment. The WRMP will also have indirect links to plans relating to health and well-being, housing, and the environment.

6.3.1 In-combination effects with other WRMPs

In-combination effects have the potential to arise where water resources are shared between neighbouring water companies, where any change in quantity or quality of these resources could be reasonably foreseen to impact on a European site. Such a situation could occur if:

- Abstraction or discharge consents are proposed to exceed current consent limits; and
- New abstraction or discharges are proposed in an area with hydrological connection with shared water resources and European sites.

The neighbouring Water Companies to the Anglian Water region are Affinity Water, Cambridge Water, Essex and Suffolk Water, Severn Trent Water, Southern Water, Thames Water and Yorkshire Water. Based on overlaps of their water catchment with the boundary of neighbouring water companies; a list of European sites likely to be susceptible to in-combination effects from neighbouring Water Companies WRMPs is given in Table 15.

Table 15: European sites within the study area susceptible to in-combination effects

Site	SAC	SPA	Ramsar
Alde-Ore & Butley Estuaries	x		
Alde-Ore Estuary		x	x
Baston Fen	x		
Benacre to Easton Bavents		x	

Site	SAC	SPA	Ramsar
Benacre to Easton Bavents Lagoons	x		
Birklands & Bilhaugh	x		
Blackwater Estuary (Mid-Essex Coast Phase 4)		x	x
Breckland	x	x	
Breydon Water		x	x
Broadland		x	x
Castle Eden Dene	x		
Chilterns Beechwoods	x		
Chippenham Fen			x
Colne Estuary (Mid-Essex Coast Phase 2)		x	x
Deben Estuary		x	x
Dengie (Mid-Essex Coast Phase 1)		x	x
Dersingham Bog			x
Devils Dyke	x		
Essex Estuaries	x		
Eversden and Wimpole Woods	x		
Fenland	x		
Hamford Water	p	x	x
Hatfield Moor	x		
Humber Estuary	x	x	x
Minsmere to Walberswick Heaths & Marshes	x		
Minsmere-Walberswick		x	x
Nene Washes	x	x	x
Norfolk Valley Fens	x		
North Norfolk Coast	x	x	x
Orfordness-Shingle Street	x		
Orton Pit	x		
Ouse Washes	x	x	x
Portholme	x		
Redgrave & South Lopham Fens			x
Rex Graham Reserve	x		
Roydon Common			x
Roydon Common & Dersingham Bog	x		
Rutland Water		x	x
Sandlings		x	
Staverton Park & The Thicks, Wantisden	x		
Stour and Orwell Estuaries		x	x
The Broads	x		
Thorne & Hatfield Moors		x	
Thorne Moor	x		
Upper Nene Valley Gravel Pits		x	x
Waveney & Little Ouse Valley Fens	x		
Wicken Fen			x
Winterton-Horsey Dunes	x		
Woodwalton Fen			x

p = possible European site, meets qualification criteria but not formally designated

For the implementation of the WRMP; the Deben Estuary, the Ouse Washes and the Stour an Orwell Estuaries have the potential to be affected in-combination with the implementation of neighbouring Water Company WRMPs. For Adaptive Strategy; Breckland (including the Norfolk Valley Fens), the Deben Estuary, the Ouse Washes and the Stour and Orwell Estuaries have the potential to be

affected in-combination. The neighbouring Water Company WRMPs are not yet published, therefore a comprehensive assessment of in-combination effects through implementation of neighbouring Water Company's WRMPs is not possible at this time. It is assumed, however, that any potential significant effects on European sites due to individual options, or in-combination effects will be avoided as far as reasonably possible, and ultimately no options that will result in residual effects (either alone or in-combination) will be implemented as part of the WRMP implementation. This will be explored further with the development of this assessment in the Task II: Appropriate Assessment report.

6.3.2 Anglian Water Drought Plan 2019

The WRMP will interact with and support the emerging Anglian Water Drought Plan 2019. The Drought Plan looks at demand side management actions and supply side management actions for ensuring water supply during drought conditions. Demand management options in the Drought Plan such as meter optants and leakage reduction are also contained in the WRMP but for the Drought Plan, meter optants, for example, would be focussed in areas at most risk of impact of drought, and leakage reduction works would be increased during periods of potential or actual drought. The Drought Plan also includes supply side schemes such as desalination and water reuse, however, specific details in terms of locations are not defined.

Eight supply side schemes that would potentially require a drought permit are defined in the Drought Plan 2019. These mainly include proposals to increase current abstraction limits (such as temporary lowering of Hands-Off or Mean Residual Flows) to allow Anglian Water to take more of its licensed abstraction quantities during low-flow periods. The eight options have been screened by Mott MacDonald for their potential to result in adverse effects on European sites (Mott MacDonald unpublished report, expected September 2018). Only one of the options has been identified with having potential LSE; specifically, potential deterioration in water quality through increased ammonia and orthophosphate was identified in the Ouse Washes through implementation of a drought permit on the River Great Ouse. It can be reasonably assumed that this option will only be implemented at a project-level with mitigation in place to avoid water quality deterioration, and ultimately no options that will result in residual effects (either alone or in-combination) will be implemented as part of the Drought Plan or the WRMP.

6.3.3 Water Resources East

The WRMP covers the 25-year period from 2020 to 2045. Through Water Resources East (WRE), Anglian Water have also carried out longer term planning (beyond 2045) at the regional level. The WRE Programme is a long-term water resources strategy to 2100. The purpose of the WRE programme is to develop a reliable, affordable, and sustainable system of water supply in the East of England which is resilient to the effects of climate change, growth, and multi-season drought. The WRMP is aligned with the WRE preliminary regional strategy as outlined below. The WRE strategy includes:

- New reservoir storage capacity, capturing high winter flows – the WRMP provides the flexibility to delivery new reservoir storage capacity in the region in the future, and distribute resources across the region.
- Treated water imports – Anglian Water has considered import options in our decision-making approach and will continue to assess these working towards WRMP 2024.
- A network of strategic transfers, to share resources between companies and across sectors – the WRMP delivers a network of strategic transfers across the region.
- Desalination and water reuse at key locations on the east coast – the WRMP includes water reuse in AMP7 and the development of desalination in AMP9.

Anglian Water will continue to assess these options working towards WRMP 2024 and all options will be subject to a HRA assessment at both a strategic and project level (pre-implementation) that includes potential effects on European sites in-combination with WRMP development.

7 Conclusions and Recommendations

The results of the HRA Task I: Screening assessment for the Anglian Water WRMP is presented in Table 16, and Table 17 below. The screening has identified the WRMP options with the potential to result in Likely Significant Effects on European sites.

Two options in the WRMP Preferred Plan were assessed as having Likely Significant Effects on European sites:

- ESU1 Felixstowe Desalination
- SHB2 Pyewipe Water Reuse for non-potable

Five options included in the adaptive strategy were assessed as having Likely Significant Effects on European sites:

- ESU1 Felixstowe
- ESU2 Ipswich Water Reuse
- NFN1 Kings Lynn Desalination
- NFN2 Kings Lynn Water Reuse
- NFN3 Fenland New Reservoir

These options will be assessed further at the Task II: Appropriate Assessment stage for their potential residual effects on the integrity of the European sites listed in the table below, where more detailed information will need to be reviewed to clarify potential source-pathway-receptor linkages, and mitigation measures will be investigated.

This report also presents a preliminary assessment of the potential for the WRMP options to act in-combination to result in cumulative effects on the European sites. The assessment did not identify any options in the Preferred Plan which could combine to result in potential cumulative effects on European sites. The implementation of the adaptive strategy however has the potential to result in cumulative effects on The Wash SPA/Ramsar site/SAC and the Stour and Orwell Estuaries SPA/Ramsar site should all the options be implemented. This will be explored further in the Task II: Appropriate Assessment after these options have been assessed further.

There is also potential for further in-combination effects through the implementation of neighbouring Water Company's WRMPs. on the Deben Estuary, the Ouse Washes and the Stour an Orwell Estuaries, where any change in quantity or quality of these resources could be reasonably foreseen through the

The results of the HRA Task I: Screening assessment for the Preferred Plan is given below.

Table 16: Preferred Plan HRA Task I: Screening assessment summary

Option ref.	Option name	WRZ	Potential for Significant Effects on a European Site?
-	Demand Management Strategy Extended Plus	All	No
BHV5	Newmarket RZ to Bury Haverhill RZ Transfer (20Ml/d)	Bury Haverhill	No
CLN13a	South Humber Bank RZ to Central Lincolnshire RZ Transfer (31Ml/d)	Central Lincolnshire	No
CLN14	South Humber Bank RZ to Central Lincolnshire RZ Transfer (6Ml/d)	Central Lincolnshire	No
CLN15	South Humber Bank RZ to Central Lincolnshire RZ Transfer (Existing)	Central Lincolnshire	No

Option ref.	Option name	WRZ	Potential for Significant Effects on a European Site?
CLN16	South Humber Bank RZ to Central Lincolnshire RZ Transfer	Central Lincolnshire	No
ELY9	North Fenland RZ to Ely RZ Transfer (20MI/d)	Ely	No
CVY1	Newmarket RZ to Cheveley RZ Transfer	Cheveley	No
ESU1	Felixstowe Desalination	East Suffolk	Yes – Stour and Orwell Estuaries SPA Deben Estuary SPA
ESU8	Bury Haverhill RZ to East Suffolk RZ transfer (20MI/d)	East Suffolk	No
HPB1	Norwich & the Broads RZ to Happisburgh RZ Transfer	Happisburgh	No
HPB2	Norwich and the Broads WRZ to Happisburgh Transfer (East Ruston/Witton)	Happisburgh	No
NFN4	South Fenland RZ to North Fenland RZ Transfer (20MI/d)	North Fenland	No
NNR8	Norwich & the Boards RZ to Norfolk Rural North RZ Transfer (5MI/d)	Norfolk Rural North	No
NWM6	Ely RZ to Newmarket RZ Transfer (20MI/d)	Newmarket	No
NTM1	Central Lincolnshire RZ to Nottinghamshire RZ Transfer	Nottinghamshire	No
RTC2	Ruthamford South RZ to Ruthamford Central RZ Transfer	Ruthamford Central	No
RTN27	South Lincolnshire RZ to Ruthamford North RZ (67MI/d)	Ruthamford North	No
SEX4	East Suffolk RZ to South Essex RZ transfer (15MI/d)	South Essex	No
SFN4	Ruthamford North RZ to South Fenland RZ Transfer (40 MI/d)	South Fenland	No
SHB2	Pyewipe Water Reuse for non-potable use	South Humber Bank	Yes – Humber Estuary SPA/Ramsar site/SAC
SLN6	Central Lincolnshire RZ to South Lincolnshire RZ Transfer (63MI/d)	South Lincolnshire	No
THT1a / THT1b	Bury Haverhill to Thetford transfer (Existing)	Thetford	No
-	Birchmoor WTW Resilience	Ruthamford South	No
-	Meppershall WTW Resilience	Ruthamford South	No
-	Diddlington WTW Resilience	Norfolk Rural North	No
-	Great Wratting WTW Resilience	Bury Haverhill	No

Table 17: Adaptive strategy HRA Task I: Screening assessment summary

Option ref.	Option name	WRZ	Potential for Significant Effects on a European site?
ESU1	Felixstowe Desalination	East Suffolk	Yes – Stour and Orwell Estuaries SPA Deben Estuary SPA
ESU2	Ipswich Water Reuse	East Suffolk	Stour and Orwell Estuaries SPA Stour and Orwell Estuaries Ramsar site
NFN1	Kings Lynn Desalination	North Fenland	Yes – The Wash SPA/Ramsar site The Wash and North Norfolk Coast SAC
NFN2	Kings Lynn Water Reuse	North Fenland	Yes –

Option ref.	Option name	WRZ	Potential for Significant Effects on a European site?
			The Wash SPA/Ramsar site The Wash and North Norfolk Coast SAC
NFN3	Fenland Reservoir	North Fenland	Yes – Ouse Washes SPA/Ramsar site/SAC Norfolk Valley Fens SAC Breckland SPA/SAC Barnack Hills and Holes SAC
RTN1	South Lincolnshire Reservoir (unsupported)	Ruthamford North	No
RTN2	South Lincolnshire Reservoir (supported)	Ruthamford North	No
RTN7	Severn Trent water Import	Ruthamford North	No

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A. Study Area and Designated Sites Map

B. European Sites and their Qualifying Features

Table 18: European sites (Natura 2000/Ramsar) within the study area and their qualifying features

European Site Name	Designation Classification	Qualifying Features
Abberton Reservoir	SPA	<p>ARTICLE 4.2 During the breeding season the area regularly supports: <i>Phalacrocorax carbo</i></p> <p>Over winter the area regularly supports: <i>Anas clypeata, Anas crecca, Anas penelope, Anas strepera, Aythya farina, Aythya fuligula, Bucephala clangula, Cygnus olor, Fulica atra, Podiceps cristatus</i></p> <p>AN INTERNATIONALLY IMPORTANT ASSEMBLAGE OF BIRDS - Over winter the area regularly supports: 39763 waterfowl (5-year peak mean 01/04/1998) Including: <i>Podiceps cristatus, Anas penelope, Anas strepera, Anas crecca, Anas clypeata, Aythya ferina, Aythya fuligula, Bucephala clangula, Fulica atra.</i></p>
	Ramsar	<p>Ramsar criterion 5 Assemblages of international importance.</p> <p>Ramsar criterion 6 Species/populations occurring at levels of international importance. Species with peak counts in spring/autumn: Gadwall, <i>Anas strepera strepera</i>, NW Europe 2002/3) Northern shoveler, <i>Anas clypeata</i>, NW & C Europe Species with peak counts in winter: Eurasian wigeon, <i>Anas penelope</i>, NW Europe Species/populations identified subsequent to designation for possible future consideration under criterion 6. Species with peak counts in spring/autumn: Mute swan, <i>Cygnus olor</i>, Britain, Common pochard, <i>Aythya ferina</i>, NE & NW Europe.</p>
Alde-Ore & Butley Estuaries	SAC	<p>1130 Estuaries 1140 Mudflats and sandflats not covered by seawater at low tide 1330 Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>)</p>
Alde-Ore Estuary	SPA	<p>ARTICLE 4.1 During the breeding season the area regularly supports: <i>Circus aeruginosus, Recurvirostra avosetta, Sterna albifrons, Sterna sandvicensis</i></p> <p>Over winter the area regularly supports: <i>Philomachus pugnax, Recurvirostra avosetta</i></p> <p>ARTICLE 4.2 During the breeding season the area regularly supports: <i>Larus fuscus</i> Over winter the area regularly supports: <i>Tringa totanus</i></p>
	Ramsar	<p>Ramsar criterion 2 The site supports a number of nationally-scarce plant species and British Red Data Book invertebrates.</p> <p>Ramsar criterion 3 The site supports a notable assemblage of breeding and wintering wetland birds.</p> <p>Ramsar criterion 6 Species/populations occurring at levels of international importance. Species regularly supported during the breeding season: Lesser black-backed gull, <i>Larus fuscus graellsii</i>, W Europe/Mediterranean/W Africa</p> <p>Species with peak counts in winter: Pied avocet, <i>Recurvirostra avosetta</i>, Europe/Northwest Africa Common redshank, <i>Tringa totanus totanus</i></p>

European Site Name	Designation Classification	Qualifying Features
Barnack Hills & Holes	SAC	6210 Semi-natural dry grasslands and scrubland facies: on calcareous substrates (<i>Festuco-Brometalia</i>)
Baston Fen	SAC	1149 Spined loach <i>Cobitis taenia</i>
Benacre to Easton Bavents	SPA	ARTICLE 4.1 During the breeding season the area regularly supports: <i>Botaurus stellaris</i> , <i>Circus aeruginosus</i> , <i>Sterna albifrons</i>
Benacre to Easton Bavents Lagoons	SAC	1150 Coastal lagoons* Priority feature. <i>Zostera angustifolia</i> and <i>Ruppia cirrhosa</i>
Birklands and Bilhaugh	SAC	9190 Old acidophilous oak woods with <i>Quercus robur</i> on sandy plains
Blackwater Estuary (Mid-Essex Coast Phase 4)	SPA	ARTICLE 4.1 During the breeding season the area regularly supports: <i>Sterna albifrons</i> Over winter the area regularly supports: <i>Circus cyaneus</i> ARTICLE 4.2 During the breeding season the area regularly supports: <i>Aythya farina</i> , <i>Charadrius hiaticula</i> Over winter the area regularly supports: <i>Branta bernicla bernicla</i> , <i>Calidris alpina alpina</i> , <i>Charadrius hiaticula</i> , <i>Limosa limosa islandica</i> , <i>Pluvialis squatarola</i> AN INTERNATIONALLY IMPORTANT ASSEMBLAGE OF BIRDS - Over winter the area regularly supports: 109964 waterfowl (5 year peak mean 01/04/1998) Including: <i>Branta bernicla bernicla</i> , <i>Charadrius hiaticula</i> , <i>Pluvialis squatarola</i> , <i>Calidris alpina alpina</i> , <i>Limosa limosa islandica</i> .
	Ramsar	Ramsar criterion 1 Qualifies by virtue of the extent and diversity of saltmarsh habitat present. This site, and the four others in the Mid-Essex Coast complex, includes a total of 3,237 ha that represent 70% of the saltmarsh habitat in Essex and 7% of the total area of saltmarsh in Britain. Ramsar criterion 2 The invertebrate fauna is well represented and includes at least 16 British Red Data Book species. In descending order of rarity these are: Endangered: a water beetle <i>Paracymus aeneus</i> ; Vulnerable: a damselfly <i>Lestes dryas</i> , the flies <i>Aedes flavescens</i> , <i>Erioptera bivittata</i> , <i>Hybomitra expollicata</i> and the spiders <i>Heliophanus auratus</i> and <i>Trichopterna cito</i> ; Rare: the beetles <i>Baris scolopacea</i> , <i>Philonthus punctus</i> , <i>Graptodytes bilineatus</i> and <i>Malachius vulneratus</i> , the flies <i>Campsicemus magius</i> and <i>Myopites eximia</i> , the moths <i>Idaea ochrata</i> and <i>Malacosoma castrensis</i> and the spider <i>Euophrys</i> . Ramsar criterion 3 This site supports a full and representative sequences of saltmarsh plant communities covering the range of variation in Britain. Ramsar criterion 5 Assemblages of international importance: Species with peak counts in winter: 105061 waterfowl (5-year peak mean 1998/99-2002/2003) Ramsar criterion 6 Species/populations occurring at levels of international importance.
Breckland	SAC	2330 Inland dunes with open <i>Corynephorus</i> and <i>Agrostis</i> grasslands 3150 Natural eutrophic lakes with Magnopotamion or Hydrocharition-type vegetation 4030 European dry heaths 6210 Semi-natural dry grasslands and scrubland facies: on calcareous substrates (<i>Festuco-Brometalia</i>) 91E0 Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i> , <i>Alnion incanae</i> , <i>Salicion albae</i>) * Priority feature 1166 Great crested newt <i>Triturus cristatus</i>
	SPA	ARTICLE 4.1

European Site Name	Designation Classification	Qualifying Features
Breydon Water	SPA	<p>During the breeding season the area regularly supports: <i>Burhinus oediconemus, Caprimulgus europaeus, Lullula arborea</i></p> <p>ARTICLE 4.1 During the breeding season the area regularly supports: <i>Sterna hirundo</i></p> <p>Over winter the area regularly supports: <i>Cygnus columbianus bewickii, Pluvialis apricaria, Recurvirostra avosetta</i></p> <p>On passage the area regularly supports: <i>Philomachus pugnax</i></p> <p>ARTICLE 4.2 Over winter the area regularly supports: <i>Vanellus vanellus</i></p> <p>AN INTERNATIONALLY IMPORTANT ASSEMBLAGE OF BIRDS - Over winter the area regularly supports: 43225 waterfowl (5-year peak mean 01/07/1999) Including: <i>Cygnus columbianus bewickii, Recurvirostra avosetta, Pluvialis apricaria, Vanellus vanellus.</i></p>
	Ramsar	<p>Ramsar criterion 5 Assemblages of international importance: Species with peak counts in winter: 68175 waterfowl (5-year peak mean 1998/99-2002/2003)</p> <p>Ramsar criterion 6 - Species/populations occurring at levels of international importance. Species with peak counts in winter: Tundra swan, <i>Cygnus columbianus bewickii</i>, NW Europe, Northern lapwing, <i>Vanellus vanellus</i>, Europe - breeding</p> <p>Species/populations identified subsequent to designation for possible future consideration under criterion 6.</p>
Broadland	SPA	<p>ARTICLE 4.1 During the breeding season the area regularly supports: <i>Botaurus stellaris, Circus aeruginosus</i></p> <p>Over winter the area regularly supports: <i>Circus cyaneus, Cygnus columbianus bewickii, Cygnus cygnus</i></p> <p>ARTICLE 4.2 Over winter the area regularly supports: <i>Anas strepera</i></p>
	Ramsar	<p>Ramsar criterion 2 The site supports a number of rare species and habitats within the biogeographical zone context, including the following Habitats Directive Annex I features: H7210 Calcareous fens with <i>Cladium mariscus</i> and species of the Caricion davallianae Calcium-rich fen dominated by great fen sedge (saw sedge). H7230 Alkaline fens Calcium-rich springwater fed fens. H91E0 Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (Alno-Padion, <i>Alnion incanae</i>, <i>Salicion albae</i>) Alder woodland on floodplains, and the Annex II species S1016 <i>Vertigo moulinsiana</i> Desmoulin's whorl snail S1355 <i>Lutra lutra</i> Otter S1903 <i>Liparis loeselii</i> Fen orchid. The site supports outstanding assemblages of rare plants and invertebrates including nine British Red Data Book plants and 136 British Red Data Book invertebrates.</p> <p>Ramsar criterion 6 Species/populations occurring at levels of international importance.</p>
Castle Eden Dene	SAC	<p>91J0 <i>Taxus baccata</i> woods of the British Isles. Extensive yew groves are found in association with ash-elm <i>Fraxinus-Ulmus</i> woodland and it is the only site selected for yew woodland on magnesian limestone in north-east England.</p>

European Site Name	Designation Classification	Qualifying Features
Chilterns Beechwoods	SAC	9130 <i>Asperulo-Fagetum</i> beech forests <i>Asperulo-Fagetum</i> beech and <i>Cardamine bulbifera</i> . 6210 Semi-natural dry grasslands and scrubland facies: on calcareous substrates Festuco-Brometalia 1083 Stag beetle <i>Lucanus cervus</i>
Chippenham Fen	Ramsar	Ramsar criterion 1 A spring-fed calcareous basin mire with a long history of management, which is partly reflected in the diversity of present-day vegetation. Ramsar criterion 2 The invertebrate fauna is very rich, partly due to its transitional position between Fenland and Breckland. The species list is very long, including many rare and scarce invertebrates characteristic of ancient fenland sites in Britain. Ramsar criterion 3 The site supports diverse vegetation types, rare and scarce plants. The site is the stronghold of Cambridge milk parsley <i>Selinum carvifolia</i> .
Colne Estuary (Mid-Essex Coast Phase 2)	SPA	ARTICLE 4.1 During the breeding season the area regularly supports: <i>Sterna albifrons</i> Over winter the area regularly supports: <i>Circus cyaneus</i> ARTICLE 4.2 During the breeding season the area regularly supports: <i>Aythya farina, Charadrius hiaticula</i> Over winter the area regularly supports: <i>Branta bernicla bernicla, Tringa totanus</i>
	Ramsar	Ramsar criterion 1 The site is important due to the extent and diversity of saltmarsh present. This site, and the four other sites in the Mid-Essex Coast complex, includes a total of 3,237 ha, that represent 70% of the saltmarsh habitat in Essex and 7% of the total saltmarsh in Britain. Ramsar criterion 2 The site supports 12 species of nationally scarce plants and at least 38 British Red Data Book invertebrate species. Ramsar criterion 3 This site supports a full and representative sequences of saltmarsh plant communities covering the range of variation in Britain. Ramsar criterion 5 Assemblages of international importance: Species with peak counts in winter: 32041 waterfowl (5-year peak mean 1998/99-2002/2003) Ramsar criterion 6 species/populations occurring at levels of international importance.
Deben Estuary	SPA	ARTICLE 4.1 Over winter the area regularly supports: <i>Recurvirostra avosetta</i> ARTICLE 4.2 Over winter the area regularly supports: <i>Branta bernicla bernicla</i>
	Ramsar	Ramsar criterion 2 Supports a population of the mollusc <i>Vertigo angustior</i> (Habitats Directive Annex II (S1014); British Red Data Book Endangered). Martlesham Creek is one of only about fourteen sites in Britain where this species survives. Ramsar criterion 6 Species/populations occurring at levels of international importance. Species with peak counts in winter: Dark-bellied brent goose, <i>Branta berniclabernicla</i> .
Dengie (Mid-Essex Coast Phase 1)	SPA	ARTICLE 4.2 Over winter the area regularly supports: <i>Circus cyaneus</i>

European Site Name	Designation Classification	Qualifying Features
		<i>Branta bernicla bernicla</i> <i>Calidris canutus</i> <i>Pluvialis squatarola</i>
	Ramsar	Ramsar criterion 2 Dengie supports a number of rare plant and animal species. The Dengie has 11 species of nationally scarce plants: sea kale <i>Crambe maritima</i> , sea barley <i>Hordeum marinum</i> , golden samphire <i>Inula crithmoides</i> and lax flowered sea lavender <i>Limonium humile</i> . Ramsar criterion 3 This site supports a full and representative sequences of saltmarsh plant communities covering the range of variation in Britain. Ramsar criterion 5 Assemblages of international importance: Species with peak counts in winter: 43828 waterfowl (5-year peak mean 1998/99-2002/2003) Ramsar criterion 6 – species/populations occurring at levels of international importance.
Dersingham Bog	Ramsar	Ramsar criterion 2 Supports an important assemblage of invertebrates - nine British Red Data Book species have been recorded.
Devils Dyke	SAC	6210 Semi-natural dry grasslands and scrubland facies: on calcareous substrates (Festuco-Brometalia)
Durham Coast	SAC	1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
Epping Forest	SAC	4010 Northern Atlantic wet heaths with <i>Erica tetralix</i> 4030 European dry heaths
Essex Estuaries	SAC	1130 Estuaries 1140 Mudflats and sandflats not covered by seawater at low tide 1310 <i>Salicornia</i> and other annuals colonising mud and sand 1320 <i>Spartina</i> swards (<i>Spartinion maritimae</i>) 1330 Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>) 1420 Mediterranean and thermo-Atlantic halophilous scrubs (<i>Sarcocornetea fruticosi</i>) 1110 Sandbanks which are slightly covered by sea water all the time
Eversden and Wimpole Woods	SAC	1308 <i>Barbastella barbastellus</i>
Fenland	SAC	6410 <i>Molinia</i> meadows on calcareous, peaty, or clayey-silt-laden soils (<i>Molinion caeruleae</i>)
Gibraltar Point	SPA	ARTICLE 4.1 During the breeding season the area regularly supports: <i>Sterna albifrons</i> Over winter the area regularly supports: <i>Limosa lapponica</i> ARTICLE 4.2 Over winter the area regularly supports: <i>Calidris alba</i> <i>Pluvialis squatarola</i>
	Ramsar	Species with peak counts in spring/autumn: Grey plover, <i>Pluvialis squatarola</i> , E Atlantic/W Africa -wintering Sanderling, <i>Calidris alba</i> , Eastern Atlantic Bar-tailed godwit, <i>Limosa lapponica lapponica</i> , W Palearctic Species with peak counts in winter: Dark-bellied brent goose, <i>Branta berniclabernicla</i> , Species/populations identified subsequent to designation for possible future consideration under criterion 6.
Great Yarmouth North Denes	SPA	ARTICLE 4.1 During the breeding season the area regularly supports: <i>Sterna albifrons</i>

European Site Name	Designation Classification	Qualifying Features
Grimsthorpe	SAC	1654 Early gentian <i>Gentianella anglica</i> 6210 Semi-natural dry grasslands and scrubland facies: on calcareous substrates (Festuco-Brometalia)
Hamford Water	SAC	4035 Fisher's estuarine moth <i>Gortyna borellii lunata</i>
	SPA	ARTICLE 4.1 During the breeding season the area regularly supports: i Over winter the area regularly supports: <i>Recurvirostra avosetta</i>
	Ramsar	Ramsar criterion 6 – species/populations occurring at levels of international importance. Qualifying Species/populations (as identified at designation): Species with peak counts in spring/autumn: Ringed plover, <i>Charadrius hiaticula</i> , Common redshank, <i>Tringa totanus</i> Species with peak counts in winter: <i>Dark-bellied brent goose</i> , <i>Branta bernicla</i> , Black-tailed godwit, <i>Limosa limosa</i> Species/populations identified subsequent to designation for possible future consideration under criterion 6.
Hatfield Moor	SAC	7120 Degraded raised bogs still capable of natural regeneration, <i>Myrica gale</i>
	SPA	ARTICLE 4.1 Inland water bodies (standing water, running water) Bogs. Marshes. Water fringed vegetation. Fens Heath. Scrub. Maquis and garrigue. <i>Phygrana</i> Broad-leaved deciduous woodland Coniferous woodland ARTICLE 4.2 During the breeding season the area regularly supports: <i>Caprimulgus europaeus</i>
Humber Estuary	SAC	H1110. Sandbanks which are slightly covered by sea water all the time; Subtidal sandbanks H1130. Estuaries H1140. Mudflats and sandflats not covered by seawater at low tide; Intertidal mudflats and sandflats H1150. Coastal lagoons* H1310. <i>Salicornia</i> and other annuals colonising mud and sand; Glasswort and other annuals colonising mud and sand H1330. Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>) H2110. Embryonic shifting dunes
	SPA	ARTICLE 4.1 During the breeding season the area regularly supports: <i>Botaurus stellaris</i> , <i>Circus aeruginosus</i> 6.3% of the population in Great Britain, <i>Recurvirostra avosetta</i> , <i>Sterna albifrons</i> Over winter the area regularly supports: <i>Botaurus stellaris</i> , <i>Circus cyaneus</i> , <i>Limosa lapponica</i> , <i>Pluvialis apricaria</i> , (North-western Europe - breeding), <i>Recurvirostra avosetta</i> On passage the area regularly supports: <i>Philomachus pugnax</i> ARTICLE 4.2

European Site Name	Designation Classification	Qualifying Features
		<p>Over winter the area regularly supports: <i>Calidris alpina alpina</i>, <i>Calidris canutus</i>, <i>Limosa limosa islandica</i>, <i>Tadorna tadorna</i>, <i>Tringa totanus</i></p> <p>On passage the area regularly supports: <i>Calidris alpina alpina</i>, <i>Calidris canutus</i>, <i>Limosa limosa islandica</i>, <i>Tringa totanus</i></p>
	Ramsar	<p>Ramsar criterion 1 The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.</p> <p>Ramsar criterion 5 Assemblages of international importance: 153,934 waterfowl, non-breeding season (5-year peak mean 1996/97-2000/2001)</p> <p>Ramsar criterion 6 Species/populations occurring at levels of international importance. Eurasian golden plover, <i>Pluvialis apricaria altifrons</i> subspecies – NW Europe, W Continental Europe, NW Africa population Red knot, <i>Calidris canutus islandica</i> subspecies Dunlin, <i>Calidris alpina alpina</i> subspecies – Western Europe (non-breeding) population Black-tailed godwit, <i>Limosa limosa islandica</i> subspecies Common redshank, <i>Tringa tetanus brittanica</i> subspecies Common shelduck, <i>Tadorna tadorna</i> North-western Europe (breeding) population Eurasian golden plover, <i>Pluvialis apricaria altifrons</i> subspecies – NW Europe, W Continental Europe, NW Africa population Red knot, <i>Calidris canutus islandica</i> subspecies Dunlin, <i>Calidris alpina alpina</i> subspecies – Western Europe (non-breeding) population Black-tailed godwit, <i>Limosa limosa islandica</i> subspecies Bar-tailed godwit, <i>Limosa lapponica lapponica</i> subspecies Common redshank, <i>Tringa tetanus brittanica</i> subspecies</p> <p>Ramsar criterion 8 The Humber Estuary acts as an important migration route for both river lamprey <i>Lampetra fluviatilis</i> and sea lamprey <i>Petromyzon marinus</i> between coastal waters and their spawning areas.</p>
Minsmere to Walberswick Heaths & Marshes	SAC	<p>1210 Annual vegetation of drift lines <i>Honckenya peploides</i> and <i>Beta vulgaris</i></p> <p>4030 European dry heaths, predominantly NVC type H8 <i>Calluna vulgaris</i> – <i>Ulex gallii</i> heath.</p> <p>1220 Perennial vegetation of stony banks</p>
Minsmere-Walberswick	SPA	<p>ARTICLE 4.1 During the breeding season the area regularly supports: <i>Botaurus stellaris</i>, <i>Caprimulgus europaeus</i>, <i>Circus aeruginosus</i>, <i>Recurvirostra avosetta</i>, <i>Sterna albifrons</i></p> <p>Over winter the area regularly supports: <i>Circus cyaneus</i></p> <p>ARTICLE 4.2 During the breeding season the area regularly supports: <i>Anas clypeata</i>, <i>Anas crecca</i>, <i>Anas strepera</i></p> <p>Over winter the area regularly supports: <i>Anas clypeata</i>, <i>Anas strepera</i>, <i>Anser albifrons albifrons</i></p>
	Ramsar	<p>Ramsar criterion 1 The site contains a mosaic of marine, freshwater, marshland, and associated habitats, complete with transition areas in between. Contains the largest continuous stand of reedbeds in England and Wales and rare transition in grazing marsh ditch plants from brackish to fresh water.</p> <p>Ramsar criterion 2 This site supports nine nationally scarce plants and at least 26 red data book invertebrates.</p>

European Site Name	Designation Classification	Qualifying Features
		Supports a population of the mollusc <i>Vertigo angustior</i> (Habitats Directive Annex II; British Red Data Book Endangered), recently discovered on the Blyth estuary river walls.
Nene Washes	SAC	1149 Spined loach <i>Cobitis taenia</i>
	SPA	<p>ARTICLE 4.1 Over winter the area regularly supports: <i>Cygnus columbianus bewickii</i></p> <p>ARTICLE 4.2 During the breeding season the area regularly supports: <i>Anas clypeata, Anas querquedula, Anas strepera, Limosa limosa limosa</i></p> <p>Over winter the area regularly supports: <i>Anas acuta, Anas clypeata, Anas crecca, Anas Penelope, Anas strepera</i></p>
	Ramsar	<p>Ramsar criterion 2 The site supports an important assemblage of nationally rare breeding birds. In addition, a wide range of raptors occur through the year. The site also supports several nationally scarce plants, and two vulnerable and two rare British Red Data Book invertebrate species have been recorded.</p> <p>Ramsar criterion 6 Species/populations occurring at levels of international importance.</p>
Norfolk Valley Fens	SAC	<p>7230 Alkaline fens, <i>Schoenus nigricans</i> – <i>Juncus subnodulosus</i> mire.</p> <p>4010 Northern Atlantic wet heaths with <i>Erica tetralix</i></p> <p>4030 European dry heaths</p> <p>6210 Semi-natural dry grasslands and scrubland facies: on calcareous substrates (<i>Festuco-Brometalia</i>)</p> <p>6410 Molinia meadows on calcareous, peaty, or clayey-silt-laden soils (<i>Molinion caeruleae</i>)</p> <p>7210 Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i> * Priority feature</p> <p>91E0 Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion, Alnion incanae, Salicion albae</i>)</p> <p>1014 Narrow-mouthed whorl snail <i>Vertigo angustior</i></p> <p>1016 Desmoulin's whorl snail <i>Vertigo moulinsiana</i></p>
North Norfolk Coast	SAC	<p>1150 Coastal lagoons * Priority feature</p> <p>1220 Perennial vegetation of stony banks</p> <p>1420 Mediterranean and thermo-Atlantic halophilous scrubs (<i>Sarcocornetea fruticosi</i>)</p> <p>2110 Embryonic shifting dunes</p> <p>2120 Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (‘white dunes’)</p> <p>2130 Fixed dunes with herbaceous vegetation (‘grey dunes’) * Priority feature</p> <p>2190 Humid dune slacks</p> <p>1355 Otter <i>Lutra lutra</i></p> <p>1395 Petalwort <i>Petalophyllum ralfsii</i></p>
	SPA	<p>ARTICLE 4.1 During the breeding season the area regularly supports: <i>Botaurus stellaris, Circus aeruginosus, Recurvirostra avosetta, Sterna albifrons, Sterna hirundo, Sterna sandvicensis</i></p> <p>Over winter the area regularly supports: <i>Recurvirostra avosetta</i></p> <p>ARTICLE 4.2 Over winter the area regularly supports: <i>Anas Penelope, Anser brachyrhynchus, Branta bernicla bernicla, Calidris canutus</i></p> <p>ARTICLE 4.2 - AN INTERNATIONALLY IMPORTANT ASSEMBLAGE OF BIRDS Over winter the area regularly supports: 91536 waterfowl (5-year peak mean 01/04/1998) Including: <i>Anser brachyrhynchus, Branta bernicla bernicla, Anas penelope, Recurvirostra avosetta, Calidris canutus.</i></p>

European Site Name	Designation Classification	Qualifying Features
	Ramsar	<p>Ramsar criterion 1 The site is one of the largest expanses of undeveloped coastal habitat of its type in Europe. It is a particularly good example of a marshland coast with intertidal sand and mud, saltmarshes, shingle banks and sand dunes. There are a series of brackish-water lagoons and extensive areas of freshwater grazing marsh and reed beds.</p> <p>Ramsar criterion 2 Supports at least three British Red Data Book and nine nationally scarce vascular plants, one British Red Data Book lichen and 38 British Red Data Book invertebrates.</p> <p>Ramsar criterion 5 Assemblages of international importance: Species with peak counts in winter: 98462 waterfowl (5-year peak mean 1998/99-2002/2003)</p> <p>Ramsar criterion 6 Species/populations occurring at levels of international importance.</p>
Northumbria Coast	SPA	<p>ARTICLE 4.1 Coastal sand dunes. Sand beaches. Machair Shingle. Sea cliffs. Islets</p> <p>During the breeding season the area regularly supports: <i>Sterna albifrons</i></p> <p>ARTICLE 4.2 Over winter the area regularly supports: <i>Arenaria interpres, Calidris maritima</i></p>
	Ramsar	<p>Ramsar criterion 6 – species/populations occurring at levels of international importance. Qualifying Species/populations (as identified at designation): Species regularly supported during the breeding season: <i>Little tern, Sterna albifrons</i> Species with peak counts in winter: <i>Purple sandpiper, Calidris maritima Ruddy turnstone, Arenaria interpres</i></p>
Orfordness-Shingle Street	SAC	<p>1150 Coastal lagoons * Priority feature 1210 Annual vegetation of drift lines 1220 Perennial vegetation of stony banks</p>
Orton Pit	SAC	<p>3140 Hard oligo-mesotrophic waters with benthic vegetation of <i>Chara</i> spp. 1166 Great crested newt <i>Triturus cristatus</i></p>
Ouse Washes	SAC	1149 Spined loach <i>Cobitis taenia</i>
	SPA	<p>ARTICLE 4.1 Over winter the area regularly supports: <i>Circus cyaneus, Cygnus columbianus bewickii, Cygnus cygnus, Philomachus pugnax</i></p> <p>ARTICLE 4.2 During the breeding season the area regularly supports: <i>Anas clypeata, Anas platyrhynchos, Anas querquedula, Anas strepera, Limosa limosa limosa</i></p> <p>Over winter the area regularly supports: <i>Anas acuta, Anas clypeata, Anas crecca, Anas penelope, Anas strepera, Aythya farina, Aythya fuligula, Cygnus olor, Fulica atra, Phalacrocorax carbo.</i></p> <p>ARTICLE 4.2 During the breeding season the area regularly supports: <i>Gallinago gallinago, Gallinula chloropus, Haematopus ostralegus, Tadorna tadorna, Tringa totanus, Vanellus vanellus.</i></p> <p>Over winter the area regularly supports: <i>Phalacrocorax carbo, Cygnus columbianus bewickii, Cygnus cygnus, Anas penelope, Anas strepera, Anas crecca, Anas acuta, Anas clypeata, Aythya ferina, Aythya fuligula, Fulica atra, Philomachus pugnax.</i></p>
	Ramsar	<p>Ramsar criterion 1 The site is one of the most extensive areas of seasonally-flooding washland of its type in Britain.</p>

European Site Name	Designation Classification	Qualifying Features
		<p>Ramsar criterion 2</p> <p>The site supports several nationally scarce plants, including small water pepper <i>Polygonum minus</i>, whorled water-milfoil <i>Myriophyllum verticillatum</i>, greater water parsnip <i>Sium latifolium</i>, river waterdropwort <i>Oenanthe fluviatilis</i>, fringed water-lily <i>Nymphoides peltata</i>, long-stalked pondweed <i>Potamogeton praelongus</i>, hair-like pondweed <i>Potamogeton trichoides</i>, grass-wrack pondweed <i>Potamogeton compressus</i>, tasteless water-pepper <i>Polygonum mite</i> and marsh dock <i>Rumex palustris</i>.</p> <p>Invertebrate records indicate that the site holds relict fenland fauna, including the British Red Data Book species large darter dragonfly <i>Libellula fulva</i> and the rifle beetle <i>Oulimnius major</i>.</p> <p>The site also supports a diverse assemblage of nationally rare breeding waterfowl associated with seasonally-flooding wet grassland.</p> <p>Ramsar criterion 5</p> <p>Assemblages of international importance:</p> <p>Species with peak counts in winter:</p> <p>59133 waterfowl (5-year peak mean 1998/99-2002/2003)</p> <p>Ramsar criterion 6</p> <p>species/populations occurring at levels of international importance.</p>
Overstrand Cliffs	SAC	1230 Vegetated sea cliffs of the Atlantic and Baltic coasts
Paston Great Barn	SAC	1308 Barbastelle <i>Barbastella barbastellus</i>
Portholme	SAC	6510 Lowland hay meadows (<i>Alopecurus pratensis</i> , <i>Sanguisorba officinalis</i>)
Redgrave & South Lopham Fens	Ramsar	<p>Ramsar criterion 1</p> <p>The site is an extensive example of spring-fed lowland base-rich valley, remarkable for its lack of fragmentation.</p> <p>Ramsar criterion 2</p> <p>The site supports many rare and scarce invertebrates, including a population of the fen raft spider <i>Dolomedes plantarius</i>.</p> <p>Ramsar criterion 3</p> <p>The site supports many rare and scarce invertebrates, including a population of the fen raft spider <i>Dolomedes plantarius</i>. The diversity of the site is due to the lateral and longitudinal zonation of the vegetation types characteristic of valley mires.</p>
Rex Graham Reserve	SAC	6210 Semi-natural dry grasslands and scrubland facies: on calcareous substrates (Festuco-Brometalia)
River Wensum	SAC	<p>3260 Water courses of plain to montane levels with the <i>Ranunculus fluitans</i> and Callitriche-Batrachion vegetation 1092 White-clawed (or Atlantic stream) crayfish <i>Austropotamobius pallipes</i></p> <p>1016 Desmoulin's whorl snail <i>Vertigo moulinsiana</i></p> <p>1096 Brook lamprey <i>Lampetra planeri</i></p> <p>1163 Bullhead <i>Cottus gobio</i></p>
Roydon Common	Ramsar	<p>Ramsar criterion 1</p> <p>The site is the most extensive example of valley mire-heathland biotope within East Anglia.— It is a mixed valley mire holding vegetation communities which reflect the influence of both base-poor and base-rich water.</p> <p>Ramsar criterion 3</p> <p>The vegetation communities have a restricted distribution within Britain. – It also supports a number of acidophilic invertebrates outside their normal geographic range and six British Red Data Book invertebrates.</p>
Roydon Common & Dersingham Bog	SAC	<p>4010 Northern Atlantic wet heaths with <i>Erica tetralix</i></p> <p>7150 Depressions on peat substrates of the <i>Rhynchosporion</i></p> <p>4030 European dry heaths</p>
Rutland Water	SPA	<p>ARTICLE 4.1</p> <p>Inland water bodies (standing water, running water)</p> <p>Bogs. Marshes. Water fringed vegetation. Fens.</p> <p>Dry grassland. Steppes</p> <p>Mixed woodland</p> <p>ARTICLE 4.2</p>

European Site Name	Designation Classification	Qualifying Features
		<p>Over winter the area regularly supports: <i>Anas clypeata, Anas crecca, Anas penelope, Anas strepera, Aythya fuligula, Bucephala clangula, Cygnus olor, Fulica atra, Mergus merganser, Podiceps cristatus</i> 25037 waterfowl (5-year peak mean 01/04/1998)</p>
	Ramsar	<p>Ramsar criterion 5 Assemblages of international importance: Species with peak counts in winter: 19274 waterfowl (5-year peak mean 1998/99-2002/2003) Ramsar criterion 6 – species/populations occurring at levels of international importance. Qualifying Species/populations (as identified at designation): Species with peak counts in spring/autumn: <i>Gadwall, Anas strepera</i> <i>Northern shoveler, Anas clypeata</i> Species/populations identified subsequent to designation for possible future consideration under criterion 6. Species with peak counts in spring/autumn: <i>Mute swan, Cygnus olor</i></p>
Saltfleetby-Theddlethorpe Dunes & Gibraltar Point	SAC	<p>2120 Shifting dunes along the shoreline with <i>Ammophila arenaria</i> ('white dunes') 2130 Fixed dunes with herbaceous vegetation ('grey dunes') * Priority feature 2160 Dunes with <i>Hippophae rhamnoides</i> 2190 Humid dune slacks 2110 Embryonic shifting dunes</p>
Sandlings	SPA	<p>ARTICLE 4.1 During the breeding season the area regularly supports: <i>Caprimulgus europaeus</i> <i>Lullula arborea</i></p>
Southern North Sea	SAC	<p>Harbour porpoise <i>Phocoena phocoena</i></p>
South West London Waterbodies	SPA	
	Ramsar	<p>Ramsar criterion 6 – species/populations occurring at levels of international importance. Qualifying Species/populations (as identified at designation): Species with peak counts in spring/autumn: Northern shoveler, <i>Anas clypeata</i>, NW & C Europe 397 individuals, representing an average of 2.6% of the GB population (5-year peak mean 1998/9-2002/3) Species with peak counts in winter: Gadwall, <i>Anas strepera strepera</i>, NW Europe 487 individuals, representing an average of 2.8% of the GB population (5-year peak mean 1998/9-2002/3)</p>
Staverton Park & The Thicks, Wantisden	SAC	<p>9190 Old acidophilous oak woods with <i>Quercus robur</i> on sandy plains</p>
Stour and Orwell Estuaries	SPA	<p>ARTICLE 4.1 During the breeding season the area regularly supports: <i>Recurvirostra avosetta</i> ARTICLE 4.2 Over winter the area regularly supports: <i>Anas acuta, Branta bernicla bernicla, Calidris alpina alpina, Calidris canutus, Limosa limosa islandica, Pluvialis squatarola</i> <i>Tringa totanus</i> On passage the area regularly supports: <i>Tringa totanus</i></p>

European Site Name	Designation Classification	Qualifying Features
		ARTICLE 4.2 - AN INTERNATIONALLY IMPORTANT ASSEMBLAGE OF BIRDS
	Ramsar	<p>Ramsar criterion 2 Contains seven nationally scarce plants: stiff saltmarsh-grass <i>Puccinellia rupestris</i>; small cord-grass <i>Spartina maritima</i>; perennial glasswort <i>Sarcocornia perennis</i>; lax-flowered sea lavender <i>Limonium humile</i>; and the eelgrasses <i>Zostera angustifolia</i>, <i>Z. marina</i> and <i>Z. noltei</i>. Contains five British Red Data Book invertebrates: the muscid fly <i>Phaonia fusca</i>; the horsefly <i>Haematopota grandis</i>; two spiders, <i>Arctosa fulvolineata</i> and <i>Baryphema duffeyi</i>; and the Endangered swollen spire snail <i>Mercuria confusa</i>.</p> <p>Ramsar criterion 5 Assemblages of international importance: Species with peak counts in winter: 63017 waterfowl (5-year peak mean 1998/99-2002/2003)</p> <p>Ramsar criterion 6 Species/populations occurring at levels of international importance.</p>
Teesmouth & Cleveland Coast	SPA	<p>Tidal rivers. Estuaries. Mud flats. Sand flats. Lagoons (including saltwork basins) Salt marshes. Salt pastures. Salt steppes Coastal sand dunes. Sand beaches. Machair Inland water bodies (standing water, running water) Bogs. Marshes. Water fringed vegetation. Fens</p> <p>During the breeding season the area regularly supports: <i>Sterna albifrons</i></p> <p>On passage the area regularly supports: <i>Sterna sandvicensis</i></p> <p>Over winter the area regularly supports: <i>Calidris canutus</i> 21312 waterfowl (5-year peak mean 01/03/2000)</p> <p>On passage the area regularly supports: <i>Tringa totanus</i></p>
	Ramsar	<p>Ramsar criterion 5 Assemblages of international importance: Species with peak counts in winter: 9528 waterfowl (5-year peak mean 1998/99-2002/2003)</p> <p>Ramsar criterion 6 – species/populations occurring at levels of international importance. Qualifying Species/populations (as identified at designation): Species with peak counts in spring/autumn: Common redshank, <i>Tringa totanus</i></p> <p>Species with peak counts in winter: Red knot, <i>Calidris canutus</i></p>
The Broads	SAC	<p>3140 Hard oligo-mesotrophic waters with benthic vegetation of <i>Chara</i> spp 3150 Natural eutrophic lakes with Magnopotamion or Hydrocharition-type vegetation. 7210 Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i> * Priority feature 7140 Transition mires and quaking bogs 7230 Alkaline fens 91E0 Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (Alno-Padion, Alnion incanae, Salicion albae) * Priority feature 6410 Molinia meadows on calcareous, peaty, or clayey-silt-laden soils (Molinion caeruleae) 1016 Desmoulin's whorl snail <i>Vertigo moulinsiana</i> 1903 Fen orchid <i>Liparis loeselii</i> 4056 Ramshorn snail <i>Anisus vorticulus</i> 1355 Otter <i>Lutra lutra</i></p>
The Wash	SPA	<p>ARTICLE 4.1 During the breeding season the area regularly supports: <i>Sterna albifrons</i>, <i>Sterna hirundo</i></p> <p>Over winter the area regularly supports:</p>

European Site Name	Designation Classification	Qualifying Features
		<p><i>Cygnus columbianus bewickii</i>, <i>Limosa lapponica</i></p> <p>ARTICLE 4.2</p> <p>Over winter the area regularly supports:</p> <p><i>Anas acuta</i>, <i>Anas Penelope</i>, <i>Anas strepera</i>, <i>Anser brachyrhynchus</i> <i>Arenaria interpres</i>, <i>Branta bernicla bernicla</i>, <i>Bucephala clangula</i>, <i>Calidris alba</i>, <i>Calidris alpina alpina</i>, <i>Calidris canutus</i>, <i>Haematopus ostralegus</i>, <i>Limosa limosa islandica</i>, <i>Melanitta nigra</i>, <i>Numenius arquata</i>, <i>Pluvialis squatarola</i>, <i>Tadorna tadorna</i>, <i>Tringa totanus</i></p> <p>ARTICLE 4.2</p> <p>Over winter the area regularly supports:</p> <p><i>Cygnus columbianus bewickii</i>, <i>Anser brachyrhynchus</i>, <i>Branta bernicla bernicla</i>, <i>Tadorna tadorna</i>, <i>Anas penelope</i>, <i>Anas strepera</i>, <i>Anas acuta</i>, <i>Melanitta nigra</i>, <i>Bucephala clangula</i>, <i>Haematopus ostralegus</i> <i>Pluvialis squatarola</i>, <i>Calidris canutus</i>, <i>Calidris alba</i>, <i>Calidris alpina alpina</i>, <i>Limosa limosa islandic</i>, <i>Limosa lapponica</i>, <i>Numenius arquata</i>, <i>Tringa totanus</i>, <i>Arenaria interpres</i>.</p>
	Ramsar	<p>Ramsar criterion 1</p> <p>The Wash is a large shallow bay comprising very extensive saltmarshes, major intertidal banks of sand and mud, shallow water and deep channels.</p> <p>Ramsar criterion 3</p> <p>Qualifies because of the inter-relationship between its various components including saltmarshes, intertidal sand and mud flats and the estuarine waters. The saltmarshes and the plankton in the estuarine water provide a primary source of organic material which, together with other organic matter, forms the basis for the high productivity of the estuary.</p> <p>Ramsar criterion 5</p> <p>Assemblages of international importance: Species with peak counts in winter: 292541 waterfowl (5-year peak mean 1998/99-2002/2003)</p> <p>Ramsar criterion 6</p> <p>Species/populations occurring at levels of international importance.</p>
The Wash & North Norfolk Coast	SAC	<p>1110 Sandbanks which are slightly covered by sea water all the time</p> <p>1140 Mudflats and sandflats not covered by seawater at low tide</p> <p>1160 Large shallow inlets and bays</p> <p>1170 Reefs</p> <p>1310 Salicornia and other annuals colonising mud and sand</p> <p>1330 Atlantic salt meadows (<i>Glauco-Puccinellietalia maritimae</i>)</p> <p>1420 Mediterranean and thermo-Atlantic halophilous scrubs (<i>Sarcocornetea fruticosi</i>)</p> <p>1150 Coastal lagoons * Priority feature</p> <p>1365 Common seal <i>Phoca vitulina</i></p> <p>1355 Otter <i>Lutra lutra</i></p>
Thorne & Hatfield Moors	SPA	<p>ARTICLE 4.1</p> <p>Inland water bodies (standing water, running water) Bogs. Marshes. Water fringed vegetation. Fens Heath. Scrub. Maquis and garrigue. Phygrana Broad-leaved deciduous woodland Coniferous woodland</p> <p>ARTICLE 4.2</p> <p>During the breeding season the area regularly supports:</p> <p><i>Caprimulgus europaeus</i></p>
Thorne Moor	SAC	<p>7120 Degraded raised bogs still capable of natural regeneration, <i>Eriophorum angustifolium</i> and <i>Drosera rotundifolia</i></p>
Thursley, Ash, Pirbright & Chobham	SAC	<p>4010 Northern Atlantic wet heaths with <i>Erica tetralix</i></p> <p>4030 European dry heaths</p> <p>7150 Depressions on peat substrates of the Rhynchosporion</p>
Upper Nene Valley Gravel Pits	SPA	<p>ARTICLE 4.1</p> <p>Over winter the area regularly supports:</p> <p><i>Botaurus stellaris</i> <i>Pluvialis apricaria</i></p>

European Site Name	Designation Classification	Qualifying Features
		<p>ARTICLE 4.2</p> <p>Over winter the area regularly supports: <i>Anas strepera</i></p> <p>ARTICLE 4.2 - AN INTERNATIONALLY IMPORTANT ASSEMBLAGE OF BIRDS</p> <p>In the non-breeding season the area regularly supports: 23821 waterfowl 5-year peak mean 1999/2000 – 2003/04 Including: <i>Anas clypeata</i>, <i>Anas penelope</i>, <i>Anas platyrhynchos</i>, <i>Anas strepera</i>, <i>Aythya ferina</i>, <i>Aythya fuligula</i>, <i>Botaurus stellaris</i>, <i>Fulica atra</i>, <i>Phalacrocorax carbo</i>, <i>Pluvialis apricaria</i>, <i>Podiceps cristatus</i>, <i>Vanellus vanellus</i> .</p>
	Ramsar	<p>The site qualifies under Criterion 5 because it regularly supports 20,000 or more waterbirds: In the non-breeding season, the site regularly supports 23,821 individual waterbirds (5-year peak mean 1999/2000 – 2003/04).</p> <p>The site qualifies under Criterion 6 because it regularly supports 1% of the individuals in the populations of the following species or subspecies of waterbird in any season: <i>Mute swan Cygnus olor</i> <i>Gadwall Anas strepera</i></p>
Waveney & Little Ouse Valley Fens	SAC	<p>6410 Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae)</p> <p>7210 Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i> * Priority feature</p> <p>1016 Desmoulin's whorl snail <i>Vertigo moulinsiana</i></p>
Wicken Fen	Ramsar	<p>Ramsar criterion 1 One of the most outstanding remnants of the East Anglian peat fens. The area is one of the few which has not been drained. Traditional management has created a mosaic of habitats from open water to sedge and litter fields.</p> <p>Ramsar criterion 2 The site supports one species of British Red Data Book plant, fen violet <i>Viola persicifolia</i>, which survives at only two other sites in Britain. It also contains eight nationally scarce plants and 121 British Red Data Book invertebrates.</p>
Winterton-Horsey Dunes	SAC	<p>2150 Atlantic decalcified fixed dunes (Calluno-Ulicetea) * Priority feature</p> <p>2190 Humid dune slacks</p> <p>2110 Embryonic shifting dunes</p> <p>2120 Shifting dunes along the shoreline with <i>Ammophila arenaria</i> ('white dunes')</p>
Woodwalton Fen	Ramsar	<p>Ramsar criterion 1 The site is within an area that is one of the remaining parts of East Anglia which has not been drained. The fen is near natural and has developed where peat-digging took place in the 19th century. The site has several types of open fen and swamp communities.</p> <p>Ramsar criterion 2 The site supports two species of British Red Data Book plants, fen violet, <i>Viola persicifolia</i> and fen wood-rush <i>Luzula pallidula</i>. Woodwalton also supports a large number of wetland invertebrates including 20 British Red Data Book species. Aquatic beetles, flies and moths are particularly well represented.</p>

Source: JNCC, 2017 and Ramsar Information Sheet, 2017

C. Superseded Options Assessments

The following options were assessed as part of the pre-consultation draft WRMP development. The options have since been updated. The superseded screening assessments of the old options is provided below. The new assessments for the updated options are presented in Chapter 4.

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
BHV2 and BHV7 - East Suffolk RZ to Bury Haverhill RZ Transfer (25MI/d / 10MI/d) and the reverse ESU5, ESU8 and ESU9 (25MI/d / 20MI/d / 10MI/d)	Stour and Orwell Estuaries SPA Stour and Orwell Estuaries Ramsar site	This transfer option includes the construction of a new pipeline between treated water reservoirs. The proposed route crosses at least two water courses that feed into the SPA/Ramsar site. The Stour Estuary is located approximately 2km away from the southern end of the proposed route at Wherstead, with the nearest river crossing over 3.5km from the site; for this reason, no likely significant effects are anticipated.	No
BHV1, BHV5 and BHV6 - Newmarket RZ to Bury Haverhill RZ Transfer (31MI/d / 20MI/d / 10MI/d)	Breckland SAC	The proposed pipeline route is over 3km south of this designated site and crosses The Holt watercourse which runs into this SAC. No foreseeable disturbance or pollution impacts are reasonably foreseeable from the construction of this pipeline on the interest features of this designated site.	No
	Breckland SPA	The proposed pipeline route is over 3km south of this designated site and crosses The Holt watercourse which runs into this SPA. No foreseeable disturbance or pollution impacts are reasonably foreseeable from the construction of this pipeline on the interest features of this designated site.	No
NWM2 and NWM7 - Bury Haverhill RZ to Newmarket RZ Transfer (10MI/d / 20MI/d)	None within Zol.	No potential impacts on European sites	No
NTM1 - Central Lincolnshire RZ to Nottinghamshire RZ transfer	None within Zol	No potential impacts on European sites	No
SLN1 and SLN5 Central Lincolnshire RZ to South Lincolnshire RZ Transfer (30MI/d / 35MI/d)	None within Zol	No potential impacts on European sites	No

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
SEX4 / SEX8 - East Suffolk RZ to South Essex RZ transfer (15MI/d / 6.5MI/d) and reverse ESU6	None within Zol	No potential impacts on European sites	No
NWM1, NWM6, NWM10 – Ely RZ to Newmarket RZ Transfer (35MI/d, 20MI/d, 10MI/d) and reverse option ELY2 – Newmarket RZ to Ely RZ Transfer	Fenland SAC Chippenham Fen Ramsar site	<p>Fenland SAC and Chippenham Fen Ramsar site are located approximately 0.5 km from the mid-point of the proposed pipeline, near Chippenham. The proximity of the construction corridor to the designated sites during pipeline installation could lead to temporary impacts on qualifying bird species due to noise and visual disturbance. The vicinity of the option to the European site also creates the potential for physical loss of habitat to occur; although outside the boundary of the European sites, it may be used as supporting habitat by qualifying species.</p> <p>The predicted impacts on the European sites could be avoided by rerouting the pipeline to lie outside the Zol (i.e. greater than 500m from the boundary of Chippenham Fen Ramsar site and the rest of Fenland SAC)</p>	<p>Yes (No if the proposed pipeline is rerouted more than 500m from the European sites)</p>
ELY1, ELY9 and ELY10 – North Fenland RZ to Ely RZ Transfer (39MI/d, 20MI/d & 10MI/d) and the reverse NFN6 (22MI/d)	Norfolk Valley Fens SAC	<p>The northern end of the option is located at an existing WTW at Stoke Ferry, approximately 5km west of the Foulton Common SSSI unit of this designated site. The proposed pipeline crosses the River Wissey at this point. Norfolk Valley Fens SAC is vulnerable to reductions on the water table and water supply is fundamental to maintaining the site's qualifying features. However, as the river crossing and WTW are over 5km from the designated sites and predicted transfer flow is relatively low at 10MI/d, there is no reasonably foreseeable significant impact on this site.</p>	No
	Breckland SAC	<p>An increase in water uptake at the WTW in Stoke Ferry has the potential to cause hydrological changes, to which the qualifying features of this site are sensitive. However, the closest crossing is over 8km from the SAC and the WTW is 13km east of the site, with no reasonably foreseeable likely significant impacts.</p>	No
	Breckland SPA	<p>The proposed pipeline route runs to the west of this designated site, with the closest point approximately 1.5km from the site boundary. Potential disturbance impacts from construction on the qualifying bird species are unlikely to be significant at this distance.</p>	No
	Fenland SAC	<p>The southern end of the proposed pipeline is approximately 3km from the Chippenham Fen SSSI unit of this SAC. No significant impacts are likely, with none of the associated river crossings linked to this site.</p>	No
	Chippenham Fen Ramsar site	<p>The southern end of the proposed pipeline is approximately 3km from this Ramsar site. No significant impacts are likely, with none of the associated river crossings linked to this site</p>	No

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
CVY1 - Newmarket RZ to Cheveley RZ Transfer	None within Zol	No potential impacts on European sites.	No
NNR1, NNR7 and NNR8 - Norwich & the Broads RZ to Norfolk Rural North RZ Transfer (20MI/d / 10MI/d / 5MI/d)	Norfolk Valley Fens SAC	The closest point of proposed pipeline runs approximately 2.2km from this SAC and crosses the River Yare approximately 2.8km downstream from the point where the river runs adjacent to the site. There are no reasonably foreseeable significant impacts on the qualifying features of the SAC from this option.	No
	River Wensum SAC	The western end of the proposed pipeline at Heigham WTW is adjacent to the River Wensum, approximately 1.5km south of the SAC border (Euclidean distance). The route crosses the river at two locations shortly before this point, with the closest crossing approximately 900m from the designated site. This is downstream of the site and therefore unlikely to have significant pollution or physical impacts on the qualifying habitat of the site within its boundaries. However, biological disturbance during construction may impact the qualifying species of the site (white-clawed crayfish, Desmoulin`s whorl snail, brook lamprey, bullhead), which are likely to use the areas beyond the site boundary for passage.	Yes (No if directional drilling is included as part of the construction)
NTB6 and NTB8 - Norfolk Rural North RZ to Norwich & the Broads RZ Transfer (20 MI/d / 11MI/d)	Norfolk Valley Fens SAC	The proposed route is located 1.5km south of a section of this SAC and crosses the River Tud at two points 2.2km upstream of the site. There is potential for changes in water quality in these water courses during construction of river crossings, with potential impacts on the qualifying habitats, which are sensitive to such changes.	Yes
	River Wensum SAC	The proposed pipeline crosses this designated site at least three times, with additional crossings of the River Wensum beyond the site boundary. This has the potential to cause physical loss and degradation of habitat through the construction of the pipeline and any associated infrastructure and has the potential to cause pollution during river construction. There may be temporary and permanent habitat loss of the emergent bank-side vegetation favoured by the qualifying species of Desmoulin`s whorl snail and with white-clawed crayfish during construction. Populations of brook lamprey and bullhead are dependent on riffle habitats within the river, which may be impacted through works within the watercourse. There are therefore likely significant impacts of this option on the qualifying features of the River Wensum SAC.	Yes
NNR2 / NNR6 – North Fenland RZ to Norfolk Rural North RZ Transfer (20MI/d & 11MI/d) and reverse option NFN5 – Norfolk Rural North RZ to North Fenland RZ Transfer (20MI/d)	Norfolk Valley Fens SAC	The western end of the option is located at the existing Stoke Ferry WTW, approximately 5 km east of this designated site. The closest river crossing to the site is over 3km away with no direct flow to the site. Consequently, there are no reasonably foreseeable significant impacts to qualifying features of Norfolk Valley Fens SAC.	No

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
	Breckland SAC	The closest point of the proposed pipeline to the designated site is approximately 2km. None of the rivers crossed by the route feed directly into the site. Therefore, there are no reasonably foreseeable significant impacts on this European site.	No
	Breckland SPA	<p>The proposed pipeline route runs between sections of this SPA. At certain points the distance between the option and sections of the designated site is less than 0.1 km. Potential impacts on qualifying bird species are noise, visual and human disturbance during the construction phase. The vicinity of the option to the designated site also creates the potential for physical loss of supporting habitat to occur; although outside the boundary of the designated site this may decrease the supporting habitat available to qualifying species. Breckland heathlands and acid grasslands, which support the qualifying species of stone-curlew, nightjar, and woodlark, are fragile in terms of the background levels of air pollution and may therefore be further impacted by any dust or other pollution caused by construction activities. Although the impacts will be temporary during construction only, they may result in likely significant effects on these qualifying features that will require an appropriate assessment.</p> <p>The identified impacts could be avoided if the pipeline was rerouted outside 500m from the boundary of Breckland SPA, however given the tight distance between the units of Breckland in which it currently sits, the reroute would have to go around Breckland SPA rather than through it.</p>	<p>Yes (No if the distance between the proposed pipeline and designated site is increased to more than 500m)</p>
NFN7, NFN8 and NFN4 - South Fenland RZ to North Fenland RZ Transfer (60 MI/d / 11MI/d / 20MI/d) and reverse SFN2 (22 MI/d)	Ouse Washes SAC	The proposed pipeline crosses this SAC at the Old Bedford River, which is sourced by the River Great Ouse and designated as an SAC for its population of spined loach. Construction of the pipeline has the potential to cause physical damage to the designated site, increase pollution and create a biological disturbance. The potential impacts of this transfer, in conjunction with existing vulnerabilities, are likely to negatively impact the spined loach qualifying feature through altering the supporting habitat and features provided by the site and potentially causing direct mortality during construction.	Yes
	Ouse Washes SPA Ouse Washes Ramsar site	The proposed pipeline crosses this site at the Old Bedford River and crosses the New Bedford River which feeds into the SPA. Construction activity has the potential to cause disturbance to the qualifying bird species of this site, through noise, visual and human disturbance. Disturbance is likely to be significant during construction only, but could remain significant without appropriate mitigation. Additionally, the river crossings and general pipeline construction activities have the potential to cause physical damage to the site within the project footprint, and may create wider pollution impacts within the river system. This could further impact the qualifying	Yes

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
		<p>species through altering the supporting habitat and features by affecting the ecological functionality of the washland.</p> <p>The Ramsar site has a wider range of qualifying features which may be impacted beyond the designated bird species. In particular, physical loss through construction and changes to water quality and flow may affect the suitability of the site for the nationally scarce plants for which it is designated under Ramsar Criterion 2, and which are sensitive to such impacts. Vegetation succession resulting from a changing hydrological regime and the high nutrient-status of receiving water has already been reported and may be amplified by impacts from the option.</p>	
HPB1 – Norwich & the Broads RZ to Happisburgh RZ Transfer	<p>Broadland SPA Broadland Ramsar site The Broads SAC</p>	<p>The proposed pipeline runs approximately 0.1 km to the east of areas of the Broadland SPA/Ramsar site and The Broads SAC. Potential impacts on qualifying bird species are noise, visual and human disturbance during the construction phase. The vicinity of the option to these designated sites also creates the potential for physical loss of habitat to occur; although outside the boundary of the designated site, this could decrease the supporting habitat available to qualifying species. The pipeline crosses at least one water course feeding into the Broads. There is potential for construction activity to result in changes in water quality, but assuming directional drilling is employed to avoid impacts at river crossings, no consequent water quality impacts are reasonably foreseeable.</p> <p>Habitat loss and disturbance of featured species could be avoided if the pipeline was situated outside of the Zol.</p>	<p>Yes (No if the pipeline is moved at least 500m from The Broads/Broadland designated sites)</p>
RTC2 – Ruthamford South RZ to Ruthamford Central RZ Transfer (12MI/d)	<p>None within Zol</p>	<p>No potential impacts on European sites</p>	<p>No</p>
RTS9, RTS11 and RTS12 - Ruthamford North RZ to Ruthamford South RZ Transfer (80MI/d / 55MI/d / 10MI/d)	<p>Upper Nene Valley Gravel Pits SPA Upper Nene Valley Gravel Pits Ramsar site</p>	<p>The proposed pipeline crosses the River Nene over 3km from this designated site. Significant disturbance impacts to the qualifying features species are not foreseeable at this distance. There is the potential for pollution to occur during the construction of the river crossing, however due to the distance from the SPA and the fact that the river does not feed directly into the gravel pits, impacts on the qualifying bird species are not reasonably foreseeable.</p>	<p>No</p>
	<p>Rutland Water SPA Rutland Water Ramsar site</p>	<p>This designated site is located 3km from the northern end of the proposed route. Significant disturbance impacts to the qualifying features species are not foreseeable at this distance and no crossings of rivers feeding into this site are required. Impacts on the qualifying features of this SPA are therefore not considered likely.</p>	<p>No</p>

Option	European Sites Within the Zol (Natura 2000/Ramsar)	Potential Effects on the European Site	Does the Option Require a Task II: Appropriate Assessment?
RTW1 and RTW3 - Ruthamford North RZ to Ruthamford West RZ Transfer (10MI/d / 70MI/d)	Upper Nene Valley Gravel Pits SPA Upper Nene Valley Gravel Pits Ramsar site	The proposed pipeline route is not within the designated gravel pits, but crosses the River Nene and other standing water habitats approximately 1.9km from its border. The river runs adjacent to the gravel pits and is likely to be functionally linked, both physically through a range of wet habitat types and ditches and through supporting a similar species range. The construction of the pipeline therefore has the potential to impact the qualifying bird species through disturbance impacts. Additionally, physical damage and degradation of habitats may occur and there is the potential for pollution within the water course during construction of the crossing.	Yes
SFN1 / SFN3 / SFN4 – Ruthamford North RZ to South Fenland RZ Transfer (80MI/d, 22MI/d & 35MI/d) and reverse option RTN17	Nene Washes SPA Nene Washes Ramsar site Nene Washes SAC	The proposed pipeline route runs adjacent to the southern edge of the Nene Washes for approximately 12 km. At one point the distance between the boundary of the designated site and the proposed pipeline route is approximately 0.1 km. Potential impacts on qualifying bird species of the Nene Washes SPA and Ramsar sites are noise and visual disturbance during the construction phase. Due to the proximity to the proposed construction site, there is also potential for physical loss of habitat to occur to the Nene Washes SAC, SPA and Ramsar sites. Although outside the boundary of the European site, there may be a decrease in the supporting habitat of qualifying species. Additionally, the proposed pipeline route crosses several water courses that are in hydrological continuity with the designated sites, however assuming directional drilling techniques are employed at river crossings, no changes in water quality within the water course feeding into the Nene Washes and its wetland habitats are envisioned. Habitat loss and disturbance of featured species could be avoided if the pipeline was situated outside of the Zol.	Yes (No if the pipeline is moved to be at least 500m from the boundary of the European site outside of the Zol)
CEX1 - Sudbury RZ Central Essex RZ Transfer	None within Zol.	No potential impacts on European sites	No
CLN11, CLN12 and CLN13 - South Humber Bank RZ to Central Lincolnshire RZ Transfer (10MI/d / 50MI/d / 31MI/d)	None within Zol	No potential impacts on European sites	No
RTN18 / RTN19 / RTN21 / RTN24 / RTN27 – South Lincolnshire RZ to Ruthamford North RZ Transfer (30MI/d, 17MI/d, 10MI/d, 25MI/d, 60MI/d)	Rutland Water SPA Rutland Water Ramsar site	At its southern end the proposed pipeline route passes the east side of Rutland Water SPA/Ramsar site at distances of approximately 0.15 km to 0.6 km. Potential impacts on qualifying bird species of Rutland Water SPA and Ramsar sites are noise and visual disturbance during the construction phase. These impacts could be avoided by rerouting the pipeline to avoid the Zol for these designated sites.	Yes (No if the pipeline is moved more than 500m from the boundary of Rutland Water European sites)

