



Anglian to Affinity Transfer Strategic Resource Option - A2AT Habitats Regulations Assessment Report

RAPID Gate 1 submission - Annex 2B

June 2021

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Executive summary

This report presents the results of the Habitats Regulations Assessment (HRA) undertaken of the four options considered for the Anglian to Affinity Transfer (A2AT) Strategic Resource Option (SRO). The HRA assesses the potential impact of the options on designated sites in the UK's National Site Network, called Habitats Sites. This report supports the *Environment Assessment Report* that accompanies the Gate 1 submission report to Regulators' Alliance for Progressing Infrastructure Development for the A2AT options.

The aim of the A2AT scheme is to transfer available water from the Anglian Water supply area to the Affinity Water's Central supply zones, where it is treated and stored for distribution. Following a screening process, the outputs of the initial route options appraisal identified four unconstrained options for A2AT. These options include raw water transfers and use of prospective reservoirs, the South Lincolnshire Reservoir (SLR), which is also an SRO, and the Fens Reservoir.

The four A2AT options have been subject to a HRA Stage 1 screening assessment. Subsequently, a HRA Stage 2 Appropriate Assessment (plan stage) has been undertaken.

The Appropriate Assessment undertaken for the **Fens Reservoir** option did not identify any transmission pathways by which a Likely Significant Effect could reasonably occur. No key risks to Habitats Sites were identified during construction or operation of this option.

The Appropriate Assessment undertaken for the **SLR to Preston** option identified a transmission pathway to the Nene Washes SPA/Ramsar site/SAC where the pipeline is required to cross the River Nene, but concluded that no significant adverse effects on the integrity of the Habitats Site are foreseeable if the identified mitigation measures are observed.

For the **River Trent** option, significant adverse effects have been identified on the Humber Estuary Ramsar site/SAC and Rutland Water SPA/Ramsar site which cannot be excluded at this stage.

- For the Humber Estuary, residual impacts have been identified from the potential reduction in flows on the River Trent as a result of the new licenced abstraction at East Bridgford affecting the behaviour of river and sea lamprey. Further hydrological modelling is required to understand the impact of abstraction on surface water levels and flows and a full investigation into the indirect impacts on migratory fish behaviour is required.
- For Rutland Water SPA/Ramsar site, residual effects have been identified during construction of the pipeline, booster station and new WTW in and directly adjacent to the reservoir which will require further noise and hydrogeological investigation to ensure construction-related effects are negated. Relocating the booster station and WTW at least 500m from the boundary of Rutland Water is recommended to reduce the significance of construction-related disturbance, especially from visual and noise impacts. A hydrological modelling assessment will also be required to understand the impact of the alteration in abstraction regime on surface water levels in the reservoir and the indirect impact this will have on usable habitat to qualifying bird species.

A project-stage HRA will be required to address these impacts fully.

For the **SLR to WRZ5 Hub** option, significant adverse effects on the Nene Washes SPA/Ramsar site /SAC have been identified which cannot be fully excluded by appropriate mitigation at this stage. The effects relate to the location of the pipeline corridor within the boundary of the designated site. The consequential impacts on habitats and qualifying bird and

fish species as a result of construction activities and potential pollution events during operation are certain. In order to avoid onerous further assessment where there is uncertainty in the outcome, it is recommended that consideration be given to rerouting the pipeline corridor to avoid the Nene Washes altogether at this stage. If this is not possible, further investigation of the impacts through a detailed project-stage HRA, informed by baseline surveys, and further hydrological and noise assessments will be required.

As options develop, should adverse effects on the integrity of the designated sites remain, the options would need to be granted derogation. Derogation would only be granted if the proposal passed three legal tests, i.e. where there are no feasible alternative solutions that would be less damaging or avoid damage to the site, where the proposal needs to be carried out for imperative reasons of overriding public interest, and where the necessary compensatory measures can be secured.

It should be noted that at this stage an in-combination assessment to identify potential cumulative effects of A2AT options with other non-related plans or projects has not been conducted. An in-combination assessment would not be considered proportionate at this stage, due to the early stages of the plan, and the consequential lack of further design details on A2AT and other SROs that is available. An updated HRA will be conducted at Gate 2 to include an in-combination assessment of the options within A2AT, between different SROs and between any other external plans or projects that may put pressure on the same water resources. As A2AT develops, it is assumed that any potential significant effects on Habitats Sites due to individual options, or in-combination effects will be avoided as far as reasonably possible.

1 Introduction

1.1 Background

The Anglian Water to Affinity Water Transfer (A2AT) Strategic Resource Option (SRO) comprises abstraction and treatment of water from the Anglian Water catchment and conveyance into the Affinity Water supply area, where it is stored prior to distribution (distribution is not within the scope of this SRO). Following a screening process, four options have been developed for Gate 1 submission which consider abstraction locations and sources, new pipe routes and water treatment works (WTW) and storage at new and existing service reservoirs (SRs).

This report presents the results of the Habitats Regulations Assessment (HRA) undertaken of the four options considered for the A2AT scheme. The aim of the HRA was to assess the potential impact of the options on European designated sites in the UK's National Site Network.

This report supports the *Environmental Assessment Report* (EAR) that accompanies the Gate 1 submission to RAPID for the A2AT options.

1.2 A2AT options

The outputs of the route options screening identified four unconstrained options for transferring water to Affinity Water's supply area. These options are shown in Table 1.1 and described in detail in the A2AT *Concept Design Report*. An HRA overview map of the options is included as Appendix A.

Table 1.1: A2AT options

Option name	Description overview
Fens Reservoir	Abstraction of raw water from the proposed Fens Reservoir, and treatment at a new WTW. The treated water would then be pumped to Water Resource Zone 5 (WRZ 5) (henceforth called WRZ5 Hub). The treated water would feed a new SR servicing supply zone WRZ5, Stort, in the Affinity Water network.
SLR to Preston	Abstraction of raw water from the proposed SLR where it would be treated at a new WTW and transferred to Etton Service Reservoir. The potable water would then be transferred to Sundon WTW routing past Grafham WTW. The treated water would be transferred to Preston SR in WRZ3, for further distribution.
SLR to WRZ5 Hub	Abstraction of raw water from the proposed SLR where it would be treated at a new WTW and transferred to Etton Service Reservoir. The potable water will then be pumped to a conditioning plant and SR near Uttlesford Bridge (henceforth called WRZ5 Hub) routing via an intermediate break tank and pumping station. Potable water would feed a new SR serving supply zone WRZ5, in the Affinity Water Network.
River Trent	Abstraction of raw water from the River Trent in the vicinity of East Bridgford, where it would be partially treated to prevent Invasive Non-Native Species (INNS) transfer. The partially treated water would then be transferred via a pipeline to Rutland Water. A new draw-off arrangement and WTW at Rutland Water would abstract, treat, and pump water from Rutland Water to Sundon WTW for conditioning, routing past Grafham WTW. From Sundon, the water would be transferred to Preston SR for further distribution into the Affinity network.

1.3 The purpose of the Habitats Regulations Assessment

This report contains all the information necessary for the competent authority to undertake an Appropriate Assessment in accordance with Part 6 of the Conservation of Habitats and Species Regulations 2017 (as amended).

A HRA includes several stages as detailed in the Conservation of Habitats and Species Regulations 2017 (as amended), known as the Habitats Regulations, to determine if a plan or project may affect the protected features of a designated site before deciding whether to undertake, permit or authorise it. Changes to the Habitats Regulations came into force on 1 January 2021 with the introduction of the Conservation of Habitats and Species Amendment (EU Exit) Regulations 2019.

A key result from the implementation of the Habitats Regulations is the designation and conservation of sites to maintain the favourable conservation status of protected habitats and species. These are listed in Annex I to the Habitats Directive, and the species listed in Annex II to that Directive as well as the threatened birds and regularly occurring migratory birds listed in the Annex I to the Birds Directive which naturally occur in the United Kingdom's territory. These sites are known as the National Site Network and are referred to as 'Habitats Sites', in accordance with the government guidance on Appropriate Assessment and the National Planning Policy Framework (NPPF).

For any plan or project that could affect one or more Habitats Sites, the provisions of Part 6 of the Conservation of Habitats and Species Regulations 2017 (as amended) establish the procedure that a competent national authority must follow before agreeing to the implementation of a plan or project. The procedure, known as an Appropriate Assessment, requires such plans or projects to undergo a stepwise impact assessment against the Habitats Sites' conservation objectives.

The HRA process follows the three stages detailed below:

- Stage 1 Screening - to check if the proposal is likely to have a significant effect on the site's conservation objectives. If so, the proposal needs to go through the appropriate assessment or derogation stages.
- Stage 2 Appropriate Assessment - to assess the likely significant effects of the proposal in more detail and identify ways to avoid or minimise any effects.
- Stage 3 Derogation - to consider if proposals that would have an adverse effect on a European site qualify for an exemption.

The competent authority can only agree to the plan or project if, based on the findings of the Appropriate Assessment, it has demonstrated the absence (rather than the presence) of an adverse effect on the integrity of the concerned Habitats Sites.

The National Site Network includes Special Areas of Conservation (SAC) and Special Protection Areas (SPA). HRAs are also required, as a matter of UK Government policy, for potential SPAs (pSPA), candidate SACs (cSAC) and Site of Community Importance (SCI). In England, Ramsar sites and proposed Ramsar sites are also included in the assessment in accordance with the NPPF.

This document presents the outcomes of Stage 1 and Stage 2 of the HRA of the A2AT.

2 HRA Stage 1 Screening

2.1 Stage 1 test of likely significance – screening principles

The purpose of the Screening Stage (Stage 1) of the HRA is to identify the Likely Significant Effects that arise from the interaction between actions of the A2AT options and sensitive receptors of a National Network Site through impact pathways.

A significant effect should be considered likely if it cannot be excluded on the basis of objective information and it might undermine a site's conservation objectives. A risk or a possibility of such an effect is enough to warrant the need for an Appropriate Assessment (Stage 2).

While A2AT is a Water Resources East (WRE) scheme, the Stage 1 assessments to support the Gate 1 submission were undertaken using the method developed for use on the Water Resources South East (WRSE) regional programme. The WRE environmental assessment approach is currently being finalised following completion of the Integrated Environmental Assessment scoping consultation exercise. It is expected that the WRE methodology will be used to support the work for Gate 2 submission. As the WRSE and WRE methodologies are very similar, this will not invalidate the Gate 1 assessments undertaken for the A2AT SRO.

2.2 Stage 1 Output

The outputs of the Stage 1 assessment are summarised in Table 2.1 and the output tables are contained in Appendix B. The results of this assessment were used to identify the A2AT options that were carried forward to HRA Stage 2: Appropriate Assessment.

Table 2.1: Summary of Stage 1 Screening Output – Likely Significant Effects and Uncertain Effects

Option name	Likely Significant Effects	Uncertain Effects
River Trent	Rutland Water SPA/Ramsar site	Humber Estuary SPA/Ramsar site/SAC Upper Nene Valley Gravel Pits SPA/Ramsar site
SLR to Preston	None identified	Nene Washes SPA/Ramsar site/SAC
SLR to WRZ5 Hub	Nene Washes SPA/Ramsar site/SAC	Fenland SAC Woodwalton Fen Ramsar site Ouse Washes SPA/Ramsar site/SAC
Fens Reservoir	None identified	Chippenham Fen Ramsar site Fenland SAC Breckland SPA

3 HRA Stage 2: Appropriate Assessment

3.1 Approach to the Appropriate Assessment

For options where potential 'Likely Significant Effects' or 'Uncertain Effects' were identified in the Stage 1 screening assessment, an Appropriate Assessment is required. The Appropriate Assessment needs to:

- Consider the impact of the project on the integrity of the Habitats Sites, either alone or in combination with other projects and plans, with respect to the conservation objectives of the site and its structure and function; and
- Assess potential mitigation strategies where adverse impacts are identified, including setting out a timescale and identifying mechanisms through which the mitigation measures will be secured, implemented and monitored.

Potential impacts may be direct or indirect and are dependent on the relationship between the source (proposed options' actions) and the receptor (the qualifying features of the Habitats Sites). The significance of an impact is relative to the sensitivity, existing condition and conservation status of the qualifying features of the site and the scale of the impact in space and time.

Potential effects on the qualifying features of the Habitats Sites are evaluated with respect to the scale, extent and nature of the impact, for example the area of habitat affected, changes in hydrodynamics, potential changes in species distribution, and the duration of the impact. Given the high-level nature of the assessment at this plan stage, it is not always possible to determine the exact scale and extent of the impact. When this is the case a precautionary approach is taken when evaluating the significance of the impact.

The competent authority must determine whether the proposal will not adversely affect the integrity of the site(s). The integrity of a site is the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was designated.

The relevant content of this report will be sent for consultation with the relevant nature conservation authorities and the public. If the competent authority considers that residual adverse effects remain, Stage 3 (Derogation) of the HRA process would be required. To qualify for derogation, three legal tests must be applied, namely; an assessment of alternative solutions, an assessment of imperative reasons of overriding public interest and security of necessary compensation measures.

This report will be updated at Gate 2 in the light of further details on the proposed options.

It should be noted that at this stage an in-combination assessment to identify potential cumulative effects of A2AT with other non-related plans or projects has not been conducted. An in-combination assessment would not be considered proportionate at this stage, due to the early stages of the plan, and the consequential lack of further design details on A2AT and other SROs that is available. An updated HRA will be conducted at Gate 2 to include an in-combination assessment of the options within A2AT, between different SROs and between any other external plans or projects that may put pressure on the same water resources. As A2AT develops, it is assumed that any potential significant effects on Habitats Sites due to individual options, or in-combination effects will be avoided as far as reasonably possible.

3.2 HRA methodology

This HRA Stage 2: Appropriate Assessment has been formulated using the following approach:

- Review the sites identified at Stage 1 and confirm any additions or exclusions
- Assessment of the construction and operation impacts of the A2AT options
- Assessment of the Habitats Sites' characteristics and identification of their conservation objectives, and
- Identification of the aspects of the proposed A2AT options that will significantly impact the conservation objectives of the Habitats Sites.

This assessment has been undertaken in accordance with the following guidance:

- GOV.UK (2019) *Appropriate Assessment - Guidance on the use of Habitats Regulations Assessment*. Published 22 July 2019¹.
- UK Water Industry Research (UKWIR, 2012). *Strategic Environmental Assessment and Habitats Regulations Assessment - Guidance for Water Resources Management Plans and Drought Plans (12/WR/02/7)*²; and
- European Commission (EU, 2018) *Managing Natura 2000 sites - The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC*³.

3.3 Potential impacts considered as part of the HRA

Following UKWIR (2012) guidance and given the nature of the proposed options, the potential impacts considered in this assessment are summarised in Table 3.1. Proposed distances are also provided following the same guidance to ascertain if, where a pathway has been identified, the impact is likely to affect the habitats or species for which the Habitats Site has been qualified. It should be noted that, in some cases, it was appropriate to use a larger Zone of Influence (Zoi) than defined in Table 3.1 for example, where a new pipeline crosses a watercourse that runs into a Habitats Site, and where changes in water quality and quantity could affect habitats that are hydrologically connected.

Table 3.1: Potential Impacts Considered in the Appropriate Assessment

Broad categories of potential impacts on European sites (with examples)	Examples of operations resulting in impacts and proposed Zoi
Physical loss Destruction (including offsite effects) e.g. foraging habitat, smothering	Development of built infrastructure associated with the pipelines, access routes. Physical loss is only likely to be significant where the boundary of the option extends within the boundary of the Habitats Site, or within an offsite area of known foraging, roosting, breeding habitat (that supports species for which a Habitats 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. 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 Habitats Site, or within/adjacent to an offsite area of known foraging, roosting, breeding habitat (that supports species for which a Habitats Site is designated).

¹ Available at: [Appropriate assessment - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/414441/AA-Guidance-on-the-use-of-Habitats-Regulations-Assessment.pdf)

² *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).

³ Available at: https://ec.europa.eu/environment/nature/natura2000/management/docs/art6/Provisions_Art_nov_2018_endocx.pdf

Broad categories of potential impacts on European sites (with examples)	Examples of operations resulting in impacts and proposed Zol
Non-physical disturbance Noise Visual presence Light pollution	Noise from vehicular traffic during construction of the option. Plant and personnel involved in construction and operation of the option e.g. for maintenance. 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 Habitats Site. 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 Habitats Site. Noise visual /human presence are only likely to be significant where the boundary of the option is within 500m of the boundary of the Habitats Site or within/adjacent to an offsite area of known foraging, roosting, breeding habitat (that supports species for which a Habitats Site is designated).
Water table/ availability Drying Flooding/storm water Changes to surface water levels and flows Changes to groundwater level and flows	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 Habitats Site. However, these effects are dependent on hydrological continuity between the option and the Habitats Site.
Toxic contamination Water pollution Soil contamination Air pollution	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 Habitats Site.
Non-toxic contamination Nutrient enrichment (e.g. of soils and water) Algal blooms Changes in turbidity Changes in sedimentation/silting Air pollution (dust)	Changes to nutrient levels, turbidity, storage, or inter-catchment transfers. 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 Habitats Site. However, these effects are dependent on hydrological continuity between the option and the Habitats Site. Emissions of dust during the earthworks, construction of plant and tunnel/pipeline construction associated with options.
Biological Disturbances Direct mortality Changes to habitat availability Out-competition by non-native species Introduction of disease Introduction of invasive species	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. This effect is only likely to be significant where the receiving water for the option is the Habitats Site or a tributary of the Habitats Site.
Physical loss Destruction (including offsite effects) e.g. foraging habitat, smothering	Development of built infrastructure associated with the pipelines, access routes. Physical loss is only likely to be significant where the boundary of the option extends within the boundary of the Habitats Site, or within an offsite area of known foraging, roosting, breeding habitat (that supports species for which a Habitats Site is designated).

Source: Adapted from: UK Water Industry Research (2012)⁴.

3.4 Assumptions and standard best-practice mitigation measures

3.4.1 Overview

The high-level nature of this assessment undertaken at the plan stage means that there is lack of detailed design for all options considered. By law any option being taken forward to be

⁴ 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.

implemented will be subject to an Appropriate Assessment at the project stage, when, in the light of more information relating to the construction and design of the project, a more refined HRA assessment can be undertaken.

Based on the current level of detail available for A2AT options, a number of assumed and established mitigation measures are proposed; these will need to be followed at the project stage to avoid or mitigate the effects identified at this stage. These measures should be applied unless the project stage HRAs or option-specific environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate. Note that these mitigation measures must be reviewed at the project stage, taking into account any changes in best-practice as well as option-specific survey information or baseline studies.

It is recommended that Affinity Water and Anglian Water work closely with Natural England and the Habitats Site managers to agree the specific mitigation measures to be included in the project stage HRA. The agreed mitigation measures will be expected to form part of planning conditions and/or conditions of relevant environmental permits, and their implementation managed through contractual obligations with supervision from an Environmental Clerk of Works.

3.4.2 Assumptions during construction

The assumptions made on the mitigation measures for the scheme design, pollution control, biosecurity, disturbance, and the CEMP are the following:

Scheme design

- Should design be altered, every opportunity for avoiding potential effects on Habitats Sites (e.g. through alternative pipeline routes, micro siting, etc.) should be taken.
- Construction of new pipeline at watercourse crossings that are in hydrological continuity of a Habitats Site will be carried out using directional drilling or other non-disruptive methods to avoid direct impacts on riverbed and permanent habitat loss.

Pollution control

- Indirect construction-related pollution is identified as one key pathway through which designated sites may be affected. There is numerous guidance on environment good practice measures during construction which can be relied on (at this level) to prevent significant adverse effects on a designated site occurring. The best-practice procedures detailed in the following documents should be followed for all construction works derived from this option, as a minimum standard:
 - CIRIA C741 Environmental Good Practice on Site Guide (Charles and Edwards, 2015)⁵
 - Environment Agency's Pollution Prevention Guidance Notes⁶ including PPG1: General Guide to Prevention of Pollution (May 2001); PPG5: Works and maintenance in or near water (October 2007), PPG6: Pollution prevention guidance for working at construction and demolition sites (April 2010); PPG21: Pollution incident response planning (March 2009); PPG22: Dealing with spillages on highways (June 2002);
- The need for the installation of sediment traps near or in watercourses or the use of cofferdams should also be considered at the project stage.

Biosecurity

- Biosecurity measures must be in place.

⁵ Charles P. and Edwards P (2015) *Environmental good practice on site guide*. CIRIA C741, 260p.

⁶ Note, the Environment Agency Pollution Prevention Guidance Notes have been withdrawn by the Government, although the principles within them are robust and still form a reasonable basis for pollution prevention measures.

Disturbance - noise

- Construction activities will be conducted in accordance with noise limits to avoid disturbance.
- Programme activities likely to result in disturbance to breeding birds outside of the bird breeding season, in the period April to mid-September inclusive;
- Programme activities likely to result in disturbance to wintering birds outside of the period October to March inclusive;
- Construction related noise disturbance can be further minimised by implementing best practice such as BS 5228-1:2009+A1:2014 (The British Standards Institute, 2008)⁷.

Disturbance - light

- Lighting will be kept to a minimum to reduce disturbance. Should the works be undertaken at night and flood lighting required, lighting should be kept to a minimum and hooded spotlights directed away from potential suitable habitat, to reduce disturbance while ensuring standards for health and safety;
- The potential impact of artificial light may be minimised through the implementation of best practice such as 'Guidance Notes for the Reduction of Obtrusive Light' (Institute of Lighting Professionals, 2011)⁸.

Construction and Environmental Management Plan

A Construction and Environmental Management Plan (CEMP) must be developed at the project stage, recommending measures to ensure that the risk of uncontrolled discharges from construction is reduced (including sediment management) and detailing an Emergency Response Plan in the event of a pollution incident. This plan must be prepared for all works and include measures listed above and additional ones identified during the project HRA.

3.4.3 Assumptions during operation

The water treatment level will need to be appropriate to avoid the risk of spreading Invasive Non-Native Species (INNS) and pathogens, this will be identified at the project stage informed by a baseline study. Refer to the A2AT *Environmental Assessment Report*, section 4 "*Invasive Non-Native Species Risk Assessment*".

3.5 River Trent option

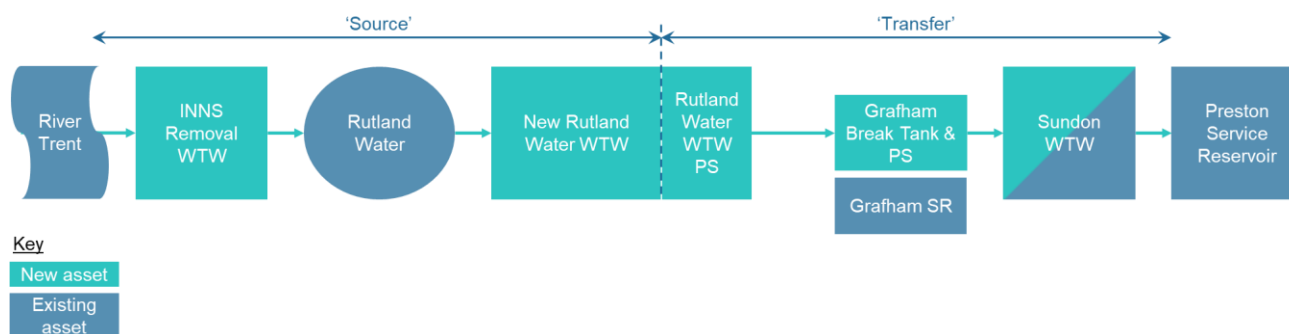
3.5.1 Summary of the option

This option involves abstraction of raw water from the River Trent at East Bridgford, and treatment to prevent Invasive Non-Native Species (INNS) transfer. The partially treated raw water will be conveyed to Rutland Water, where a new draw-off arrangement and Rutland Water WTW will abstract, treat, and convey water to Sundon WTW for conditioning, routing past Grafham WTW. The treated water will be transferred to Preston SR. The option is of 50MI/d or 100MI/d capacity, and has an interdependency with network enhancement downstream of Preston.

⁷ The British Standards Institute, 2008. BS 5228-1:2009+A1:2014. *Code of practice for noise and vibration control on construction and open sites. Noise*. BSI Standards Limited, London.

⁸ Institution of Lighting Professionals (2020) Guidance note for the reduction of obtrusive light. Guidance Note1/20.

Figure 3.1: Schematic diagram of the River Trent option



3.5.2 HRA Stage 1 screening of national network sites

A Habitats Site must be both exposed and sensitive to potential effects from the construction or operation of the option for Likely Significant Effects to be considered possible. Therefore, all sites downstream or within 20km of the option, or otherwise linked by a potential effect pathway was considered.

The HRA Stage 1 Screening assessment identified six Habitats Sites within the ZoI of the River Trent option. A summary of the screening assessment is given in Appendix B. Potential for Likely Significant Effects or Uncertain Effects was identified at two sites, namely Rutland Water and The Upper Nene Valley Gravel Pits which both comprise an SPA and Ramsar site. Both sites are required to undergo an Appropriate Assessment. A summary of the HRA screening results for this site is given in Table 3.2.

Table 3.2: River Trent option: HRA Stage 1 Screening Assessment results where Likely Significant Effects or Uncertain Effects have been identified

National Network Site	Distance from the option	Potential for Likely Significant Effects or Uncertain Effects
Humber Estuary SPA/Ramsar site/SAC	Approximately 100km downstream	Uncertain Effects This option proposes to add a new intake in the River Trent at East Bridford more than 100km upstream from the Humber Estuary designated site. The abstraction will result in a reduction in flows in the River Trent. It is possible that the number of tributaries between the proposed intake and the designated sites will attenuate the reduction in flows sufficiently so that the designated sites located more than 100km will not be significantly affected. The pathway through which the reduction in flows exists however and could particularly affect habitats that support bird species for which the SPA/Ramsar site is designated. An Appropriate Assessment is required to assess the potential significance of this effect on habitats that support bird species namely areas of reedbed and saltmarsh as well as potential effects on both river lamprey <i>Lampetra fluviatilis</i> and sea lamprey <i>Petromyzon marinus</i> .
Rutland Water SPA/Ramsar site	Option within designated site boundary	Yes The proposed option goes through the Rutland Water SPA/Ramsar site. As such, the option has the potential for significant impacts including damage and/or the loss of habitat. There is also the potential for sediment and pollution caused by the construction work occurring nearby and directly within the site's area. There remains the potential for further damage to the habitat during the operational phase, should the pipeline ever need to be repaired by a method requiring its excavation.

National Network Site	Distance from the option	Potential for Likely Significant Effects or Uncertain Effects
Upper Nene Valle Gravel Pits SPA/Ramsar site	4.8km west	<p>There is also the potential for loss of qualifying species such as gadwall, shoveler and other internationally important species given that the pipeline is proposed within the SPA boundary and through the wetland habitat.</p> <p>Uncertain Effects</p> <p>The proposed option is hydrologically connected to the River Nene which is directly linked to the Upper Nene Valley Gravel Pits SPA/Ramsar site. The proposed pipeline crosses the River Nene once. During the construction of the pipeline there is the possibility of sediment discharge into this connected watercourse which could lead to greater amounts of sediment into the SPA/Ramsar site. The silting of watercourses within the designated could cause negative impacts to the wetland habitat that supports the qualifying species of the site: bittern, golden plover and gadwall. As detailed, there is a potential impact pathway arising from the construction of the pipeline.</p>

3.5.3 Likely impact pathways and potential effects

Considering the type, size and scale of the River Trent option, the potential impacts (of construction and operational phases) are described below.

3.5.3.1 Construction

Rutland Water SPA/Ramsar site

The River Trent option requires the construction of approximately 150km of new pipeline. The initial route requires approximately 50km of new pipeline infrastructure from the intake on the River Trent near East Bridgford to Rutland Water.

The Humber Estuary SPA/Ramsar site/SAC is located nearly 100km downstream of the indicative intake location. As the designated site is of considerable distance from the works and appropriate mitigation measures will be in place, and as any changes to the surface water column as a result of construction such as accidental pollution resulting in water quality changes would be temporary in nature, it is assumed that the water column would attenuate the pollutants before the flow reaches the designated site. Therefore, it is considered that construction of the pipeline in or near the River Trent at this location is unlikely to result in any adverse impacts on the Humber Estuary.

The initial stretch of the pipeline route terminates at Rutland Water therefore impacts on Rutland Water SPA/Ramsar site are certain. Rutland Water is designated for its assemblage of internationally important wintering waterfowl, namely Gadwall *Anas strepera* and Northern Shoveler *Anas clypeata* and construction activities associated with trenching and pipeline layout has the potential to result in disturbance of these species due to noise, lighting, visual impact, vibration, etc. The qualifying bird species are wintering species and therefore sensitive to disturbance in the wintering period (October to March inclusive). Construction works in or near the Rutland waterbody can also result in toxic contamination of the wetland habitats through, for example, runoff from accidental pollution events contaminating the water with trade materials or dust emissions from construction-related activities. There is also potential for increased sedimentation and silting. Given the scale of the works, and the relatively short section of pipeline required in the vicinity of the site, most disturbance and pollution risks can almost certainly be avoided or controlled through the application of standard best-practice measures and mitigation, and typical mitigation reduce effects from construction-related pollution and disturbance is given in Section 3.4.

Construction of the associated draw-off facility and WTW directly adjacent to Rutland Water have the potential to increase the magnitude of the disturbance factors, in particular the risks of visual impact and noise disturbance on the wintering birds. For elevated noise levels, research indicates that there is a flight response in waterfowl above 70dBA (Cutts et al. 2009)⁹. It would be impossible to fully assess the magnitude of this impact on the wintering bird species at this stage as there is no detailed design and construction information available. As a bare minimum, consultation with Natural England would be required in relation to the noise disturbance and a suitable noise assessment and mitigation strategy would be required in the project stage HRA to ensure that noise levels do not breach agreed thresholds for sensitive bird species within the designated site. Construction of the pipeline and associated infrastructure in the vicinity of the designated waterbody would also have to be carefully informed by hydrogeological investigations to ensure any excavation and dewatering works were undertaken so as not to disrupt groundwater continuity to the Habitats Site.

The indirect effects of construction-related impacts such as habitat fragmentation, species displacement and permanent habitat loss due to hydrological changes are more difficult to assess at this stage due to the early stages of the project, and the consequential lack of detailed design of this option. Assent from Natural England would only be granted after a detailed impact assessment, supported by adequate baseline surveys of sensitive species and an appropriate mitigation plan. The works may have to be sensitively timed to avoid the peak season Gadwall and Northern Shoveler. To reduce these direct impacts and reduce the requirement for onerous further assessment, it is recommended that consideration be given to locating the new WTW and booster pumping station at least 500m from the Habitats Site boundary. A project-stage HRA would still be required to investigate the impacts of construction fully, but it is certain that the predicted impacts would be easier to mitigate in these circumstances.

Spread of invasive species can occur during construction where personnel, vehicles and equipment move between and within sites and during the excavation and disposal of materials (e.g. sediments and vegetation). The presence and increase in INNS can lead to loss of habitat and over time they can overtake native species affecting habitats and qualifying species they support. Appropriate biosecurity measures should be incorporated into the design of the option to ensure to spread of INNS is limited during construction and no significant adverse effects occur as a result of this pathway.

Upper Nene Valley Gravel Pits SPA/Ramsar site

From Rutland Water, the pipeline corridor progresses over approximately 50km to a proposed booster pumping station near Grafham Water (approximately 50km of new pipeline infrastructure) and from here an additional approximate 50km of pipeline infrastructure to Sundon and the Preston Service Reservoir. The Upper Nene Valley Gravel Pits is the only other Habitats Site in the Zol of the pipeline corridor, located approximately 5km west of the pipeline at it closest point on the River Nene. Construction of the pipeline will be required to cross the River Nene near Armstrong, thus creating an impact pathway from the potential ingress of pollutants and increased sedimentation affecting water quality in the river. The Upper Nene Valley gravel Pits is located upstream of the location where the pipeline is required to cross the river, therefore no adverse impacts on the designated site is likely to occur. Construction at river crossings should always be sensitively planned following good practice guidelines for pollution control, but are not expected to result in any adverse effects on Habitats Sites as a result of this option.

⁹ Cutts, N., Phelps, A. & Burdon, D. (2009). Construction and Waterfowl: Defining Sensitivity, Response, Impacts and Guidance. The University of Hull, Hull.

New WTW construction

Regarding the construction of the INNS removal WTW at the intake and the proposed Sundon WTW, both sites are significantly removed from any Habitats Site for disturbance effects or impacts from excavation works affecting groundwater balance to be considered further. The indicative location of the INNS removal WTW is close to the intake near East Bridgford which is in hydrological continuity with the Humber Estuary SPA/Ramsar site/SAC. As discussed for pipeline construction effects, it is assumed that any temporary changes to the River Trent as a result of construction-related contamination would be attenuated by the river before it reaches the estuary as it is of considerable distance from the works. Therefore, it is considered that construction of the INNS removal WTW near the River Trent at this location is unlikely to result in any adverse impacts on the Humber Estuary.

3.5.3.2 Operation

The Humber Estuary SPA/Ramsar site/SAC

The River Trent option will require a new abstraction of 100ML/d of raw water from the River Trent. The intake at East Bridgford is located more than 100km upstream of the Humber Estuary SPA/Ramsar site/SAC and will result in a reduction in flows in the River Trent. A reduction in flows entering the estuary could particularly affect the sensitive qualifying habitat of the Ramsar site and SAC, e.g. H1130 Estuaries, H1310 *Salicornia* and other annuals colonising mud and sand, H1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*), H1140 Intertidal mudflats and sandflats and H1110 Subtidal sandbanks; the habitats that support the breeding and wintering bird species of the SPA as well as potential effects on both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus*.

Although the River Trent is one of the major contributors of freshwater flows to the Humber estuary, it is most likely that the number of tributaries between the proposed intake and the designated sites will attenuate the reduction in flows in so far that the flows entering the designated site are not measurable. Freshwater abstraction is not identified as a current or predicted issue in the Humber Estuary Site Improvement Plan and although the habitats identified are wetland habitats, the inner estuary where reduction in flows from the River Trent are most likely to be apparent is a dynamic tidal system of inter-tidal and subtidal mudflats as well as saltmarsh and reedbed – the nature of which is not particularly sensitive to minor alterations in flows. Therefore, it is not considered that qualifying habitat and bird species of the Humber Estuary SPA/Ramsar site will be affected by the reduction in flows expected in implementing the River Trent option.

It is more difficult to quantify the significance of reduced flows in the River Trent on river and sea lamprey. Lamprey species require specific flow conditions at certain stages of their lifecycle, and will not begin upstream migration in the River Trent for example in low-flow conditions. Continuous abstraction under new licence at East Bridgford may therefore exasperate low-flow inputs during drought conditions, therefore impacting on the migration pattern of these species. The distribution of lamprey species in the River Trent is likely most-related to the presence of structures and weirs that inhibit fish migration upstream, and passage of lamprey species to their typical spawning sites in the mid and upper reaches of the Trent therefore depend on consistent water levels on entering any such structures. It is most likely that the new abstraction would not result in any significant change to water levels in the downstream river, but in the absence of a dedicated assessment to quantify any changes to water levels and flows, it is not possible to dismiss potential impacts on river and sea lamprey at this time.

Rutland Water SPA/Ramsar site

The River Trent option requires the input of partially treated water to Rutland Water and abstraction of the same for conveyance to the Preston service reservoir through the new pipeline infrastructure proposed. An INNS risk assessment was undertaken for the purposes of

the EAR which indicated that *“there is a significant INNS risk associated with raw water transfer between the River Trent and Rutland Water. Mitigation measures would have to be developed to eliminate or minimise the INNS risk if this option is selected”*. The abstracted water will be treated for INNS removal at the new WTW proposed at East Bridgford, therefore there is confidence that the risk of INNS will be reduced to acceptable levels and that the risk of invasion by INNS into Rutland Water as a result of this option will not be significant. The option will however involve an alteration to the current abstraction regime at Rutland Water, therefore there is potential for water levels to fluctuate over the long-term as a result of the amended operation. Changes in water levels can directly result in adverse effects on the dilution capacity of the waterbody thus affecting the water chemistry balance and also impact on the physical availability of marginal wetted habitats. This may result in a reduction in suitable habitat available to Gadwall and Northern Shoveler populations and indirectly in species displacement and long-term habitat degradation. The significance of this impact is difficult to assess at this stage due to the early stages of the plan, and the consequential lack of detailed design of this option. A project-stage HRA will be required to understand the magnitude of this impact, informed by a full hydrological study to model the expected changes in surface water at Rutland Water as a result of the alteration to the abstraction regime. Assent from Natural England would only be granted after a detailed impact assessment, supported by adequate baseline surveys of sensitive species and an appropriate mitigation plan to ensure there will be no residual impacts on the sensitive features of Rutland Water.

3.5.3.3 Potential effects on designated sites

The following key risks on Habitats Sites have been identified as a result of the River Trent option:

Construction

- Rutland Water SPA/Ramsar site
 - Physical loss/physical damage – localised habitat loss and/or habitat degradation leading to a reduction of habitat extent
 - Non-physical disturbance – increased noise/visual/human presence leading to disturbance to qualifying bird species
 - Toxic contamination – accidental pollution events during construction in or near the waterbody resulting in habitat degradation or biological disturbance to the qualifying bird species.
 - Non-toxic contamination – increased sediments in suspension due to construction activities in or near the waterbody resulting in increased turbidity, siltation and river substrate smothering. Air pollution may also affect habitat vegetation due to dust deposition.
 - Changes to water table availability - ground water level and flows may be affected during excavation works and dewatering of the pipeline construction within the designated site.
 - Biological disturbance – potential for invasive species spread during construction.

Operation

- Humber Estuary SPA/Ramsar site/SAC
 - Changes to water table/availability – reduction in flows entering the Humber Estuary may affect biological behaviour of anadromous fish species, river lamprey and sea lamprey.
- Rutland Water SPA/Ramsar site
 - Changes to water availability – changes to abstraction regime may result in fluctuating water levels affecting the quality of habitat available to qualifying bird species.

For the Appropriate Assessment, a review of the sensitivity of the qualifying features of these Habitats Sites in relation to the potential impacts identified from the option and the conservation

objectives of the designated site is required. Table 3.3 lists the features for which each site is designated and identifies the Likely Significant Effects before and after mitigation measures are assumed. An assessment of each potential impact on the integrity of the sites are made, in view of the sites' structure, function and conservation objectives. Where adverse impacts are deemed significant, standard mitigation measures addressing some of these impacts are described in Section 3.4.

Full descriptions of the Habitats Sites including their conservation objectives and any current pressures or threats are given in Appendix C.

3.5.3.4 River Trent option: Appropriate Assessment

Considering the type, size and scale of the proposed River Trent option, the potential impacts (of construction and operational phases) are described in Table 3.3 below.

Table 3.3: River Trent option: Potential effects on designated sites and qualifying features

Designated Site (Habitats Sites)	Qualifying features	Potential Adverse Significant Effects (before mitigation)	Proposed Mitigation Measures ¹⁰	Residual Effects (after mitigation)
Humber Estuary Ramsar site	<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. It is a large macro-tidal coastal plain estuary with high suspended sediment loads, which feed a dynamic and rapidly changing system of accreting and eroding intertidal and subtidal mudflats, sandflats, saltmarsh and reedbeds. Examples of both strandline, foredune, mobile, semi-fixed dunes, fixed dunes and dune grassland occur on both banks of the estuary and along the coast. The estuary supports a full range of saline conditions from the open coast to the limit of saline intrusion on the tidal rivers of the Ouse and Trent.</p> <p>Ramsar Criterion 3 The Humber Estuary Ramsar site supports a breeding colony of grey seals <i>Halichoerus grypus</i> at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast. The dune slacks at Saltfleetby-Theddlethorpe on the southern extremity of the Ramsar site are the most north-easterly breeding site in Great Britain of the natterjack toad <i>Bufo calamita</i>.</p> <p>Ramsar Criterion 5 Assemblages of international importance: 153,934 waterfowl, non-breeding season.</p>	<p>The new abstraction from East Bridgford on the River Trent has the potential to reduce freshwater flows entering the Humber Estuary designated site 100km downstream. Reduced flows may result in:</p> <ul style="list-style-type: none"> Changes to water table/availability – reduction in flows entering the Humber Estuary may affect biological behaviour of river lamprey and sea lamprey entering the River Trent. <p>River and sea lamprey species are a qualifying feature of both the Ramsar and SAC site.</p> <p>The impacts are considered to be permanent with potential long-term effects on the downstream site.</p> <p>The identified effects have the potential to reduce the extent and distribution of anadromous fish species by altering their migratory and spawning patterns in adjoining freshwater habitats. The potential impact therefore may affect the structure and function compromising the integrity of the Humber Estuary Ramsar site/SAC.</p> <p>No significant effects are identified during construction.</p>	<ol style="list-style-type: none"> A full hydrological modelling investigation will be required to understand the impact on the new abstraction on surface water levels and flows downstream of the abstraction and entering the Humber Estuary. Further investigation should include assessment of minimum flows required for migration triggers of lamprey species entering the Trent. Model should include assessment of impacts on fish passage through the downstream structures on the River Trent and their usability by lamprey species under full licence conditions. HOF values and HOL levels must take into account the minimum requirements for lamprey species migrating through the River Trent to spawning sites in the mid and upper reaches. 	<p>Uncertain</p> <p>Further hydrological investigation required to understand the impact of new licence on downstream river and flows in relation to impact on river and sea lamprey species.</p> <p>Fish and sea lamprey are relevant to both the Ramsar and the SAC site</p>

¹⁰ Full references of guidance documents are given in Section 3.4. where they are first listed

Designated Site (Habitats Sites)	Qualifying features	Potential Adverse Significant Effects (before mitigation)	Proposed Mitigation Measures ¹⁰	Residual Effects (after mitigation)
	<p>Ramsar Criterion 6 - species/populations occurring at levels of international importance. Common shelduck, <i>Tadorna tadorna</i>; Eurasian golden plover <i>Pluvialis apricaria altifrons</i> subspecies; Red knot, <i>Calidris canutus</i>; Dunlin, <i>Calidris alpina</i>; Black-tailed godwit, <i>Limosa limosa islandica</i>; Bar-tailed godwit, <i>Limosa lapponica lapponica</i>; Common redshank, <i>Tringa totanus britannica</i>.</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>			
Humber Estuary SPA	<p>ARTICLE 4.1 The area regularly supports more than 1% of the GB population of the following Annex I species: A132 <i>Recurvirostra avosetta</i>; Pied avocet A021 <i>Botaurus stellaris</i>; Great bittern A082 <i>Circus cyaneus</i>; Hen harrier A140 <i>Pluvialis apricaria</i>; European golden plover A157 <i>Limosa lapponica</i>; Bar-tailed godwit A151 <i>Philomachus pugnax</i>; Ruff A081 <i>Circus aeruginosus</i>; Eurasian marsh harrier A195 <i>Sterna albifrons</i>; Little tern (Breeding)</p> <p>ARTICLE 4.2 The area is used by more than 1% of the biogeographical populations of the following migratory species: A048 <i>Tadorna</i>; Common shelduck A143 <i>Calidris canutus</i>; Red knot (Non-breeding) A149 <i>Calidris alpina</i>; Dunlin (Non-breeding) A156 <i>Limosa limosa islandica</i>; Black-tailed godwit (Non-breeding)</p>			

Designated Site (Habitats Sites)	Qualifying features	Potential Adverse Significant Effects (before mitigation)	Proposed Mitigation Measures ¹⁰	Residual Effects (after mitigation)
	<p>A162 <i>Tringa totanus</i>; Common redshank (Non-breeding)</p> <p>The site also qualifies under Article 4.2 as it is used regularly by over 20,000 waterbirds in any season</p>			
Humber Estuary SAC	<p>Annex I habitat that are primary reason for site selection:</p> <ul style="list-style-type: none"> 1130 Estuaries, which includes <ul style="list-style-type: none"> 1330 Atlantic salt meadows H1110 Subtidal sandbanks H1140 Intertidal mudflats H1310 Salicornia and other annuals 1150 coastal lagoons 1099 river lamprey <i>Lampreta fluviatilis</i> 1095 Sea lamprey <i>Petromyzon marinus</i> 1140 Mudflats and sandflats not covered by seawater at low tide <p>Annex I habitats present that are not primary reason for site selection:</p> <ul style="list-style-type: none"> 1110 Sandbanks which are slightly covered by sea water all the time 1150 Coastal lagoons * Priority feature 1310 Salicornia and other annuals colonizing mud and sand 1330 Atlantic salt meadows (<i>Glaucopuccinellietalia maritima</i>) 2110 Embryonic shifting dunes 2120 "Shifting dunes along the shoreline with <i>Ammophila arenaria</i> ("white dunes")" 2130 "Fixed coastal dunes with herbaceous vegetation ("grey dunes")" * Priority feature 2160 Dunes with <i>Hippophae rhamnoides</i> <p>Annex II species present that are not a primary reason for site selection:</p>			

Designated Site (Habitats Sites)	Qualifying features	Potential Adverse Significant Effects (before mitigation)	Proposed Mitigation Measures ¹⁰	Residual Effects (after mitigation)
	<ul style="list-style-type: none"> S1095. Sea lamprey <i>Petromyzon marinus</i>; S1099. River lamprey <i>Lampetra fluviatilis</i>; S1364. Grey seal <i>Halichoerus grypus</i> 			
Rutland Water Ramsar site	<p>Ramsar Criterion 5 Assemblages of international importance: 19,274 waterfowl, non-breeding season</p> <p>Ramsar Criterion 6 Species with peak counts in spring/autumn: Gadwall <i>Anas strepera</i> Northern Shoveler <i>Anas clypeata</i></p> <p>Species/populations identified subsequent to designation for possible future consideration under Criterion 6: Mute swan <i>Cygnus olor</i></p>	<p>The option requires input of 100ML/d of partially treated water from the new abstraction source to Rutland Water, construction of associated draw-off tower and WTW directly adjacent and new pipeline infrastructure for conveyance from source to terminal at Preston service reservoir.</p> <p>The construction of the new pipeline and associated infrastructure has the potential to result in:</p> <ul style="list-style-type: none"> Physical loss/physical damage – localised habitat loss and/or habitat degradation leading to a reduction of habitat extent Non-physical disturbance – increased noise/visual/human presence leading to disturbance to qualifying bird species Toxic contamination – accidental pollution events during construction in or near the waterbody resulting in habitat degradation or biological disturbance to the qualifying bird species. Non-toxic contamination – increased sediments in suspension due to construction activities in or near the waterbody resulting in increased turbidity, siltation and river substrate smothering. Air pollution may also affect habitat vegetation due to dust deposition. Changes to water table availability - ground water level and flows may be affected during excavation works and dewatering of the pipeline construction within the designated site. Biological disturbance – potential for invasive species spread during construction. 	<ol style="list-style-type: none"> Standard best practice procedures should be followed during construction to limit construction-related disturbance and contamination including (but are not limited to) the following: <ul style="list-style-type: none"> CIRIA C741 Environmental good practice on site guide Environment Agency's PPGs (PPG1: General Guide to Prevention of Pollution; PPG5: Works and maintenance in or near water; PPG6: Pollution prevention guidance for working at construction and demolition sites). Best practice such as BS 5228-1:2009+A1:2014 (The British Standards Institute, 2008) to avoid significant effects due to noise. Best practice such as 'Guidance Notes for the Reduction of Obtrusive Light' (Institute of Lighting Professionals, 2011) to avoid significant effects due to increased light (if works are programmed at night). Industry best practice mitigation measures for dust suppression Consideration should be given to relocating the WTW and booster pumping station to at least 500m from the boundary of Rutland Water to remove any disturbance effects (specifically visual and noise related) 	<p>Uncertain</p> <p>Construction impacts from noise excavation works leading to water table disruption unable to quantify fully at this stage.</p> <p>Relocating booster station and new WTW to avoid works within 500m of Rutland Water designated site recommended to reduce construction-effects.</p> <p>Operational impacts from potential changes to water levels as a result of changes to abstraction regime unable to quantify at this stage.</p>
Rutland Water SPA	<p>Article 4.1 Qualifying individual species not listed in Annex I: Gadwall <i>Anas strepera</i> Northern Shoveler <i>Anas clypeata</i>.</p>			

Designated Site (Habitats Sites)	Qualifying features	Potential Adverse Significant Effects (before mitigation)	Proposed Mitigation Measures ¹⁰	Residual Effects (after mitigation)
		<p>The operation of the option has the potential to result in:</p> <ul style="list-style-type: none"> Changes to water availability – changes to abstraction regime may result in fluctuating water levels affecting the quality of habitat available to qualifying bird species. <p>The construction-related impacts will be temporary but the operational effects may be permanent and lead to long-term changes to habitats over time.</p> <p>The identified effects have the potential to reduce the extent and distribution of qualifying bird species by altering their available habitat.</p> <p>The potential impact therefore may affect the structure and function compromising the integrity of Rutland Water SPA and Ramsar site.</p>	<ol style="list-style-type: none"> Construction works of pipeline and associated project infrastructure directly adjacent to Rutland Water to be accompanied by a noise assessment and noise thresholds agreed with Natural England. Construction works to be further accompanied by hydrogeological investigation to ensure excavation works do not disrupt the groundwater continuity at Rutland Water. Good practice guidelines in relation to spread of INNS during construction (including unexpected pollution events) to be followed. Development of a Construction and Environmental Management Plan which will include all the above proposed mitigation measures and any further measures identified at project stage. Hydrological modelling investigation required to understand the impact on the change in abstraction regime on water levels in the reservoir and knock-on effects to qualifying bird species 	<p>Project-stage HRA is required to assess impacts fully.</p>

3.5.4 Summary of the River Trent option Appropriate Assessment

Potential significant adverse effects have been identified which may affect the integrity of the following Habitats Sites which cannot be resolved at this stage:

- Humber Estuary Ramsar site/SAC; and,
- Rutland Water SPA/Ramsar site

For the Humber Estuary, the adverse effects relate to the potential reduction in flows on the River Trent as a result of the new licenced abstraction at East Bridgford affecting the behaviour of river and sea lamprey entering the river for migration and spawning up stream. Further hydrological modelling is required to understand the impact of abstraction on surface water levels and flows and a full investigation into the indirect impacts on migratory and spawning behaviour is required. In particular the question of whether fish passage will be affected by reduced water levels and flows needs to be resolved to understand the magnitude of these impacts, and in order to design an appropriate mitigation strategy for these fish species.

For Rutland Water SPA/Ramsar site, both construction and operation of the option have identified potential impacts which may result in residual effects on qualifying bird species. Construction of the pipeline, booster station and new WTW in and directly adjacent to the reservoir will require further noise and hydrogeological investigation to ensure construction-related effects are negated. Operation of the option will result in an alteration to the abstraction regime. A hydrological modelling assessment is required to understand the impact of this changes to surface water levels in the reservoir and the indirect impact this will have on usable habitat to qualifying bird species.

In order to reduce the construction-related impacts, it is recommended that consideration be given to relocating the booster station and new WTW further away from Rutland Water but this will not remove the requirement for further assessment fully. A detailed project-stage HRA will be required for both designated sites, informed by baseline surveys and the further investigations identified and the project will require a robust mitigation strategy to receive assent from Natural England.

If the project-stage HRA cannot rule out adverse effects on the integrity of the designated sites, the option must be rejected in its current form unless it can be granted derogation. In order to be considered for derogation, there are three legal tests which the proposal must pass, i.e. the proposal must show that:

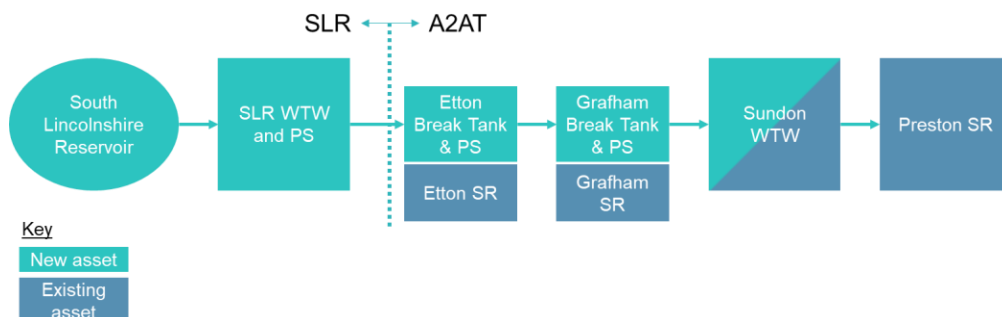
1. There are no feasible alternative solutions that would be less damaging or avoid damage to the site,
2. The option needs to be carried out for imperative reasons of overriding public interest, and
3. The necessary compensatory measures can be secured.

3.6 South Lincolnshire Reservoir to Preston option

3.6.1 Summary of the option

This option involves abstraction of raw water from the proposed South Lincolnshire Reservoir, and conveyance to new SLR WTW. The potable water will then be conveyed to Sundon WTW for conditioning, via Etton Service Reservoir and routing past Grafham WTW. The treated water will be transferred to Preston SR. The option is of 50MI/d or 100MI/d capacity and has interdependencies of the SLR SRO and network enhancement downstream of Preston.

Figure 3.2: Schematic diagram of the SLR to Preston option



3.6.2 HRA Stage 1 screening of national network sites

A Habitats Site must be both exposed and sensitive to potential effects from the construction or operation of the option for Likely Significant Effects to be considered possible. Therefore, all sites downstream or within 20km of the option, or otherwise linked by a potential effect pathway was considered.

The HRA Stage 1 Screening assessment identified nine Habitats Sites within the Zol of the SLR to Preston option. A summary of the screening assessment is given in Appendix B. Potential for Likely Significant Effects or Uncertain Effects was identified in The Nene Washes, which comprise the Nene Washes SPA, Ramsar site and SAC. The Nene Washes is therefore required to undergo an Appropriate Assessment. A summary of the HRA screening results for this site is given in Table 3.4.

Table 3.4: SLR to Preston option: HRA Stage 1 Screening Assessment results where Likely Significant Effects or Uncertain Effects have been identified

National Network Site	Distance from the option	Potential for Likely Significant Effects or Uncertain Effects
Nene Washes SPA	6.4 km east (10km river corridor length)	<p>Uncertain</p> <p>The proposed option is hydrologically connected to the River Nene which is directly linked to the SPA. The proposed pipeline crosses the River Nene once. During the construction of the pipeline there is the possibility of sediment discharge into this connected watercourse which could lead to greater amounts of sediment in the SPA habitat. The silting of watercourses within the SPA may cause negative impacts to the internationally important assemblage of wintering and breeding birds. As detailed, there is a potential impact pathway arising from the construction of the pipeline.</p> <p>It is not known if increased water abstraction is proposed from the River Nene. If this were the case then there may be further uncertain effects on the designated species, which are likely to be affected by changes in water level.</p>
Nene Washes Ramsar site	6.4 km east (10km river corridor length)	<p>Uncertain</p> <p>The proposed option is hydrologically connected to the River Nene which is directly linked to the SPA. The proposed pipeline crosses the River Nene once. During the construction of the pipeline there is the possibility of sediment discharge into this connected watercourse which could lead to greater amounts of sediment in the SPA habitat. The silting of watercourses within the SPA may cause negative impacts to the internationally important</p>

National Network Site	Distance from the option	Potential for Likely Significant Effects or Uncertain Effects
		<p>assemblage of wintering and breeding birds. As detailed, there is a potential impact pathway arising from the construction of the pipeline.</p> <p>It is not known if increased water abstraction is proposed from the River Nene. If this were the case then there may be further uncertain effects on the designated species, which are likely to be affected by changes in water level.</p>
Nene Washes SAC	6.4 km east (10km river corridor length)	<p>Uncertain</p> <p>The proposed option is hydrologically connected to the River Nene which is directly linked to the SAC. The proposed pipeline crosses the River Nene once. During the construction of the pipeline there is the possibility of sediment discharge into this connected watercourse which could lead to greater amounts of sediment in the SAC habitat. The silting of watercourses within the SAC may cause negative impacts to the SAC's designated features including the spined loach. As detailed, there is a potential impact pathway arising from the construction of the pipeline.</p> <p>It is not known if increased water abstraction is proposed from the River Nene. If this were the case then there may be further uncertain effects on the designated species, which are known to be affected by changes in water level during its life cycle for example, in order to reach areas around the wetland habitats.</p>

3.6.3 Likely impact pathways and potential effects

Considering the type, size and scale of the SLR to Preston option, the potential impacts (of construction and operational phases) are described below.

3.6.3.1 Construction

The SLR to Preston option is a relatively simple option that requires the construction of approximately 90km of new pipeline from the existing Etton Service Reservoir to a proposed WTW at Sundon, and approximately 15km of pipeline infrastructure from Sundon to its terminal at Preston Service Reservoir. The River Nene is in direct hydrological continuity with the Nene Washes SPA/Ramsar site/SAC, and the pipeline is required to cross the River Nene approximately 10km upstream from the designated site. In the particular case of river crossings, in-channel works can result in impacts on habitats and species through, for example, runoff from accidental pollution events or dust emissions from construction-related activities. Construction works in or near the River Nene have the potential to result in toxic contamination of the Nene Washes designated sites through the ingress of harmful substances such as contaminated water, concrete, cement and grouts, oils and chemicals and trade materials. There is also the potential for accidental pollution events contaminating the water and for increased sedimentation and silting from the construction run-off. These potential changes to the water quality could result in degradation to the wetland habitats which depend on ground and surface water stability within the Nene Washes washland and the sensitive aquatic species which have specific water quality requirements, i.e. breeding and wintering birds and spined loach.

There is also the risk of introducing invasive species to the River Nene during construction where personnel, vehicles and equipment move between and within sites, as well as where excavation and disposal of materials (e.g. sediments and vegetation) is required. Invasive, non-native species entering the Nene Washes designated sites can lead to loss of native habitat and, over time, invasive species can overtake native species affecting the long-term quality of

habitats. This may have indirect impacts on the qualifying bird and fish species which these habitats support.

The risk of contamination at river crossings can almost certainly be avoided or controlled through the application of standard best-practice measures and typical mitigation considered adequate to ensure water pollution control are given in Section 3.4. Appropriate biosecurity measures also be incorporated into the design of the option at the project-stage to ensure the spread of INNS is limited and no significant adverse effects occur from this pathway.

Regarding the construction of the proposed SLR and Sundon WTW, although the exact locations are not yet known, the general locations are significantly removed from any Habitats Site (>10km) for both WTWs, therefore any disturbance effects or impacts from excavation works affecting groundwater bodies are not considered. Any impacts on designated sites would be from temporary contamination of waterbodies which are in hydrological continuity with the Wash SPA/Ramsar site and the Wash and North Norfolk Coast SAC as a result of construction of the SLR WTW, if works were required in or near any such waterbody. It is reasonably assumed that these impacts could be easily mitigated thorough the application of standard good-practice measures for pollution control, as detailed in Section 3.4. This assessment should however be readdressed once the exact location of the WTW is defined.

3.6.3.2 Operation

The SLR to Preston option will transfer water from the proposed SLR, the operation of which is outside the scope of this HRA. It is assumed that any new water source to stock the new reservoir will be appropriately consented and no inter-basin transfers to surface or groundwater bodies will affect Habitats Sites. The SLR SRO will undergo its own HRA assessment for construction and operation.

Raw water transfers always introduce a risk of spreading invasive species if present at the abstraction source, but as the SLR to Preston option includes immediate treatment at the SLR WTW, it is assumed that INNS will be eliminated during treatment and the risk of future invasion by INNS is considered low overall. Regardless of the presence of INNS at source, there are no Habitats Sites directly linked to the Preston Service Reservoir where the transfer terminates. Therefore, there is confidence that the risk of INNS spread to Habitats Sites as a result of operation of this and all A2AT options is low and therefore not considered further in this HRA assessment.

3.6.3.3 Potential effects on designated sites

The following key risks on Habitats Sites have been identified as a result of the SLR to Preston option:

Construction

- Nene Washes SPA/Ramsar site/SAC
 - Toxic contamination – accidental pollution events where pipeline crosses River Nene resulting in water quality changes, habitat degradation or biological disturbance to the qualifying bird and fish species of the SPA/Ramsar site/SAC.
 - Non-toxic contamination – increased sediments in suspension due to construction activities at River Nene crossing resulting in increased turbidity, siltation and river substrate smothering of waters entering the Nene Washes.

Operation

- No key risk to Habitats Sites have been identified as a result of the operation of the SLR to Preston option.

For the Appropriate Assessment, a review of the sensitivity of the qualifying features of the Habitats Sites in relation to the potential impacts identified from the option and the conservation objectives of the designated site is required. Table 3.5 lists the features for which each site is designated and identifies the Likely Significant Effects before and after mitigation measures are assumed. An assessment of each potential impact on the integrity of the sites are made, in view of the sites' structure, function and conservation objectives. Where adverse impacts are deemed significant, standard mitigation measures addressing some of these impacts are described in Section 3.4.

Full descriptions of the Habitats Sites including their conservation objectives and any current pressures or threats are given in Appendix C.

3.6.3.4 SLR to Preston option: Appropriate Assessment

Considering the type, size and scale of the proposed SLR to Preston option, the potential impacts (of construction and operational phases) are described in Table 3.5 below.

Table 3.5: SLR to Preston option: Potential effects on designated sites and qualifying features

Designated Site (Habitats Sites)	Qualifying features	Potential Adverse Significant Effects (before mitigation)	Proposed Mitigation Measures ¹¹	Residual Effects (after mitigation)
Nene Washes Ramsar site 4.6km east (10km river corridor length)	<p>RAMSAR CRITERION 2 The site supports an important assemblage of nationally rare breeding birds and a wide range of raptors occur through the year. The site also supports several nationally scarce plants, two vulnerable and two rare British Red Data Book invertebrate species.</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>,</p> <p>Species/populations identified subsequent to designation for possible future consideration: Species with peak counts in spring/autumn: Black-tailed godwit <i>Limosa limosa islandica</i>.</p> <p>Species with peak counts in winter: Northern pintail <i>Anas acuta</i></p>	<p>The pipeline is required to cross the River Nene approximately 10km upstream from the Nene Washes SPA/Ramsar site/SAC. There is potential for pipeline trenching to result in:</p> <ul style="list-style-type: none"> – Toxic contamination – accidental pollution events where pipeline crosses River Nene resulting in habitat degradation or biological disturbance to the qualifying bird and fish species. – Non-toxic contamination – increased sediments in suspension due to construction activities at River Nene crossing resulting in increased turbidity, siltation and river substrate smothering of waters entering the Nene Washes. <p>The identified effects have the potential to reduce the extent and distribution of the qualifying species as well as affecting the structure and function of their supporting habitats, compromising the integrity of the Nene Washes SPA/Ramsar site/SAC.</p> <p>The impacts are considered to be temporary, localised and minor given the river-crossing is over 10km upstream.</p>	<ol style="list-style-type: none"> 1. Direction drilling to be employed at River Nene crossing to avoid direct impacts on the banks and riverbed and to reduce potential for in-channel contamination. 2. Standard best practice procedures should be followed during construction in or near the River Nene to limit construction-related contamination including (but not limited to) the following: <ul style="list-style-type: none"> – CIRIA C741 Environmental good practice on site guide. – Environment Agency's PPGs (PPG1: General Guide to Prevention of Pollution; PPG5: Works and maintenance in or near water; PPG6: Pollution prevention guidance for working at construction and demolition sites). – Industry best practice mitigation measures for dust suppression. – Sediment traps near or in watercourses or the use of cofferdams to control sediment runoff. 3. Good practice guidelines in relation to spread of INNS during construction (including a strategy for unexpected pollution events) to be followed. 4. Strategy to limit contamination from accidental pipeline failure during operation to be developed. 5. Development of a Construction and Operational Environmental Management Plan which will include all the above proposed mitigation 	No

¹¹ Full references of guidance documents are given in Section 3.4. where they are first listed

Designated Site (Habitats Sites)	Qualifying features	Potential Adverse Significant Effects (before mitigation)	Proposed Mitigation Measures ¹¹	Residual Effects (after mitigation)
Nene Washes SPA 4.6km east (10km river corridor length)	ARTICLE 4.1 Over winter the area regularly supports: <i>Cygnus columbianus bewickii</i> ARTICLE 4.2 During the breeding season the area regularly supports: <i>Anas clypeata, Anas querquedula, Anas strepera, Limosa limosa limosa</i> Over winter the area regularly supports: <i>Anas acuta, Anas clypeata, Anas crecca, Anas Penelope, Anas strepera</i>	No significant pathways have been identified during operation that could lead to significant effects to the integrity of this SPA/Ramsar site/SAC.	measures and any further measures identified at project stage.	
Nene Washes SAC 4.6km east (10km river corridor length)	Annex II species that are a primary reason for selection of this site: 1149 Spined loach <i>Cobitis taenia</i> .			

3.6.4 Summary of the SLR to Preston option Appropriate Assessment

No significant adverse effects resulting from the implementation of this option alone are reasonably foreseeable on the integrity of the following Habitats Sites if the suggested mitigation measures are observed:

- Nene Washes SPA;
- Nene Washes Ramsar site; and,
- Nene Washes SAC.

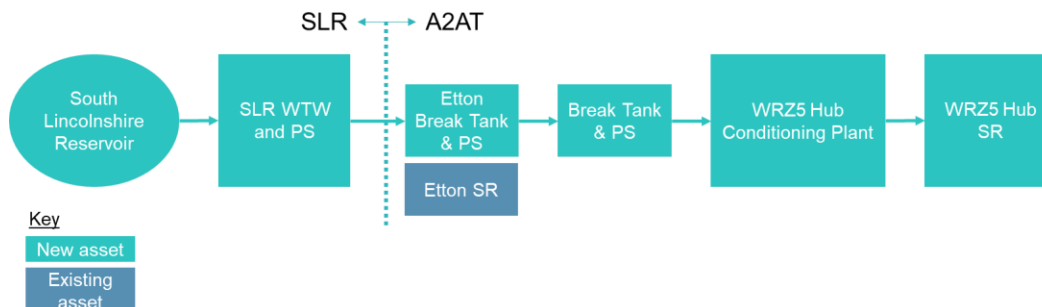
In conclusion, provided that the proposed mitigation measures are taken forward at the project stage, no residual impacts on the Habitats Sites are likely to occur and therefore no further stages in the HRA process will be necessary for the SLR to Preston option.

3.7 South Lincolnshire Reservoir to WRZ5 Hub option

3.7.1 Summary of the option

This option involves abstraction of raw water from the proposed South Lincolnshire Reservoir, and treatment at a new SLR WTW. The potable water will then be conveyed to a conditioning plant and SR near Uttlesford Bridge, described as the WRZ 5 Hub in this report, routing past Etton SR and a new intermediate break tank and pumping station. The option is of 50Ml/d or 100Ml/d capacity and has interdependencies of the SLR SRO and network enhancement in WRZ5.

Figure 3.3: Schematic diagram of the SLR to WRZ5 option



3.7.2 HRA Stage 1 screening of national network sites

A Habitats Site must be both exposed and sensitive to potential effects from the construction or operation of the option for Likely Significant Effects to be considered possible. Therefore, all sites downstream or within 20km of the option, or otherwise linked by a potential effect pathway was considered.

The HRA Stage 1 Screening assessment identified thirteen Habitats Sites within the Zol of the SLR to WRZ5 Hub option. A summary of the screening assessment is given in Appendix B. Potential for Likely Significant Effects or Uncertain Effects was identified in eight sites, and therefore are required to undergo an Appropriate Assessment. A summary of the HRA screening results for these sites is given in Table 3.6.

Table 3.6: SLR to WRZ5 Hub option: HRA Stage 1 Screening Assessment results where Likely Significant Effects or Uncertain Effects have been identified.

National Network Site	Distance from the option	Potential for Likely Significant Effects or Uncertain Effects
Nene Washes Ramsar site	Proposed option is within Ramsar area	<p>Yes</p> <p>The proposed option goes through the middle of the Nene Washes Ramsar Site. As such, the option has the potential for significant impacts to the Ramsar habitats including damage or the loss of habitat area within the Nene Washes site boundary. There is also the potential for sediment and pollution caused by the construction work occurring nearby and directly within the site's area. There remains the potential for further damage to the habitat during the operational phase, should the pipeline ever need to be repaired by a method requiring its excavation.</p> <p>There is also the potential for loss of qualifying species such as Tundra swan <i>Cygnus columbianus</i> given that the pipeline is proposed within the Ramsar boundary and through the wetland habitat.</p>
Nene Washes SPA	Proposed option is within SPA area	<p>Yes</p> <p>The proposed option goes through the middle of the Nene Washes SPA. As such, the option has the potential for significant impacts to the SPA habitats including damage or the loss of habitat area within the Nene Washes site boundary. There is also the potential for sediment and pollution caused by the construction work occurring nearby and directly within the site's area. There remains the potential for further damage to the habitat during the operational phase, should the pipeline ever need to be repaired by a method requiring its excavation.</p> <p>There is also the potential for loss of qualifying species such as spined loach given that the pipeline is proposed within the SPA boundary and through the wetland habitat.</p>
Nene Washes SAC	proposed option is within SAC area	<p>Yes</p> <p>The proposed option goes through the middle of the Nene Washes SAC. As such, the option has the potential for significant impacts to the SAC habitats including damage or the loss of habitat area within the Nene Washes site boundary. There is also the potential for sediment and pollution caused by the construction work occurring nearby and directly within the site's area. There remains the potential for further damage to the habitat during the operational phase, should the pipeline ever need to be repaired by a method requiring its excavation.</p> <p>There is also the potential for loss of qualifying species such as spined loach given that the pipeline is proposed within the SAC boundary and through the wetland habitat.</p>
Fenland SAC	8km west	<p>Uncertain</p> <p>The proposed option is hydrologically connected to the River Nene which links to New Dyke through to Great Raveley Drain linked to the SAC. The proposed pipeline crosses the River Nene once. During the construction of the pipeline there is the possibility of sediment discharge into this connected watercourse which could lead to greater amounts of sediment in the SAC habitat. The silting of watercourses within the SAC may cause negative impacts to the SAC's designated features, including Molinia meadow, calcareous fens, spined loach and great crested newt. As detailed, there is a potential impact pathway arising from the construction of the pipeline.</p>
Woodwalton Fen Ramsar site	8km west	<p>Uncertain</p> <p>The proposed option is hydrologically connected to the River Nene</p>

National Network Site	Distance from the option	Potential for Likely Significant Effects or Uncertain Effects
		which links to New Dyke through to Great Raveley Drain linked to the Ramsar site. The proposed pipeline crosses the River Nene once. During the construction of the pipeline there is the possibility of sediment discharge into this connected watercourse which could lead to greater amounts of sediment in the Ramsar habitat. The silting of watercourses within the Ramsar wetland causes negative impacts to the Ramsar's designated features, including hen violet, fen wood-rush and a number of wetland invertebrates. As detailed, there is a potential impact pathway arising from the construction of the pipeline.
Ouse Washes Ramsar site	4.6km east	Uncertain The proposed option is hydrologically connected to the River Great Ouse which is directly linked to Ouse Washes Ramsar site. The proposed pipeline crosses the River Great Ouse once. During the construction of the pipeline there is the possibility of sediment discharge into this connected watercourse which could lead to greater amounts of sediment in the Ramsar habitat. The silting of watercourses within the Ramsar site could cause negative impacts to the wetland habitat that supports nationally and internationally important wintering waterfowl. As detailed, there is a potential impact pathway arising from the construction of the pipeline.
Ouse Washes SPA	4.6km east	Uncertain The proposed option is hydrologically connected to the River Great Ouse which is directly linked to Ouse Washes SPA. The proposed pipeline crosses the River Great Ouse once. During the construction of the pipeline there is the possibility of sediment discharge into this connected watercourse which could lead to greater amounts of sediment in the SPA. The silting of watercourses within the SPA could cause negative impacts to the wetland habitat that supports nationally and internationally important wintering waterfowl. As detailed, there is a potential impact pathway arising from the construction of the pipeline.
Ouse Washes SAC	4.6km east	Uncertain The proposed option is hydrologically connected to the River Great Ouse which is directly linked to Ouse Washes Ramsar site. The proposed pipeline crosses the River Great Ouse once. During the construction of the pipeline there is the possibility of sediment discharge into this connected watercourse which could lead to greater amounts of sediment in the SAC. The silting of watercourses within the SAC could cause negative impacts to the spined loach, for which the SAC has been designated. As detailed, there is a potential impact pathway arising from the construction of the pipeline.

3.7.3 Likely impact pathways and potential effects

Considering the type, size and scale of the SLR to WRZ5 Hub option, the potential impacts (of construction and operational phases) are described below.

3.7.3.1 Construction

Nene Washes SPA/Ramsar site/SAC

The SLR to WRZ5 Hub option requires the construction of approximately 90km of new pipeline from Etton to the WRZ5 Hub at Stort, near Uttlesford. The initial portion of the pipeline route passes straight through the Nene Washes SPA/SAC/Ramsar site, therefore impacts on this designated site are certain. The Nene Washes SPA and Ramsar site are both designated for its notable assemblages of both breeding and wintering waterbird species, therefore sensitive bird

species are likely to be present all year round. The Ramsar site is further designated for its unique washland habitat, nationally scarce plants and its relict invertebrate fauna. The Nene Washes SAC is designated for its population of the Annex II species Spined Loach *Cobitis taenia*.

Construction activities associated with trenching and pipeline layout have the potential to result in physical damage and/or loss of habitat area within the designated site, and in disturbance of sensitive species due to noise, lighting, visual impact, vibration, etc. The pipeline route will also be required to cross the River Nene within the Nene Washes designated site. In-channel works can result in toxic contamination of the river or wetland habitats through, for example, runoff from accidental pollution events contaminating the water with trade materials or dust emissions from construction-related activities. There is also potential for increased sedimentation and silting during in-channel construction works and surface water levels and flows may be disrupted if construction requires the use of coffer dams or any other structure which causes flows to be temporarily slowed or halted.

Most disturbance and pollution risks can almost certainly be avoided or controlled through the application of standard best-practice measures. The typical mitigation considered adequate to reduce disturbance effects from increased lighting and visual impacts and to reduce the impact of any pollution events given in Section 3.4 should be considered adequate to ensure no adverse effects on qualifying bird species occurs. Spined loach are particularly sensitive to increased vibrations and to habitat changes from water pollution and sedimentation due to its restricted microhabitat associated with a specialist filter-feeding, and preference for sandy substrates in which juvenile fish tend to bury themselves. Therefore, a specific assessment on the impact of the works on spined loach would be required, likely accompanied by appropriate baseline surveys and bespoke mitigation measures such as temporary fish exclusions or limiting works where spined loach are present.

The impact of noise disturbance is also a particular concern, as research indicates that there is a flight response in waterfowl above 70dBA (Cutts et al. 2009)¹². In general, birds tend to habituate to continual noises so long as there is no large amplitude 'startling' component, with vehicle movements being more greatly tolerated¹³. It would be impossible to fully assess the magnitude of this impact at this stage as there is no detailed design and construction information available. As a bare minimum, consultation with Natural England would be required in relation to the noise disturbance and a suitable noise assessment and mitigation strategy would be required in the project stage HRA to ensure that noise levels do not breach agreed thresholds for sensitive bird species within the designated site.

For impacts related to the location of the pipeline within the Nene Washes site boundary and the physical loss of habitat required for this option, indirect effects such as habitat fragmentation, species displacement and permanent habitat loss due to hydrological changes are more difficult to assess at this stage due to the early stages of the plan, and the consequential lack of detailed design of this option. The design of the pipeline would have to be carefully informed by hydrogeological investigations to ensure any excavation works were undertaken so as not to disrupt continuity of the water table within the Habitats Site which may result in habitat degradation. Assent from Natural England would only be granted after a detailed impact assessment, supported by adequate baseline surveys of sensitive species and an appropriate mitigation plan. The works may have to be sensitively timed to avoid both the peak periods for breeding and wintering bird species, allowing only a small window between August-November. To avoid these direct impacts all together and reduce the requirement for further detailed impact

¹² Cutts, N., Phelps, A. & Burdon, D. (2009). Construction and Waterfowl: Defining Sensitivity, Response, Impacts and Guidance. The University of Hull, Hull.

¹³ Hockin, D., Ounsted, M., Gorman, M., Hill, D., Keller, V. & Barker, M.A. (1992). Examination of the effects of disturbance on birds with reference to its importance in ecological assessments. *J. Environ. Manage.* 36: 253–286.

assessment, it is recommended that rerouting the pipeline to avoid the Nene Washes should be considered for this option, ensuring no works take place at least 500m from the site boundary for disturbance effects to not be considered. Directional drilling under the width of the designated site could also be considered. If these approaches cannot be considered and pipeline trenching is developed further in its current location, a project-stage HRA will be required to investigate these impacts fully to ensure there will be no residual impacts on the sensitive habitats and features of the Nene Washes designated site.

Ouse Washes SPA/Ramsar site/SAC

The River Great Ouse is in direct hydrological continuity with the Ouse Washes SPA/Ramsar site/SAC, and the pipeline is required to cross the River Great Ouse approximately 5km upstream from the designated site. Construction works in or near the River Great Ouse have the potential to result in toxic contamination of this designated site through the ingress of harmful substances such as contaminated water, concrete, cement and grouts, oils and chemicals and trade materials. There is also the potential for accidental pollution events contaminating the water and for increased sedimentation and silting from the construction run-off. These potential changes to the water table could cause negative impacts to the wetland habitats within the Ouse Washes and the sensitive features for which it is designated. The risk of contamination at river crossings can almost certainly be avoided or controlled through the application of standard best-practice measures and typical mitigation considered adequate to ensure water pollution control are given in Section 3.4.

Spread of invasive species can occur during construction where personnel, vehicles and equipment move between and within sites, at river crossings hydrologically connected to Habitats Sites and during the excavation and disposal of materials (e.g. sediments and vegetation). The presence and increase in INNS can lead to loss of habitat and over time they can overtake native species affecting habitats and qualifying species they support. The Nene Washes SPA/Ramsar site/SAC, Fenland SAC, and the Ouse Washes SPA/Ramsar site/SAC are all hydrologically connected to the pipeline route. Appropriate biosecurity measures should be incorporated into the design of the option at the project-stage to ensure spread of INNS is limited and no significant adverse effects occur as a result of this pathway.

Other Habitats Sites in the Zol

For the other Habitats Sites identified in the Zol with Uncertain Effects, the potential impacts relate to where the new pipeline is required to cross rivers that are hydrologically linked to these sites. Woodwalton Fen Ramsar site is located upstream on the River Nene therefore no construction-related impacts are considered further. Fenland SAC includes the Woodwalton Fen site as well as Chippenham and Snailwell Poor's Fen and Wicken Fen. The downstream sites are not in direct hydrological links to any waterbodies where cross-channel works will take place, therefore impacts on Fenland SAC are equally not considered likely.

Potential Impacts Relating to the SLR WTW

Regarding the construction of the new SLR WTW and the WRZ5 WTW, although the exact locations are not yet defined, the general locations are significantly removed from any Habitats Site (>10km) to consider any disturbance effects or impacts from excavation works affecting groundwater bodies to be relevant to this HRA. As for the SLR WTW, there is possibility that a pollution pathway to the Wash SPA/Ramsar site and the Wash and North Norfolk Coast SAC exists if works for the SLR WTW are required in or near and waterbody that is in hydrological continuity with these sites, but there is confidence that these impacts could be reasonably mitigated through the application of standard pollution prevention methods, details of which are given in Section 3.4.

3.7.3.2 Operation

The SLR to WRZ5 Hub option will transfer water from the proposed SLR, the operation of which is outside the scope of this HRA. It is assumed that any new water source to stock the new reservoir will be appropriately consented and no inter-basin transfers to surface or groundwater bodies will affect Habitats Sites. The SLR SRO will undergo its own HRA assessment for construction and operation.

Raw water transfers always introduce a risk of spreading invasive species if present at the abstraction source, but as the SLR to WRZ5 Hub option includes immediate treatment at the SLR WTW, it is assumed that INNS will be eliminated during treatment and the risk of future invasion by INNS is considered low overall. Regardless of the presence of INNS at source, there are no Habitats Sites directly linked to the WRZ5 Hub where the transfer terminates. Therefore, there is confidence that the risk of INNS spread to Habitats Sites as a result of operation of this and all A2AT options is low and therefore not considered further in this HRA assessment.

Given the proposed pipeline route bisects the Nene Washes SPA/Ramsar site/SAC, there remains the potential for further damage to this site during the operational phase, should the pipeline ever need to be repaired by a method requiring its excavation. The impacts may include increased sedimentation or pollution input and disruptions to the water table and would be difficult to predict in unforeseen failure events for the purposes of this HRA. The project-stage HRA would have to make an appropriate evaluation of any such risks, including a prediction of frequency and magnitude and ensure mitigation measures are adequate and appropriately designed prior to construction. These impacts cannot be eliminated at this stage, due to the early stages of the project and the consequential lack of further design details of the A2AT options. As discussed for the potential impacts from construction on the Nene Washes, it is recommended that rerouting the pipeline to avoid the Nene Washes should be considered for this option, ensuring no works take place at least 500m from the site boundary. If this is not possible, a detailed impact assessment on the Nene Washes would be required beyond the Gate 1 submission.

3.7.3.3 Potential effects on designated sites

The following key risks on Habitats Sites have been identified as a result of the SLR to WRZ5 Hub option:

Construction

- Nene Washes SPA/Ramsar site/SAC
 - Physical loss/physical damage – significant localised habitat loss and/or habitat degradation leading to a reduction of habitat extent
 - Non-physical disturbance – increased noise/visual/human presence leading to disturbance to qualifying bird and fish species
 - Toxic contamination – accidental pollution events at River Nene crossing or where works are within washland resulting in habitat degradation or biological disturbance to the qualifying bird and fish species.
 - Non-toxic contamination – increased sediments in suspension due to construction activities at River Nene crossing or where works are within washland resulting in increased turbidity, siltation and river substrate smothering. Air pollution may also affect habitat vegetation due to dust deposition.
 - Changes to water table availability - ground water level and flows may be affected during excavation works and dewatering of the pipeline construction within the designated site.
 - Biological disturbance – potential for invasive species spread.

- Ouse Washes SPA/Ramsar site/SAC
 - Toxic contamination – accidental pollution events where pipeline crosses River Great Ouse resulting in habitat degradation or biological disturbance to the qualifying bird and fish species.
 - Non-toxic contamination – increased sediments in suspension due to construction activities at River Great Ouse crossing resulting in increased turbidity, siltation and river substrate smothering of waters entering the Ouse Washes.

Operation

- Nene Washes SPA/Ramsar site/SAC
 - Toxic contamination – accidental pollution events from pipeline failure at River Nene crossing or within washland resulting in habitat degradation or biological disturbance to the qualifying bird and fish species.
 - Non-toxic contamination – increased sediments in suspension due to pipeline failure at River Nene crossing or within washland resulting in increased turbidity, siltation and river substrate smothering. Air pollution may also affect habitat vegetation due to dust deposition.

For the Appropriate Assessment, a review of the sensitivity of the qualifying features of these Habitats Sites in relation to the potential impacts identified from the option and the conservation objectives of the designated site is required. Table 3.7 lists the features for which each site is designated and identifies the Likely Significant Effects before and after mitigation measures are assumed. An assessment of each potential impact on the integrity of the sites are made, in view of the sites' structure, function and conservation objectives. Where adverse impacts are deemed significant, standard mitigation measures addressing some of these impacts are described in Section 3.4.

Full descriptions of the Habitats Sites including their conservation objectives and any current pressures or threats are given in Appendix C.

3.7.3.4 SLR to WRZ5 Hub option: Appropriate Assessment

Considering the type, size and scale of the proposed SLR to WRZ5 Hub option, the potential impacts (of construction and operational phases) are described in Table 3.7 below.

Table 3.7: SLR to WRZ5 Hub option: Potential effects on designated sites and qualifying features

Designated Site (Habitats Sites)	Qualifying features	Potential Adverse Significant Effects (before mitigation)	Proposed Mitigation Measures ¹⁴	Residual Effects (after mitigation)
Nene Washes Ramsar site (proposed option is within Ramsar area)	<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. Species with peak counts in winter: Tundra swan <i>Cygnus columbianus bewickii</i>,</p> <p>Species/populations identified subsequent to designation for possible future consideration: Species with peak counts in spring/autumn: Black-tailed godwit <i>Limosa limosa islandica</i>.</p> <p>Species with peak counts in winter: Northern pintail <i>Anas acuta</i></p>	<p>The pipeline corridor bisects the Nene Washes designated site. There is potential for pipeline trenching to result in:</p> <ul style="list-style-type: none"> Physical loss/physical damage – significant localised habitat loss and/or habitat degradation leading to a reduction of habitat extent. Non-physical disturbance – increased noise/visual/human presence leading to disturbance to qualifying fish and bird species (breeding and wintering). Toxic contamination – accidental pollution events at River Nene crossing or where works are within washland resulting in habitat degradation or biological disturbance to the qualifying fish and bird species (breeding and wintering). Non-toxic contamination – increased sediments in suspension due to construction activities at River Nene crossing or where works are within washland resulting in increased turbidity, siltation and river substrate smothering. Indirect impacts may result in habitat degradation or biological disturbance to qualifying fish and bird species (breeding and wintering). Changes to water table availability - ground water level and flows may be affected during excavation works and dewatering of the pipeline construction within the designated site. Indirect impacts may 	<p>1. Standard best practice procedures should be followed during construction to limit construction-related disturbance and contamination including (but are not limited to) the following:</p> <ul style="list-style-type: none"> CIRIA C741 Environmental good practice on site guide Environment Agency's PPGs (PPG1: General Guide to Prevention of Pollution; PPG5: Works and maintenance in or near water; PPG6: Pollution prevention guidance for working at construction and demolition sites). Best practice such as BS 5228-1:2009+A1:2014 (The British Standards Institute, 2008) to avoid significant effects due to noise. Best practice such as 'Guidance Notes for the Reduction of Obtrusive Light' (Institute of Lighting Professionals, 2011) to avoid significant effects due to increased light (if works are programmed at night). Industry best practice mitigation measures for dust suppression. 	<p>Uncertain</p> <p>Construction impacts from physical loss of habitat and habitat degradation due to water table disruption unable to quantify fully at this stage.</p> <p>Rerouting of pipeline corridor to avoid works within 500m of Nene Washes designated site or directional drilling under the entire site recommended to avoid physical loss/damage of habitats and disruption to the water table.</p>

¹⁴ Full references of guidance documents are given in Section 3.4. where they are first listed

Designated Site (Habitats Sites)	Qualifying features	Potential Adverse Significant Effects (before mitigation)	Proposed Mitigation Measures ¹⁴	Residual Effects (after mitigation)
Nene Washes SPA (proposed option is within SPA area)	<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> Over winter the area regularly supports: <i>Anas acuta, Anas clypeata, Anas crecca, Anas Penelope, Anas strepera</i></p>	<p>result in habitat degradation or biological disturbance to qualifying fish and bird species (breeding and wintering).</p> <ul style="list-style-type: none"> Biological disturbance – potential for invasive species spread. <p>This designated site is already suffering from similar pressures from other sources and therefore the proposed works may further prevent the improvement of the site condition (currently unfavourable-recovering). The identified effects have the potential to reduce the extent and distribution of washland habitat as well as affecting its structure and function compromising the integrity of the Nene Washes SPA.</p>	<ul style="list-style-type: none"> Sediment traps near or in watercourses or the use of cofferdams to control sediment runoff. <ol style="list-style-type: none"> Works to be accompanied by a noise assessment and noise thresholds agreed with Natural England and/or works in the Nene Washes to be undertaken outside the peak breeding and wintering period for birds. Works to be accompanied by an assessment of impacts of increased vibrations in relation to spined loach Works to be carefully informed by hydrogeological investigations to ensure any excavation works do not disrupt continuity of the water table within the Habitats Site. Assent from Natural England would only be granted after a detailed impact assessment, supported by adequate baseline surveys of sensitive species and an appropriate mitigation plan. Direction drilling to be employed at river crossings that are hydrologically linked to the designated site to reduce potential for in-channel contamination and avoid direct impacts on the banks and riverbed. Good practice guidelines in relation to spread of INNS during construction (including a strategy for unexpected pollution events) to be followed. Strategy to limit contamination during accidental pipeline failure to be developed. Development of a Construction and Operational Environmental Management Plan which will include all the above proposed mitigation measures and any further measures identified at project stage. 	Project-stage HRA is required to assess direct impacts fully.
Nene Washes SAC (proposed option is within SAC area)	<p>Annex II species that are a primary reason for selection of this site: 1149 Spined loach <i>Cobitis taenia</i>.</p>	<p>The potential for pipeline failure during operation of the option may result in the following:</p> <ul style="list-style-type: none"> Toxic contamination – accidental pollution events from pipeline failure at River Nene crossing or within washland resulting in habitat degradation or biological disturbance to the qualifying bird and fish species. Non-toxic contamination – increased sediments in suspension due to pipeline failure at River Nene crossing or within washland resulting in increased turbidity, siltation and river substrate smothering. Indirect impacts may result in habitat degradation or biological disturbance to qualifying fish and bird species (breeding and wintering). 	<ol style="list-style-type: none"> Direction drilling to be employed at River Great Ouse crossing to avoid direct impacts 	No
Ouse Washes Ramsar site	RAMSAR CRITERION 1	The pipeline is required to cross the River Great Ouse approximately 5km upstream from the Ouse Washes		

Designated Site (Habitats Sites)	Qualifying features	Potential Adverse Significant Effects (before mitigation)	Proposed Mitigation Measures ¹⁴	Residual Effects (after mitigation)
4.6km east	<p>The site contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.</p> <p>RAMSAR CRITERION 2 The site supports vulnerable, endangered, or critically endangered species or threatened ecological communities.</p> <p>RAMSAR CRITERION 5 The site regularly supports 20,000 or more waterbirds.</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>, whooper swan <i>Cygnus cygnus</i>, Eurasian wigeon <i>Mareca penelope</i>, gadwall <i>Mareca strepera</i>, Eurasian teal <i>Anas crecca</i>, northern pintail <i>Anas acuta</i>, northern shoveler <i>Anas clypeata</i></p> <p>Species/populations identified subsequent to designation for possible future consideration: Species with peak counts in winter: mute swan <i>Cygnus olor</i>, common pochard <i>Athya ferina</i>, black-tailed godwit <i>Limosa limosa</i></p>	<p>SPA/Ramsar site/SAC. There is potential for pipeline trenching to result in:</p> <ul style="list-style-type: none"> – Toxic contamination – accidental pollution events where pipeline crosses River Great Ouse resulting in habitat degradation or biological disturbance to the qualifying bird and fish species. – Non-toxic contamination – increased sediments in suspension due to construction activities at River Great Ouse crossing resulting in increased turbidity, siltation and river substrate smothering of waters entering the Ouse Washes. 	<p>on the banks and riverbed and to reduce potential for in-channel contamination.</p> <ol style="list-style-type: none"> Standard best practice procedures should be followed during construction in or near the Great River Ouse to limit construction-related contamination including (but not limited to) the following: <ul style="list-style-type: none"> – CIRIA C741 Environmental good practice on site guide – Environment Agency's PPGs (PPG1: General Guide to Prevention of Pollution; PPG5: Works and maintenance in or near water; PPG6: Pollution prevention guidance for working at construction and demolition sites). – Industry best practice mitigation measures for dust suppression. – Sediment traps near or in watercourses or the use of cofferdams to control sediment runoff. Good practice guidelines in relation to spread of INNS during construction (including a strategy for unexpected pollution events) to be followed. Strategy to limit contamination during accidental pipeline failure to be developed. Development of a Construction and Operational Environmental Management Plan which will include all the above proposed mitigation measures and any further measures identified at project stage. 	
Ouse Washes SPA	<p>ARTICLE 4.1 Over winter the area regularly supports:</p>			
4.6km east	<i>Cygnus columbianus bewickii</i>			

Designated Site (Habitats Sites)	Qualifying features	Potential Adverse Significant Effects (before mitigation)	Proposed Mitigation Measures ¹⁴	Residual Effects (after mitigation)
	<p>ARTICLE 4.2</p> <p>During the breeding season the area regularly supports:</p> <p><i>Anas strepera</i>, <i>Anas querquedula</i>, <i>A. clypeata</i>, <i>Limosa limosa</i></p> <p>Over winter the area regularly supports:</p> <p><i>Anas penelope</i>, <i>Anas crecca</i>, <i>Anas strepera</i>, <i>Anas acuta</i>, <i>Anas clypeata</i>.</p>			
<p>Ouse Washes SAC</p> <p>4.6km east</p>	<p>Annex II species that are a primary reason for selection of this site:</p> <p>1149 Spined loach <i>Cobitis taenia</i>.</p>			

3.7.4 Summary of the SLR to WRZ5 option Appropriate Assessment

No significant adverse effects resulting from the implementation of this option are reasonably foreseeable on the integrity of the following Habitats Sites as there are no pathways by which a reasonable Likely Significant Effect could occur:

- Fenland SAC; and,
- Woodwalton Ramsar site.

No significant adverse effects resulting from the implementation of this option are reasonably foreseeable on the integrity of the following Habitats Sites if the suggested mitigation measures are implemented:

- Ouse Washes SPA/Ramsar site/SAC.

Potential significant adverse effects have been identified which may affect the integrity of the Nene Washes SPA/Ramsar site/SAC. The effects relate to the location of the pipeline corridor within the boundary of the designated site and the consequential impacts on habitats and qualifying bird and fish species as a result of construction activities and potential pollution events during operation are certain. Due to the early stage of the project and the consequential lack of detailed design of the option, the magnitude of these impacts cannot be fully assessed, and an appropriate mitigation strategy cannot be reliably designed. The impacts of this option on the Nene Washes SPA/Ramsar site/SAC will require further investigation through a detailed project-stage HRA, informed by baseline surveys, and further hydrological and noise assessments. The project would require a robust mitigation strategy to receive assent from Natural England, which may further require limiting the works to a short window between August and November to avoid both the breeding and overwintering period for birds.

In order to avoid onerous further assessment where there is uncertainty in the outcome, it is recommended that consideration be given to rerouting the pipeline corridor to avoid the Nene Washes altogether at this stage. If this option is brought forward, the feasibility of using directional drilling techniques to avoid the impacts from pipeline trenching should further be considered, but this strategy will not remove the identified impacts altogether. Underground drilling must ensure that no adverse impacts to the water table occur in no indirect impacts on qualifying habitats, bird and fish species and this potential effect will have to be assessed appropriately.

If the project-stage HRA cannot rule out adverse effects on the integrity of the Nene Washes designated site, the options must be rejected in its current form unless it can be granted derogation under Stage 3. In order to be considered for derogation, there are three legal tests which the proposal must pass, i.e. the proposal must show that:

1. There are no feasible alternative solutions that would be less damaging or avoid damage to the site,
2. The option needs to be carried out for imperative reasons of overriding public interest, and
3. The necessary compensatory measures can be secured.

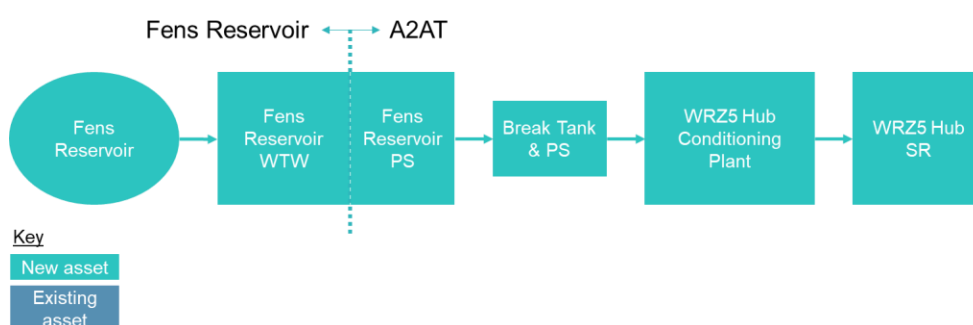
National strategic plans, policy statements and major projects are more likely to have a high level of public interest and be able to show they are imperative and overriding but the proposal must show that there are no alternative solutions before it can move on to Test 2.

3.8 Fens Reservoir option

3.8.1 Summary of the option

This option involves abstraction of raw water from the proposed Fens Reservoir, and treatment at a new Fens Reservoir WTW. The potable water will then be conveyed to a conditioning plant and SR in WRZ5 Hub via an intermediate break tank and pumping station. The option is of 50MI/d or 70MI/d capacity and has interdependencies of the Fens Reservoir and network enhancement in WRZ5. Please note that the Fens Reservoir is considered a separate SRO, and therefore any impacts on Habitats Sites as a result of the reservoir are not considered further in this assessment.

Figure 3.4: Schematic Diagram of the Fens Reservoir option



3.8.2 HRA Stage 1 screening of national network sites

A Habitats Site must be both exposed and sensitive to potential effects from the construction or operation of the option for Likely Significant Effects to be considered possible. Therefore all sites downstream or within 20km of the option, or otherwise linked by a potential effect pathway was considered.

The HRA Stage 1 Screening assessment identified five Habitats Sites within the Zol of the Fens Reservoir option. A summary of the screening assessment is given in Appendix B. Potential for Likely Significant Effects or Uncertain Effects was identified in two sites, and therefore are required to undergo an Appropriate Assessment. A summary of the HRA screening results for these sites is given in Table 3.8.

Table 3.8: Fens Reservoir option: HRA Stage 1 Screening Assessment results where Likely Significant Effects or Uncertain Effects have been identified

National Network Site	Distance from the option	Potential for Likely Significant Effects or Uncertain Effects
Chippenham Fen Ramsar site	2.35km east	Uncertain
		The proposed option is hydrologically connected to the River Snail which is directly linked to Chippenham Fen. The proposed pipeline crosses the River Snail once. During the construction of the pipeline there is the possibility of pollution and sediment discharge into this connected watercourse which could lead to greater amounts of sediment in the SAC. The pollution and silting of watercourses within the SAC may cause negative impacts to the internationally important assemblage of waterbirds. As detailed, there is a potential impact pathway arising from the construction of the pipeline.
Fenland SAC	2.35km east	Uncertain

National Network Site	Distance from the option	Potential for Likely Significant Effects or Uncertain Effects
		The proposed option is hydrologically connected to the River Snail which is directly linked to Chippenham Fen, a component site of the SAC. The proposed pipeline crosses the River Snail once. During the construction of the pipeline there is the possibility of pollution and sediment discharge into this connected watercourse which could lead to greater amounts of sediment in the SAC. The pollution and silting of watercourses within the SAC may cause negative impacts to the internationally important assemblage of waterbirds. As detailed, there is a potential impact pathway arising from the construction of the pipeline.
Breckland SPA	1.1km south east	Uncertain The proposed option requires crossing the Little Ouse which flows directly adjacent to the SPA. During the construction of the pipeline there is the possibility of increased pollution and sediment discharge into this connected watercourse. The site qualifies as a SPA based on the presence of breeding bird species associated with terrestrial habitats, therefore it is not considered that impacts on the watercourse will result in any negative impacts on the integrity of the SPA. For the construction of the pipeline, the site is considered significantly distant for construction-related disturbance effects to be considered.

3.8.3 Likely impact pathways and potential effects

Considering the type, size and scale of the Fens Reservoir option, the potential impacts (of construction and operational phases) are described below.

3.8.3.1 Construction

Construction of the pipeline corridor will be required to cross the River Snail as it passes near Fordham en route to the new WRZ5 Hub. The River Snail is in hydrological continuity with Chippenham Fen Ramsar site which is also one of four component fen sites that comprise Fenland SAC. Construction at River crossings have the potential to result in ingress of pollutants and increase sedimentation in the river, but it is noted that that Chippenham Fen is located upstream of the river crossing, therefore no impacts on the Chippenham Fen Ramsar site are likely to occur. Fenland SAC is composed of Chippenham Fen and Snailwells Poor Fen, Wicken Fen and Woodwalton Fen, the latter two fens sites being significantly removed and having no hydrological connection to the Fens Reservoir option. Therefore, no significant effects are considered likely for Fenland SAC. Construction at river crossings should always be sensitively planned following good practice guidelines for pollution control but are not expected to result in any adverse effects on Habitats Sites as a result of this option.

Regarding the construction of the two WTWs required for this option, the WWRZ5 Hub WTW will be significantly removed from any Habitats Site (>10km), therefore any disturbance effects or impacts from excavation works affecting groundwater bodies are not considered.

For the proposed Fenland WTW, Breckland SPA is in the impact zone of the indicative location, positioned on the eastern bank of the River Little Ouse. Given its location, the option is unlikely to be close enough for construction-related disturbance effects to be considered. The only realistic impacts could be from temporary changes to the water table as a result of excavation and dewatering works during construction of the WTW or temporary contamination of the River Little Ouse which flows directly adjacent to the boundary of the Breckland SPA. The site

qualifies as a SPA based on the presence of breeding bird species associated with terrestrial habitats, therefore it is not considered that temporary changes to the watercourse or the water table will result in any negative impacts on the integrity of this SPA. As for all options, it is reasonably assumed that potential pollution events affecting waterbodies can be easily mitigated through the application of standard good-practice measures for pollution control, as detailed in Section 3.4. It should be noted that there are a number of other Habitats Sites in the region of the proposed Fens Reservoir; therefore if the location of the associated WTW (which is part of this A2AT SRO) were to change greatly from the indicative location, there may be a requirement to consider potential impact pathways to the Ouse Washes SPA/Ramsar site/SAC, Nene Washes SPA/Ramsar site/SAC and Fenland SAC. The HRA Stage 1 screening assessment for the A2AT Fens Reservoir option should be readdressed at Gate 2 once the exact location of the WTW is defined.

3.8.3.2 Operation

The Fens Reservoir option will transfer water from the proposed Fens Reservoir, the operation of which is outside the scope of this HRA. It is assumed that any new water source to stock the new reservoir will be appropriately consented and no inter-basin transfers to surface or groundwater bodies will affect Habitats Sites. The Fens Reservoir SRO will undergo its own HRA assessment for construction and operation.

Raw water transfers always introduce a risk of spreading invasive species if present at the abstraction source, but as the Fens Reservoir option includes immediate treatment at the SLR WTW, it is assumed that INNS will be eliminated during treatment and the risk of future invasion by INNS is considered low overall. Regardless of the presence of INNS at source, there are no Habitats Sites directly linked to the WRZ5 Hub where the transfer terminates. Therefore there is confidence that the risk of INNS spread to Habitats Sites as a result of operation of this and all A2AT options is low and therefore not considered further in this HRA assessment.

3.8.4 Summary of the Fens Reservoir option Appropriate Assessment

Based on the current indicative design, no significant adverse effects resulting from the implementation of this option are reasonably foreseeable on the integrity of the following Habitats Sites as there are no pathways by which a reasonable Likely Significant Effect could occur:

- Chippenham Fen Ramsar site;
- Fenland SAC; and,
- Breckland SPA.

It should be noted that the location of the Fens Reservoir WTW is indicative at this stage, therefore a HRA Stage 1 screening assessment should be readdressed at Gate 2 to consider pathways to other Habitats Sites in the region once the exact location of the WTW is defined.

4 Conclusions

Four options for the Anglian to Affinity Transfer have been subject to a HRA Stage 1 screening assessment. Subsequently, a HRA Stage 2 Appropriate Assessment (plan stage) has been undertaken.

The Appropriate Assessment undertaken for the Fens Reservoir option did not identify any transmission pathways by which a Likely Significant Effect could reasonably occur. No key risks to Habitats Sites were identified during construction or operation of this option.

The Appropriate Assessment undertaken for the SLR to Preston option identified a transmission pathway to the Nene Washes SPA/Ramsar site/SAC where the pipeline is required to cross the River Nene, but concluded that no significant adverse effects on the integrity of the Habitats Site are foreseeable if the following mitigation measures are observed;

- Directional drilling or other non-disruptive construction under the River Nene to avoid direct impacts on waterbody;
- standard best-practice applied to ensure no construction-related pollution of the waterbody or spread of INNS; and
- Strategy to limit contamination from accidental pipeline failure at River Nene crossing.

For the River Trent option, significant adverse effects have been identified on the Humber Estuary Ramsar site/SAC and Rutland Water SPA/Ramsar site which have not been resolved at this stage.

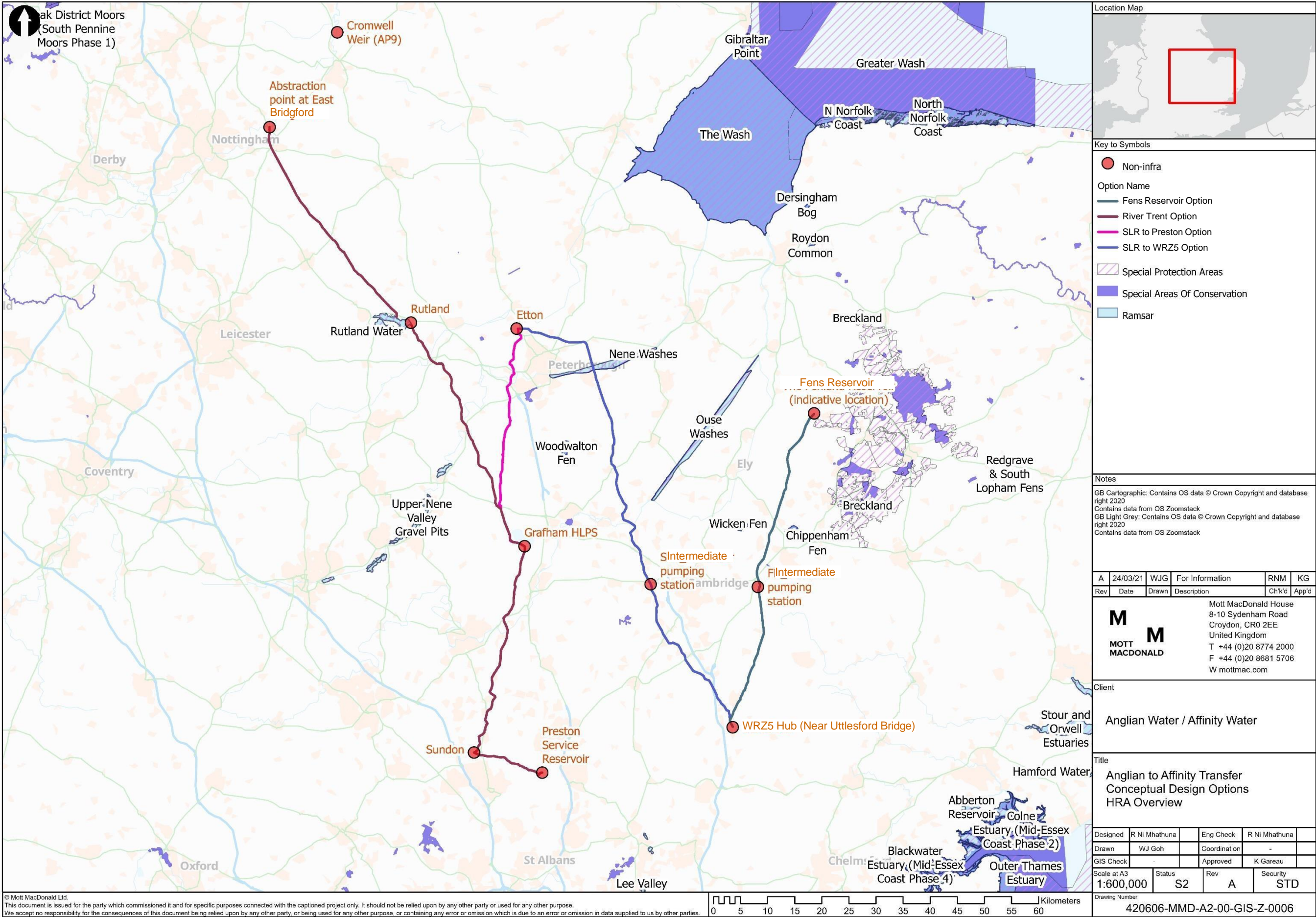
- For the Humber Estuary, residual impacts have been identified from the potential reduction in flows on the River Trent as a result of the new licenced abstraction at East Bridgford affecting the behaviour of river and sea lamprey. Further hydrological modelling is required to understand the impact of abstraction on surface water levels and flows and a full investigation into the indirect impacts on migratory fish behaviour is required.
- For Rutland Water SPA/Ramsar site, residual effects have been identified during construction of the pipeline, pumping station and new WTW in and directly adjacent to the reservoir which will require further noise and hydrogeological investigation to ensure construction-related effects are negated. Relocating the pumping station and WTW at least 500m from the boundary of Rutland Water is recommended to reduce the significance of construction-related disturbance, especially from visual and noise impacts. A hydrological modelling assessment will also be required to understand the impact of the alteration in abstraction regime on surface water levels in the reservoir and the indirect impact this will have on usable habitat to qualifying bird species.
- A project-stage HRA will be required to address these impacts fully.

For the SLR to WRZ5 Hub option significant adverse effects on the Nene Washes SPA/Ramsar site /SAC have been identified which have not been fully resolved at this stage. The effects relate to the location of the pipeline corridor within the boundary of the designated site and the consequential indirect impacts on habitats and qualifying bird and fish species as a result of construction activities and potential pollution events during operation. In order to avoid onerous further assessment where there is uncertainty in the outcome, it is recommended that consideration be given to rerouting the pipeline corridor to avoid the Nene Washes altogether at this stage. If this is not possible, further investigation of the impacts through a detailed project-stage HRA, informed by baseline surveys, and further hydrological and noise assessments will be required.

As options develop, should adverse effects on the integrity of the designated sites remain, the options would need to be granted derogation. Derogation would only be granted if the proposal passed three legal tests, i.e. where there are no feasible alternative solutions that would be less damaging or avoid damage to the site, where the proposal needs to be carried out for imperative reasons of overriding public interest, and where the necessary compensatory measures can be secured.

It should be noted that at this stage an in-combination assessment to identify potential cumulative effects of A2AT options with other non-related plans or projects has not been conducted. An in-combination assessment would not be considered proportionate at this stage, due to the early stages of the plan, and the consequential lack of further design details on A2AT and other SROs that is available. An updated HRA will be conducted at Gate 2 to include an in-combination assessment of the options within A2AT, between different SROs and between any other external plans or projects that may put pressure on the same water resources. As A2AT develops, it is assumed that any potential significant effects on Habitats Sites due to individual options, or in-combination effects will be avoided as far as reasonably possible.

A. Map: A2AT HRA Overview



B. Stage 1 HRA Screening Results for A2AT

The Stage 1 HRA outputs are available on the South Lincs Reservoir Community SharePoint site here:

<https://anglianwater.sharepoint.com/:f:/r/sites/fcmSouthLincsReservoir/Shared%20Documents/A2AT/Gate%201%20submission%20-%20ready%20for%20review/02%20Environmental%20Assessment%20Report/Stage%201%20Environmental%20Assessments/HRA?csf=1&web=1&e=5zsZpk>

The outputs can be provided as digital files upon request.

C. Designated Site Information

C.1 Breckland SPA

C.1.1 Conservation Objectives

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;

- The extent and distribution of the habitats of the qualifying features
- The structure and function of the habitats of the qualifying features
- The supporting processes on which the habitats of the qualifying features rely
- The population of each of the qualifying features, and,
- The distribution of the qualifying features within the site.

C.1.2 Qualifying Features

During the breeding season the area regularly supports:

- *Burhinus oedichenus* (Western Europe - breeding) 60.1% of the GB breeding population 5-year mean (1994-98)
- *Caprimulgus europaeus* 12.2% of the GB breeding population Count as at 1998
- *Lullula arborea* 28.7% of the GB breeding population Count as at 1997.

C.1.3 Vulnerabilities

The following are the prioritised issues for the site and the features they affect:

- Lack of ground disturbance is a pressure on A133(B) Stone curlew, A246(B) Woodlark, H2330 Open grassland with grey-hair grass and common bent grass of inland dunes, H4030 European dry heaths, H6210 Dry grasslands and scrublands on chalk or limestone (important orchid sites)
- Undergrazing is a pressure on A133(B) Stone curlew, A246(B) Woodlark, H4030 European dry heaths, H6210 Dry grasslands and scrublands on chalk or limestone (important orchid sites)
- Forestry and woodland management are a threat to A224(B) European nightjar, A246(B) Woodlark
- Water pollution is a pressure on H3150 Naturally nutrient-rich lakes or lochs which are often dominated by pondweed
- Changes in species distribution is a pressure / threat to H2330 Open grassland with grey-hair grass and common bent grass of inland dunes, H4030 European dry heaths, H6210 Dry grasslands and scrublands on chalk or limestone (important orchid sites)
- Changes in species distribution is a pressure to H2330 Open grassland with grey-hair grass and common bent grass of inland dunes, H4030 European dry heaths, H6210 Dry grasslands and scrublands on chalk or limestone (important orchid sites)
- Stone curlew monitoring and intervention is a threat to A133(B) Stone curlew
- Planning permission: general is a pressure to A133(B) Stone curlew, A224(B) European nightjar, A246(B) Woodlark
- Monitoring is a threat to A133(B) Stone curlew
- Air pollution: impact of atmospheric nitrogen deposition is a threat to A133(B) Stone curlew, A246(B) Woodlark, H2330 Open grassland with grey-hair grass and common

bent grass of inland dunes, H4030 European dry heaths, H6210 Dry grasslands and scrublands on chalk or limestone (important orchid sites)

- Public access / disturbance is a threat to A224(B) European nightjar, A246(B) Woodlark
- Climate change is a threat to A133(B) Stone curlew, A246(B) Woodlark, H2330 Open grassland with grey-hair grass and common bent grass of inland dunes, H4030 European dry heaths, H6210 Dry grasslands and scrublands on chalk or limestone (important orchid sites)
- Changes in species distributions is a pressure on H4030 European dry heaths
- Inappropriate scrub control is a pressure on A133(B) Stone curlew, A246(B) Woodlark, H4030 European dry heaths, H6210 Dry grasslands and scrublands on chalk or limestone (important orchid sites)
- Inappropriate management practices are a pressure on A133(B) Stone curlew, A246(B) Woodlark, H4030 European dry heaths, H6210 Dry grasslands and scrublands on chalk or limestone (important orchid sites)
- Habitat fragmentation is a threat to H2330 Open grassland with grey-hair grass and common bent grass of inland dunes, H4030 European dry heaths, H6210 Dry grasslands and scrublands on chalk or limestone (important orchid sites)
- Inappropriate weed control is a pressure / threat to A133(B) Stone curlew, A246(B) Woodlark, H2330 Open grassland with grey-hair grass and common bent grass of inland dunes, H4030 European dry heaths, H6210 Dry grasslands and scrublands on chalk or limestone (important orchid sites)
- Inappropriate pest control is a threat to A133(B) Stone curlew, A224(B) European nightjar, A246(B) Woodlark
- Changes in species distribution is a pressure on H2330 Open grassland with grey-hair grass and common bent grass of inland dunes
- Inappropriate cutting / mowing is a pressure to H6210 Dry grasslands and scrublands on chalk or limestone (important orchid sites).

C.2 Fenland SAC

C.2.1 Conservation Objectives

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring:

- The extent and distribution of qualifying natural habitats and habitats of qualifying species;
- The structure and function (including typical species) of qualifying natural habitats;
- The structure and function of the habitats of qualifying species;
- The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely;
- The populations of qualifying species; and
- The distribution of qualifying species within the site.

C.2.2 Qualifying Features

Annex I habitats that are a primary reason for selection of this site:

6410 *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinia caerulea*)

Fenland contains, particularly at Chippenham Fen, one of the most extensive examples of the tall herb-rich East Anglian type of M24 *Molinia caerulea* – *Cirsium dissectum* fen-meadow. It is

important for the conservation of the geographical and ecological range of the habitat type, as this type of fen-meadow is rare and ecologically distinctive in East Anglia.

7210 Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* * Priority feature

The individual sites within Fenland cSAC each hold large areas of calcareous fens, with a long and well-documented history of regular management. There is a full range from species-poor *Cladium*-dominated fen to species-rich fen with a lower proportion of *Cladium* and containing such species as black bog-rush *Schoenus nigricans*, tormentil *Potentilla erecta* and meadow thistle *Cirsium dissectum*. There are good transitions to purple moor-grass *Molinia caerulea* and rush pastures, all set within a mosaic of reedbeds and wet pastures.

Annex II species present as a qualifying feature, but not a primary reason for site selection:

1149 Spined loach *Cobitis taenia*

1166 Great crested newt *Triturus cristatus*

C.2.3 Vulnerabilities

The following are the prioritised issues for the site and the features they affect:

- Water pollution is a pressure on H6410 Purple moor-grass meadows, H7210 Calcium-rich fen dominated by great fen sedge (saw sedge), S1166 Great crested newt;
- Hydrological changes are a threat to H6410 Purple moor-grass meadows, H7210 Calcium-rich fen dominated by great fen sedge (saw sedge), S1166 Great crested newt;
- Water pollution is a pressure / threat to H6410 Purple moor-grass meadows, H7210 Calcium-rich fen dominated by great fen sedge (saw sedge);
- Hydrological changes are a pressure / threat to H6410 Purple moor-grass meadows, H7210 Calcium-rich fen dominated by great fen sedge (saw sedge);
- Air pollution: impact of atmospheric nitrogen deposition is a pressure / threat to H6410 Purple moor-grass meadows, H7210 Calcium-rich fen dominated by great fen sedge (saw sedge).

C.3 Chippenham Fen Ramsar

C.3.1 Conservation Objectives

No information available.

C.3.2 Qualifying Features

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 *Selinum carvifolia*.

C.3.3 Vulnerabilities

Adverse factors affecting the ecological character of the site:

- Water diversion for irrigation / domestic / industrial use off-site.

C.4 Wicken Fen Ramsar

C.4.1 Conservation Objectives

No information available.

C.4.2 Qualifying Features

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.

Ramsar criterion 2

The site supports one species of British Red Data Book plant, fen violet *Viola persicifolia*, which survives at only two other sites in Britain. It also contains eight nationally scarce plants and 121 British Red Data Book invertebrates.

C.4.3 Vulnerabilities

Adverse factors affecting the ecological character of the site:

- Reservoir / barrage / dam impact: flooding on and off-site.

C.5 Devil's Dyke SAC

C.5.1 Conservation Objectives

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

- The extent and distribution of qualifying natural habitats
- The structure and function (including typical species) of qualifying natural habitats, and
- The supporting processes on which qualifying natural habitats rely

C.5.2 Qualifying Features

Annex I habitats that are a primary reason for selection of this site;

6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites)

C.5.3 Vulnerabilities

The following are the prioritised issues for the site and the features they affect:

- Inappropriate scrub control is a pressure / threat to H6210 Dry grasslands and scrublands on chalk or limestone (important orchid sites)
- Air pollution: risk of atmospheric nitrogen deposition is a threat to H6210 Dry grasslands and scrublands on chalk or limestone (important orchid sites).

C.6 Nene Washes Ramsar

C.6.1 Conservation Objectives

No information available.

C.6.2 Qualifying Features

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.

Ramsar criterion 6 – species/populations occurring at levels of international importance

Qualifying Species/populations (as identified at designation): Species with peak counts in winter: Tundra swan, *Cygnus columbianus bewickii*, NW Europe 694 individuals, representing an average of 2.3% of the population (5 year peak mean 1998/9- 2002/3).

Species/populations identified subsequent to designation for possible future consideration under criterion 6. Species with peak counts in spring/autumn: Black-tailed godwit, *Limosa limosa islandica*, Iceland/W Europe 482 individuals, representing an average of 1.3% of the population (5 year peak mean 1998/9- 2002/3 - spring peak) **Species with peak counts in winter:** Northern pintail, *Anas acuta*, NW Europe 1848 individuals, representing an average of 3% of the population (5 year peak mean 1998/9- 2002/3).

C.6.3 Vulnerabilities

No factors adversely affecting the ecological character of the site.

C.7 Nene Washes SPA

C.7.1 Conservation Objectives

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;

- The extent and distribution of the habitats of the qualifying features
- The structure and function of the habitats of the qualifying features
- The supporting processes on which the habitats of the qualifying features rely
- The population of each of the qualifying features, and,
- The distribution of the qualifying features within the site.

C.7.2 Qualifying Features

The site qualifies under Article 4.1 of the EC Birds Directive by regularly supporting, in winter, an internationally important wintering population of Bewick's swan *Cygnus columbarius bewickii* (1,300 individuals: over 7% of the north-west European population wintering population: average of peak counts for the five year period 1987/88 to 1991/92).

Nene Washes qualifies also under Article 4.2 by supporting, in summer, in recent years, nationally important breeding populations of regularly occurring migratory species: 25 pairs of gadwall *Anas strepera* (5% of British); five pairs of garganey *Anas querquedula* (10% of British), 36 pairs of shoveler *A. clypeata* (3% of British), and 16 pairs of black-tailed godwits *Limosa limosa* (30% of British), as well as several other rare birds.

The site further qualifies under Article 4.2 by supporting, in winter, nationally important wintering populations of five migratory species (average peak counts for the most recent five year period for which data is available (1984/5 - 1985/86 and 1988/89 - 1990/91): 3,640 wigeon *Anas penelope* (over 1 % of the British wintering population); 980 teal *A. crecca* (1% of British), 95 gadwall *Anas strepera* (over 1% of British); 440 Pintail *Anas acuta* (over 1% of British) and 110 shoveler *Anas clypeata* (over 1% of British).

C.7.3 Vulnerabilities

The following are the prioritised issues for the site and the features they affect:

- Hydrological changes are a threat to A037(NB) Bewick's Swan, A050(NB) Wigeon, A051(B) Gadwall, A051(NB) Gadwall, A052(NB) Eurasian teal, A054(NB) Pintail, A055(B) Garganey, A056(B) Shoveler, A056(NB) Shoveler, A119(B) Spotted Crake, A151(B) Ruff, A151(NB) Ruff, A156a(B) Black-tailed Godwit, Waterbird assemblage;
- Water pollution is a threat to S1149 Spined loach.

C.8 Nene Washes SAC

C.8.1 Conservation Objectives

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

- The extent and distribution of the habitats of qualifying species
- The structure and function of the habitats of qualifying species
- The supporting processes on which the habitats of qualifying species rely
- The populations of qualifying species, and,
- The distribution of qualifying species within the site.

C.8.2 Qualifying Features

Annex II species that are a primary reason for selection of this site: Spined loach *Cobitis taenia*.

C.8.3 Vulnerabilities

The following are the prioritised issues for the site and the features they affect:

- Hydrological changes are a threat to A037(NB) Bewick's Swan, A050(NB) Wigeon, A051(B) Gadwall, A051(NB) Gadwall, A052(NB) Eurasian teal, A054(NB) Pintail, A055(B) Garganey, A056(B) Shoveler, A056(NB) Shoveler, A119(B) Spotted Crake, A151(B) Ruff, A151(NB) Ruff, A156a(B) Black-tailed Godwit, Waterbird assemblage;

- Water pollution is a threat to S1149 Spined loach.

C.9 Barnack Hills & Holes SAC

C.9.1 Conservation Objectives

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

- The extent and distribution of qualifying natural habitats
- The structure and function (including typical species) of qualifying natural habitats, and
- The supporting processes on which qualifying natural habitats rely

C.9.2 Qualifying Features

Annex I habitats that are a primary reason for selection of this site; Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites).

C.9.3 Vulnerabilities

The following are the prioritised issues for the site and the features they affect:

- Changes in species distributions is a threat to H6210 Dry grasslands and scrublands on chalk or limestone (important orchid sites)
- Public access / disturbance is a pressure to H6210 Dry grasslands and scrublands on chalk or limestone (important orchid sites)
- Air pollution: impact of atmospheric nitrogen deposition is a threat to H6210 Dry grasslands and scrublands on chalk or limestone (important orchid sites).

C.10 Baston Fen SAC

C.10.1 Conservation Objectives

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring; The extent and distribution of the habitats of qualifying species

- The structure and function of the habitats of qualifying species
- The supporting processes on which the habitats of qualifying species rely
- The populations of qualifying species, and,
- The distribution of qualifying species within the site.

C.10.2 Qualifying Features

Annex II species that are a primary reason for selection of this site; Spined loach *Cobitis taenia*.

C.10.3 Vulnerabilities

The following are the prioritised issues for the site and the features they affect:

- Situation is a threat to S1149 Spined loach
- Changes in species distribution is a threat to S1149 Spined loach.

C.11 Orton Pits SAC

C.11.1 Conservation Objectives

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring:

- The extent and distribution of qualifying natural habitats and habitats of qualifying species
- The structure and function (including typical species) of qualifying natural habitats
- The structure and function of the habitats of qualifying species
- The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely
- The populations of qualifying species, and,
- The distribution of qualifying species within the site.

C.11.2 Qualifying Features

Annex I habitats that are a primary reason for selection of this site: Hard oligo-mesotrophic waters with benthic vegetation of *Chara spp.*

Annex II species that are a primary reason for selection of this site: Great crested newt *Triturus cristatus*.

C.11.3 Vulnerabilities

The following are the prioritised issues for the site and the features they affect:

- Predation threat to S1166 Great crested newt;
- Inappropriate scrub control is a threat to H3140 Calcium-rich nutrient-poor lakes, lochs and pools, and S1166 Great crested newt;
- Inappropriate weed control is a threat to H3140 Calcium-rich nutrient-poor lakes, lochs and pools;
- Direct impact from 3rd party is a threat to S1166 Great crested newt;
- Disease is a threat to S1166 Great crested newt.

C.12 Woodwalton Fen Ramsar

C.12.1 Conservation Objectives

No information available.

C.12.2 Qualifying Features

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.

Ramsar criterion 2

The site supports two species of British Red Data Book plants, fen violet, *Viola persicifolia* and fen wood-rush *Luzula pallidula*. 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.

C.12.3 Vulnerabilities

Adverse factors affecting the ecological character of the site:

- Vegetation succession on and off-site;
- Drainage / land-claim for agriculture off-site;
- Eutrophication on and off-site.

C.13 Portholme SAC

C.13.1 Conservation Objectives

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

- The extent and distribution of qualifying natural habitats
- The structure and function (including typical species) of qualifying natural habitats, and
- The supporting processes on which qualifying natural habitats rely.

C.13.2 Qualifying Features

Annex I habitats that are a primary reason for selection of this site: Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*).

C.13.3 Vulnerabilities

The following are the prioritised issues for the site and the features they affect:

- Inappropriate water levels are a threat to H6510 Lowland hay meadows
- Water pollution is a threat to H6510 Lowland hay meadows.

C.14 Ouse Washes Ramsar

C.14.1 Conservation Objectives

No information available.

C.14.2 Qualifying Features

Ramsar criterion 1

The site is one of the most extensive areas of seasonally-flooding washland of its type in Britain.

Ramsar criterion 2

The site supports several nationally scarce plants, including small water pepper *Polygonum minus*, whorled water-milfoil *Myriophyllum verticillatum*, greater water parsnip *Sium latifolium*, river waterdropwort *Oenanthe fluviatilis*, fringed water-lily *Nymphoides peltata*, long-stalked pondweed *Potamogeton praelongus*, hair-like pondweed *Potamogeton trichoides*, grass-wrack pondweed *Potamogeton compressus*, tasteless water-pepper *Polygonum mite* and marsh dock *Rumex palustris*.

Invertebrate records indicate that the site holds relict fenland fauna, including the British Red Data Book species large darter dragonfly *Libellula fulva* and the rifle beetle *Oulimnius major*. The site also supports a diverse assemblage of nationally rare breeding waterfowl associated with seasonally-flooding wet grassland.

Ramsar criterion 5 - Assemblages of international importance:

Species with peak counts in winter: 59133 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 winter:

Tundra swan, *Cygnus columbianus bewickii*, NW Europe 1140 individuals, representing an average of 3.9% of the population (5 year peak mean 1998/9-2002/3)

Whooper swan, *Cygnus cygnus*, Iceland/UK/Ireland 653 individuals, representing an average of 3.1% of the population (5-year peak mean 1998/9- 2002/3)

Eurasian wigeon, *Anas penelope*, NW Europe 22630 individuals, representing an average of 1.5% of the population (5 year peak mean 1998/9-2002/3)

Gadwall, *Anas strepera strepera*, NW Europe 438 individuals, representing an average of 2.5% of the GB population (5 year peak mean 1998/9- 2002/3)

Eurasian teal, *Anas crecca*, NW Europe 3384 individuals, representing an average of 1.7% of the GB population (5 year peak mean 1998/9-2002/3)

Northern pintail, *Anas acuta*, NW Europe 2108 individuals, representing an average of 3.5% of the population (5 year peak mean 1998/9-2002/3)

Northern shoveler, *Anas clypeata*, NW & C Europe 627 individuals, representing an average of 1.5% of the population (5 year peak mean 1998/9- 2002/3)

Species/populations identified subsequent to designation for possible future consideration under criterion 6.

Species with peak counts in winter:

Mute swan, *Cygnus olor*, Britain 722 individuals, representing an average of 1.9% of the population (5 year peak mean 1998/9- 2002/3)

Common pochard, *Aythya ferina*, NE & NW 4678 individuals, representing an average of 1.3% of the population (5 year peak mean 1998/9-2002/3)

Black-tailed godwit, *Limosa limosa islandica*, Iceland/W Europe 2647 individuals, representing an average of 7.5% of the population (5 year peak mean 1998/9-2002/3).

C.14.3 Vulnerabilities

Factors adversely affecting the ecological character of the site:

- Vegetation succession on-site;
- Eutrophication on-site;
- Reservoir / barrage / dam impact: flooding on-site.

C.15 Ouse Washes SPA

C.15.1 Conservation Objectives

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;

- The extent and distribution of the habitats of the qualifying features

- The structure and function of the habitats of the qualifying features
- The supporting processes on which the habitats of the qualifying features rely
- The population of each of the qualifying features, and,
- The distribution of the qualifying features within the site.

C.15.2 Qualifying Features

The Ouse Washes qualifies under Article 4.2 by supporting, in summer, in recent years, nationally important breeding populations of five migratory species. 111 pairs of gadwall *Anas strepera* (20% of the British breeding population); 850 pairs of mallard *Anas platyrhynchos* (2% of British); 14 pairs of garganey *Anas querquedula* (20% of British). 155 pairs of shoveler *A. clypeata* (12% of British), and 26 pairs of black-tailed godwits *Limosa limosa* (44% of British).

C.15.3 Vulnerabilities

The following are the prioritised issues for the site and the features they affect:

- Inappropriate water levels are a pressure on A050(NB) Wigeon, A056(B) Shoveler, A119(B) Spotted Crake, A151(B) Ruff, A156a(B) Black-tailed Godwit;
- Water pollution is a threat to A037(NB) Bewick's Swan, A038(NB) Whooper Swan, A050(NB) Wigeon, A051(B) Gadwall, A051(NB) Gadwall, A052(NB) Eurasian teal, A053(B) Mallard, A054(NB) Pintail, A055(B) Garganey, A056(B) Shoveler, A056(NB) Shoveler, A059(NB) Common pochard, A082(NB) Hen Harrier, A119(B) Spotted Crake, A151(B) Ruff, A151(NB) Ruff, A156a(B) Blacktailed Godwit, A156a(NB) Black-tailed Godwit, Breeding bird assemblage, S1149 Spined loach, Waterbird assemblage.

C.16 Ouse Washes SAC

C.16.1 Conservation Objectives

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

- The extent and distribution of the habitats of qualifying species
- The structure and function of the habitats of qualifying species
- The supporting processes on which the habitats of qualifying species rely
- The populations of qualifying species, and,
- The distribution of qualifying species within the site.

C.16.2 Qualifying Features

Annex II species that are a primary reason for selection of this site: Spined loach *Cobitis taenia*.

C.16.3 Vulnerabilities

The following are the prioritised issues for the site and the features they affect:

- Inappropriate water levels are a pressure on A050(NB) Wigeon, A056(B) Shoveler, A119(B) Spotted Crake, A151(B) Ruff, A156a(B) Black-tailed Godwit;
- Water pollution is a threat to A037(NB) Bewick's Swan, A038(NB) Whooper Swan, A050(NB) Wigeon, A051(B) Gadwall, A051(NB) Gadwall, A052(NB) Eurasian teal, A053(B) Mallard, A054(NB) Pintail, A055(B) Garganey, A056(B) Shoveler, A056(NB) Shoveler, A059(NB) Common pochard, A082(NB) Hen Harrier, A119(B) Spotted Crake,

A151(B) Ruff, A151(NB) Ruff, A156a(B) Blacktailed Godwit, A156a(NB) Black-tailed Godwit, Breeding bird assemblage, S1149 Spined loach, Waterbird assemblage.

C.17 Eversden and Wimpole Woods SAC

C.17.1 Conservation Objectives

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

- The extent and distribution of the habitats of qualifying species
- The structure and function of the habitats of qualifying species
- The supporting processes on which the habitats of qualifying species rely
- The populations of qualifying species, and,
- The distribution of qualifying species within the site.

C.17.2 Qualifying Features

Annex II species that are a primary reason for selection of this site: Barbastelle *Barbastella barbastellus*.

C.17.3 Vulnerabilities

The following are the prioritised issues for the site and the features they affect:

- Feature location / extent / condition unknown is a pressure / threat to S1308 Barbastelle bat
- Offsite habitat availability / management is a pressure / threat to S1308 Barbastelle bat
- Forestry and woodland management are a threat to S1308 Barbastelle bat
- Air pollution: impact of atmospheric nitrogen deposition is a pressure to S1308 Barbastelle bat.

C.18 Rutland Water SPA

C.18.1 Conservation Objectives

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;

- The extent and distribution of the habitats of the qualifying features
- The structure and function of the habitats of the qualifying features
- The supporting processes on which the habitats of the qualifying features rely
- The population of each of the qualifying features, and,
- The distribution of the qualifying features within the site.

C.18.2 Qualifying Features

Qualifying individual species not listed in Annex I of the Wild Birds Directive (Article 4.2): Gadwall *Anas strepera* and Northern Shoveler *Anas clypeata*.

C.18.3 Vulnerabilities

The following are the prioritised issues for the site and the features they affect:

- Water abstraction is a threat to A005(NB) Great Crested Grebe, A036(NB) Mute swan, A050(NB) Wigeon, A051(NB) Gadwall, A052(NB) Eurasian teal, A056(NB) Shoveler,

- A061(NB) Tufted Duck, A067(NB) Goldeneye, A070(NB) Goosander, A125(NB) Common coot, Waterbird assemblage
- Inappropriate water levels are a threat to A005(NB) Great Crested Grebe, A036(NB) Mute swan, A050(NB) Wigeon, A051(NB) Gadwall, A052(NB) Eurasian teal, A056(NB) Shoveler, A061(NB) Tufted Duck, A067(NB) Goldeneye, A070(NB) Goosander, A125(NB) Common coot, Waterbird assemblage
 - Direct impact from 3rd party is a threat to A005(NB) Great Crested Grebe, A036(NB) Mute swan, A050(NB) Wigeon, A051(NB) Gadwall, A052(NB) Eurasian teal, A056(NB) Shoveler, A061(NB) Tufted Duck, A067(NB) Goldeneye, A070(NB) Goosander, A125(NB) Common coot, Waterbird assemblage
 - Invasive species are a threat to A005(NB) Great Crested Grebe, A036(NB) Mute swan, A050(NB) Wigeon, A051(NB) Gadwall, A052(NB) Eurasian teal, A056(NB) Shoveler, A061(NB) Tufted Duck, A067(NB) Goldeneye, A070(NB) Goosander, A125(NB) Common coot, Waterbird assemblage
 - Water pollution is a threat to A005(NB) Great Crested Grebe, A036(NB) Mute swan, A050(NB) Wigeon, A051(NB) Gadwall, A052(NB) Eurasian teal, A056(NB) Shoveler, A061(NB) Tufted Duck, A067(NB) Goldeneye, A070(NB) Goosander, A125(NB) Common coot, Waterbird assemblage
 - Planning permission: general is a threat to A005(NB) Great Crested Grebe, A036(NB) Mute swan, A050(NB) Wigeon, A051(NB) Gadwall, A052(NB) Eurasian teal, A056(NB) Shoveler, A061(NB) Tufted Duck, A067(NB) Goldeneye, A070(NB) Goosander, A125(NB) Common coot, Waterbird assemblage
 - Public access / disturbance is a threat to A005(NB) Great Crested Grebe, A036(NB) Mute swan, A050(NB) Wigeon, A051(NB) Gadwall, A052(NB) Eurasian teal, A056(NB) Shoveler, A061(NB) Tufted Duck, A067(NB) Goldeneye, A070(NB) Goosander, A125(NB) Common coot, Waterbird assemblage
 - Fisheries: freshwater is a threat to A005(NB) Great Crested Grebe, A036(NB) Mute swan, A050(NB) Wigeon, A051(NB) Gadwall, A052(NB) Eurasian teal, A056(NB) Shoveler, A061(NB) Tufted Duck, A067(NB) Goldeneye, A070(NB) Goosander, A125(NB) Common coot, Waterbird assemblage.

C.19 Rutland Water Ramsar

C.19.1 Conservation Objectives

No information available.

C.19.2 Qualifying Features

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:

Gadwall, *Anas strepera strepera*, NW Europe 1014 individuals, representing an average of 1.6% of the population (5 year peak mean 1998/9-2002/3)

Northern shoveler, *Anas clypeata*, NW & C Europe 619 individuals, representing an average of 1.5% of the population (5 year peak mean 1998/9- 2002/3)

Species/populations identified subsequent to designation for possible future consideration under criterion 6. Species with peak counts in spring/autumn:

Mute swan, *Cygnus olor*, Britain 563 individuals, representing an average of 1.5% of the population (5 year peak mean 1998/9- 2002/3).

C.19.3 Vulnerabilities

No factors adversely affecting the ecological character of the site.

C.20 Upper Nene Valley Gravel Pits SPA

C.20.1 Conservation Objectives

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;

- The extent and distribution of the habitats of the qualifying features
- The structure and function of the habitats of the qualifying features
- The supporting processes on which the habitats of the qualifying features rely
- The population of each of the qualifying features, and,
- The distribution of the qualifying features within the site.

C.20.2 Qualifying Features

The site qualifies under article 4.1 of the Directive (Directive 2009/147/EC) as it is used regularly by 1% or more of the Great Britain populations of the following species listed in Annex I in any season: Bittern *Botaurus stellaris* and golden plover *Pluvialis apricaria*.

The site qualifies under article 4.2 of the Directive (Directive 2009/147/EC) as it is used regularly by 1% or more of the biogeographical populations of the following regularly occurring migratory species (other than those listed in Annex I) in any season: Gadwall *Anas strepera*.

C.20.3 Vulnerabilities

The following are the prioritised issues for the site and the features they affect:

- Public access / disturbance is a threat to A021(NB) Bittern, A051(NB) Gadwall, A140(NB) Golden Plover, Waterbird assemblage
- Planning permission: general is a threat to A021(NB) Bittern, A051(NB) Gadwall, A140(NB) Golden Plover, Waterbird assemblage
- Fisheries: freshwater is a threat to A021(NB) Bittern, A051(NB) Gadwall, A140(NB) Golden Plover, Waterbird assemblage.
- Change in land management is a threat to A021(NB) Bittern, A051(NB) Gadwall, A140(NB) Golden Plover, Waterbird assemblage.

C.21 Upper Nene Valley Gravel Pits Ramsar

C.21.1 Conservation Objectives

No information available.

C.21.2 Qualifying Features

Criterion 5

The site 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).

Criterion 6

The site regularly supports 1% of the individuals in the populations of the following species or subspecies of waterbird in any season: Mute swan *Cygnus olor* and gadwall *Anas strepera*.

C.21.3 Vulnerabilities

Factors adversely affecting the ecological character of the site:

- Unspecified development: urban use off-site
- Vegetation succession on-site
- Introduction / invasion of non-native plant species on-site
- Recreation / tourism disturbance on and off-site.

C.22 Humber Estuary SPA

C.22.1 Conservation Objectives

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;

- The extent and distribution of the habitats of the qualifying features
- The structure and function of the habitats of the qualifying features
- The supporting processes on which the habitats of the qualifying features rely
- The population of each of the qualifying features, and,
- The distribution of the qualifying features within the site.

C.22.2 Qualifying Features

The site qualifies under article 4.1 of the Directive (Directive 2009/147/EC) as it is used regularly by 1% or more of the Great Britain populations of the following species listed in Annex I in any season: Pied avocet *Recurvirostra avosetta*, Great bittern *Botaurus stellaris*, Hen harrier *Circus cyaneus*, European golden plover *Pluvialis apricaria*, Bar-tailed godwit *Limosa lapponica*, Ruff *Philomachus pugnax*, Eurasian marsh harrier *Circus aeruginosus*, Little tern *Sterna albifrons* (Breeding).

The site qualifies under article 4.2 of the Directive (Directive 2009/147/EC) as it is used regularly by 1% or more of the biogeographical populations of the following regularly occurring migratory species (other than those listed in Annex I) in any season: Common shelduck *Tadorna tadorna*, Red knot *Calidris canutus* (Non-breeding), Dunlin *Calidris alpina alpina* (Non-breeding), Black-tailed godwit *Limosa limosa islandica* (Non-breeding), Common redshank *Tringa totanus* (Non-breeding).

C.22.3 Vulnerabilities

The following are the prioritised issues for the site and the features they affect:

- Water pollution is a pressure / threat to A021(B) Bittern, A021(NB) Bittern, A048(NB) Common shelduck, A081(B) Marsh harrier, A082(NB) Hen harrier, A132(B) Avocet, A132(NB) Avocet, A140(NB) Golden plover, A143(NB) Red knot, A149(NB) Dunlin, A151(NB) Ruff, A156(NB) Black-tailed godwit, A157(NB) Bar-tailed godwit, A162(NB) Common redshank, A195(B) Little tern, H1130 Estuaries, H1140 Intertidal mudflats and sandflats, S1095 Sea lamprey, S1099 River lamprey, Waterbird assemblage
- Coastal squeeze is a threat to A021(B) Bittern, A021(NB) Bittern, A048(NB) Common shelduck, A081(B) Marsh harrier, A082(NB) Hen harrier, A132(B) Avocet, A132(NB) Avocet, A140(NB) Golden plover, A143(NB) Red knot, A149(NB) Dunlin, A151(NB) Ruff, A156(NB) Black-tailed godwit, A157(NB) Bar-tailed godwit, A162(NB) Common

redshank, A195(B) Little tern, H1130 Estuaries, H1140 Intertidal mudflats and sandflats, H1310 Glasswort and other annuals colonising mud and sand, H1330 Atlantic salt meadows, Waterbird assemblage

- Changes in species distribution is a threat to A021(B) Bittern, A021(NB) Bittern, A048(NB) Common shelduck, A081(B) Marsh harrier, A082(NB) Hen harrier, A132(B) Avocet, A132(NB) Avocet, A140(NB) Golden plover, A143(NB) Red knot, A149(NB) Dunlin, A151(NB) Ruff, A156(NB) Black-tailed godwit, A157(NB) Bar-tailed godwit, A162(NB) Common redshank, A195(B) Little tern, S1095 Sea lamprey, S1099 River lamprey, Waterbird assemblage
- Undergrazing is a pressure on A140(NB) Golden plover, A143(NB) Red knot, A151(NB) Ruff, A156(NB) Black-tailed godwit, A162(NB) Common redshank, H1310 Glasswort and other annuals colonising mud and sand, H1330 Atlantic salt meadows, H2110 Shifting dunes, H2120 Shifting dunes with marram, H2130 Dune grassland, H2160 Dunes with seabuckthorn, Waterbird assemblage
- Invasive species are a threat to A021(B) Bittern, A021(NB) Bittern, A048(NB) Common shelduck, A081(B) Marsh harrier, A082(NB) Hen harrier, A132(B) Avocet, A132(NB) Avocet, A140(NB) Golden plover, A143(NB) Red knot, A149(NB) Dunlin, A151(NB) Ruff, A156(NB) Black-tailed godwit, A157(NB) Bar-tailed godwit, A162(NB) Common redshank, A195(B) Little tern, H1130 Estuaries, H1330 Atlantic salt meadows, Waterbird assemblage
- Natural changes to site conditions are a pressure / threat to A021(B) Bittern, A021(NB) Bittern, A048(B) Common shelduck, A081(B) Marsh harrier, A082(NB) Hen harrier, A132(B) Avocet, A132(NB) Avocet, A140(NB) Golden plover, A143(NB) Red knot, A149(NB) Dunlin, A151(NB) Ruff, A156(NB) Black-tailed godwit, A157(NB) Bar-tailed godwit, A162(NB) Common redshank, A195(B) Little tern, H1140 Intertidal mudflats and sandflats, Waterbird assemblage
- Public access / disturbance is a pressure to A021(B) Bittern, A021(NB) Bittern, A048(NB) Common shelduck, A081(B) Marsh harrier, A082(NB) Hen harrier, A132(B) Avocet, A132(NB) Avocet, A140(NB) Golden plover, A143(NB) Red knot, A149(NB) Dunlin, A151(NB) Ruff, A156(NB) Black-tailed godwit, A157(NB) Bar-tailed godwit, A162(NB) Common redshank, A195(B) Little tern, H1130 Estuaries, H1330 Atlantic salt meadows, Waterbird assemblage
- Fisheries: fish stocking is a pressure to A021(B) Bittern, A021(NB) Bittern, A048(NB) Common shelduck, A081(B) Marsh harrier, A082(NB) Hen harrier, A132(B) Avocet, A132(NB) Avocet, A140(NB) Golden plover, A143(NB) Red knot, A149(NB) Dunlin, A151(NB) Ruff, A156(NB) Black-tailed godwit, A157(NB) Bar-tailed godwit, A162(NB) Common redshank, A195(B) Little tern, Waterbird assemblage
- Fisheries: commercial marine and estuarine is a pressure / threat to H1140 Intertidal mudflats and sandflats
- Direct land take from development is a threat to A021(B) Bittern, A021(NB) Bittern, A048(NB) Common shelduck, A081(B) Marsh harrier, A082(NB) Hen harrier, A132(B) Avocet, A132(NB) Avocet, A140(NB) Golden plover, A143(NB) Red knot, A149(NB) Dunlin, A151(NB) Ruff, A156(NB) Black-tailed godwit, A157(NB) Bar-tailed godwit, A162(NB) Common redshank, A195(B) Little tern, H1130 Estuaries, H1140 Intertidal mudflats and sandflats, Waterbird assemblage
- Air pollution: impact of atmospheric nitrogen deposition is a pressure on H1310 Glasswort and other annuals colonising mud and sand, H1330 Atlantic salt meadows, H2110 Shifting dunes, H2120 Shifting dunes with marram, H2130 Dune grassland, H2160 Dunes with sea-buckthorn
- Shooting / scaring is a pressure on A021(B) Bittern, A021(NB) Bittern, A048(NB) Common shelduck, A081(B) Marsh harrier, A082(NB) Hen harrier, A132(B) Avocet, A132(NB) Avocet, A140(NB) Golden plover, A143(NB) Red knot, A149(NB) Dunlin,

- A151(NB) Ruff, A156(NB) Black-tailed godwit, A157(NB) Bar-tailed godwit, A162(NB) Common redshank, A195(B) Little tern, Waterbird assemblage
- Direct impact from 3rd party is a threat to A021(B) Bittern, A021(NB) Bittern, A048(NB) Common shelduck, A081(B) Marsh harrier, A082(NB) Hen harrier, A132(B) Avocet, A132(NB) Avocet, A140(NB) Golden plover, A143(NB) Red knot, A149(NB) Dunlin, A151(NB) Ruff, A156(NB) Black-tailed godwit, A157(NB) Bar-tailed godwit, A162(NB) Common redshank, A195(B) Little tern, H1310 Glasswort and other annuals colonising mud and sand, Waterbird assemblage
- Inappropriate scrub control is a pressure to Change in land management is a threat to A081(B) Marsh harrier.

C.23 Humber Estuary Ramsar

C.23.1 Conservation Objectives

No information available.

C.23.2 Qualifying Features

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.

It is a large macro-tidal coastal plain estuary with high suspended sediment loads, which feed a dynamic and rapidly changing system of accreting and eroding intertidal and subtidal mudflats, sandflats, saltmarsh and reedbeds. Examples of both strandline, foredune, mobile, semi-fixed dunes, fixed dunes and dune grassland occur on both banks of the estuary and along the coast. The estuary supports a full range of saline conditions from the open coast to the limit of saline intrusion on the tidal rivers of the Ouse and Trent. Wave exposed sandy shores are found in the outer/open coast areas of the estuary. These change to the more moderately exposed sandy shores and then to sheltered muddy shores within the main body of the estuary and up into the tidal rivers. The lower saltmarsh of the Humber is dominated by common cordgrass *Spartina anglica* and annual glasswort *Salicornia* communities. Low to mid marsh communities are mostly represented by sea aster *Aster tripolium*, common saltmarsh grass *Puccinellia maritima* and sea purslane *Atriplex portulacoides* communities. The upper portion of the saltmarsh community is atypical, dominated by sea couch *Elytrigia atherica* (*Elymus pycnanthus*) saltmarsh community. In the upper reaches of the estuary, the tidal marsh community is dominated by the common reed *Phragmites australis* fen and sea club rush *Bolboschoenus maritimus* swamp with the couch grass *Elytrigia repens* (*Elymus repens*) saltmarsh community. Within the Humber Estuary Ramsar site there are good examples of four of the five physiographic types of saline lagoon.

Ramsar criterion 3

The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast. The dune slacks at Saltfleetby-Theddlethorpe on the southern extremity of the Ramsar site are the most north-easterly breeding site in Great Britain of the natterjack toad *Bufo calamita*.

Ramsar criterion 5

Assemblages of international importance: 153,934 waterfowl, non-breeding season (5 year peak mean 1996/97-2000/2001).

Ramsar criterion 6 – species/populations occurring at levels of international importance.

Eurasian golden plover, *Pluvialis apricaria altifrons* subspecies – NW Europe, W Continental Europe, NW Africa population 17,996 individuals, passage, representing an average of 2.2% of the population (5 year peak mean 1996-2000)

Red knot, *Calidris canutus islandica* subspecies 18,500 individuals, passage, representing an average of 4.1% of the population (5 year peak mean 1996-2000)

Dunlin, *Calidris alpina alpina* subspecies – Western Europe (non-breeding) population 20,269 individuals, passage, representing an average of 1.5% of the population (5 year peak mean 1996-2000)

Black-tailed godwit, *Limosa limosa islandica* subspecies 915 individuals, passage, representing an average of 2.6% of the population (5-year peak mean 1996-2000)

Common redshank, *Tringa totanus brittanica* subspecies 7,462 individuals, passage, representing an average of 5.7% of the population (5 year peak mean 1996-2000)

Common shelduck, *Tadorna tadorna* North-western Europe (breeding) population 4,464 individuals, wintering, representing an average of 1.5% of the population (5-year peak mean 1996/7-2000/1)

Eurasian golden plover, *Pluvialis apricaria altifrons* subspecies – NW Europe, W Continental Europe, NW Africa population 30,709 individuals, wintering, representing an average of 3.8% of the population (5 year peak mean 1996/7-2000/1)

Red knot, *Calidris canutus islandica* subspecies 28,165 individuals, wintering, representing an average of 6.3% of the population (5 year peak mean 1996/7-2000/1)

Dunlin, *Calidris alpina alpina* subspecies – Western Europe (non-breeding) population 22,222 individuals, wintering, representing an average of 1.7% of the population (5 year peak mean 1996/7-2000/1)

Black-tailed godwit, *Limosa limosa islandica* subspecies 1,113 individuals, wintering, representing an average of 3.2% of the population (5 year peak mean 1996/7-2000/1)

Bar-tailed godwit, *Limosa lapponica lapponica* subspecies 2,752 individuals, wintering, representing an average of 2.3% of the population (5 year peak mean 1996/7-2000/1)

Common redshank, *Tringa totanus brittanica* subspecies 4,632 individuals, wintering, representing an average of 3.6% of the population (5 year peak mean 1996/7-2000/1)

Ramsar criterion 8

The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.

Ramsar criterion 5

Assemblages of international importance:

Species with peak counts in winter: 153934 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:

European golden plover, *Pluvialis apricaria apricaria*, *P. a. altifrons* Iceland & Faroes/E Atlantic 17996 individuals, representing an average of 2.2% of the population (1996-2000)

Red knot, *Calidris canutus islandica*, W & Southern Africa (wintering) 18500 individuals, representing an average of 4.1% of the population (1996-2000)

Dunlin, *Calidris alpina alpina*, W Siberia/W Europe 20269 individuals, representing an average of 1.5% of the population (1996-2000)

Black-tailed godwit, *Limosa limosa islandica*, Iceland/W Europe 915 individuals, representing an average of 2.6% of the population (1996-2000)

Common redshank, *Tringa totanus totanus*, 7462 individuals, representing an average of 5.7% of the population (1996-2000)

Species with peak counts in winter:

Common shelduck, *Tadorna tadorna*, NW Europe 4464 individuals, representing an average of 1.5% of the population (1996/7 to 2000/1)

European golden plover, *Pluvialis apricaria apricaria*, *P. a. altifrons* Iceland & Faroes/E Atlantic 30709 individuals, representing an average of 3.8% of the population (1996/7 to 2000/1)

Red knot, *Calidris canutus islandica*, W & Southern Africa (wintering) 28165 individuals, representing an average of 6.3% of the population (1996/7 to 2000/1)

Dunlin, *Calidris alpina alpina*, W Siberia/W Europe 22222 individuals, representing an average of 1.7% of the population (1996/7 to 2000/1)

Black-tailed godwit, *Limosa limosa islandica*, Iceland/W Europe 1113 individuals, representing an average of 3.2% of the population (1996/7 to 2000/1)

Bar-tailed godwit, *Limosa lapponica lapponica*, W Palearctic 2752 individuals, representing an average of 2.3% of the population (1996/7 to 2000/1).

C.23.3 Vulnerabilities

Factors adversely affecting the ecological character of the site:

- Disturbance to vegetation through cutting / clearing on-site
- Vegetation succession on-site
- Water diversion for irrigation / domestic / industrial use on and off-site
- Overfishing off-site
- Pollution – domestic sewage on and off-site
- Pollution – agricultural fertilisers on and off-site
- Recreational / tourism disturbance (unspecified) on-site
- Other factor (coastal squeeze) on-site

C.24 Humber Estuary SAC

C.24.1 Conservation Objectives

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

- The extent and distribution of qualifying natural habitats and habitats of qualifying species
- The structure and function (including typical species) of qualifying natural habitats
- The structure and function of the habitats of qualifying species
- The supporting processes on which qualifying natural habitats and habitats of qualifying species rely
- The populations of qualifying species, and,
- The distribution of qualifying species within the site.

C.24.2 Qualifying Features

Annex I habitat that are primary reason for site selection:

Estuaries, which includes Atlantic salt meadows, subtidal sandbanks, intertidal mudflats, Salicornia and other annuals, coastal lagoons, river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus*.

Mudflats and sandflats not covered by seawater at low tide.

Annex I habitats present that are not primary season for site selection:

Sandbanks which are slightly covered by sea water all the time, coastal lagoons (priority feature), Salicornia and other annuals colonizing mud and sand, Atlantic salt meadows (*Glauco-Puccinellietalia maritima*), embryonic shifting dunes, "Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")", "Fixed coastal dunes with herbaceous vegetation ("grey dunes")" (priority feature), dunes with *Hippopha rhamnoides*.

Annex II species present that are not a primary reason for site selection:

Sea lamprey *Petromyzon marinus*, river lamprey *Lampetra fluviatilis*, grey seal *Halichoerus grypus*.

C.24.3 Vulnerabilities

The following are the prioritised issues for the site and the features they affect:

- Water pollution is a pressure / threat to A021(B) Bittern, A021(NB) Bittern, A048(NB) Common shelduck, A081(B) Marsh harrier, A082(NB) Hen harrier, A132(B) Avocet, A132(NB) Avocet, A140(NB) Golden plover, A143(NB) Red knot, A149(NB) Dunlin, A151(NB) Ruff, A156(NB) Black-tailed godwit, A157(NB) Bar-tailed godwit, A162(NB) Common redshank, A195(B) Little tern, H1130 Estuaries, H1140 Intertidal mudflats and sandflats, S1095 Sea lamprey, S1099 River lamprey, Waterbird assemblage
- Coastal squeeze is a threat to A021(B) Bittern, A021(NB) Bittern, A048(NB) Common shelduck, A081(B) Marsh harrier, A082(NB) Hen harrier, A132(B) Avocet, A132(NB) Avocet, A140(NB) Golden plover, A143(NB) Red knot, A149(NB) Dunlin, A151(NB) Ruff, A156(NB) Black-tailed godwit, A157(NB) Bar-tailed godwit, A162(NB) Common redshank, A195(B) Little tern, H1130 Estuaries, H1140 Intertidal mudflats and sandflats, H1310 Glasswort and other annuals colonising mud and sand, H1330 Atlantic salt meadows, Waterbird assemblage
- Changes in species distribution is a threat to A021(B) Bittern, A021(NB) Bittern, A048(NB) Common shelduck, A081(B) Marsh harrier, A082(NB) Hen harrier, A132(B)

- Avocet, A132(NB) Avocet, A140(NB) Golden plover, A143(NB) Red knot, A149(NB) Dunlin, A151(NB) Ruff, A156(NB) Black-tailed godwit, A157(NB) Bar-tailed godwit, A162(NB) Common redshank, A195(B) Little tern, S1095 Sea lamprey, S1099 River lamprey, Waterbird assemblage
- Undergrazing is a pressure on A140(NB) Golden plover, A143(NB) Red knot, A151(NB) Ruff, A156(NB) Black-tailed godwit, A162(NB) Common redshank, H1310 Glasswort and other annuals colonising mud and sand, H1330 Atlantic salt meadows, H2110 Shifting dunes, H2120 Shifting dunes with marram, H2130 Dune grassland, H2160 Dunes with seabuckthorn, Waterbird assemblage
 - Invasive species are a threat to A021(B) Bittern, A021(NB) Bittern, A048(NB) Common shelduck, A081(B) Marsh harrier, A082(NB) Hen harrier, A132(B) Avocet, A132(NB) Avocet, A140(NB) Golden plover, A143(NB) Red knot, A149(NB) Dunlin, A151(NB) Ruff, A156(NB) Black-tailed godwit, A157(NB) Bar-tailed godwit, A162(NB) Common redshank, A195(B) Little tern, H1130 Estuaries, H1330 Atlantic salt meadows, Waterbird assemblage
 - Natural changes to site conditions are a pressure / threat to A021(B) Bittern, A021(NB) Bittern, A048(B) Common shelduck, A081(B) Marsh harrier, A082(NB) Hen harrier, A132(B) Avocet, A132(NB) Avocet, A140(NB) Golden plover, A143(NB) Red knot, A149(NB) Dunlin, A151(NB) Ruff, A156(NB) Black-tailed godwit, A157(NB) Bar-tailed godwit, A162(NB) Common redshank, A195(B) Little tern, H1140 Intertidal mudflats and sandflats, Waterbird assemblage
 - Public access / disturbance is a pressure to A021(B) Bittern, A021(NB) Bittern, A048(NB) Common shelduck, A081(B) Marsh harrier, A082(NB) Hen harrier, A132(B) Avocet, A132(NB) Avocet, A140(NB) Golden plover, A143(NB) Red knot, A149(NB) Dunlin, A151(NB) Ruff, A156(NB) Black-tailed godwit, A157(NB) Bar-tailed godwit, A162(NB) Common redshank, A195(B) Little tern, H1130 Estuaries, H1330 Atlantic salt meadows, Waterbird assemblage
 - Fisheries: fish stocking is a pressure to A021(B) Bittern, A021(NB) Bittern, A048(NB) Common shelduck, A081(B) Marsh harrier, A082(NB) Hen harrier, A132(B) Avocet, A132(NB) Avocet, A140(NB) Golden plover, A143(NB) Red knot, A149(NB) Dunlin, A151(NB) Ruff, A156(NB) Black-tailed godwit, A157(NB) Bar-tailed godwit, A162(NB) Common redshank, A195(B) Little tern, Waterbird assemblage
 - Fisheries: commercial marine and estuarine is a pressure / threat to H1140 Intertidal mudflats and sandflats
 - Direct land take from development is a threat to A021(B) Bittern, A021(NB) Bittern, A048(NB) Common shelduck, A081(B) Marsh harrier, A082(NB) Hen harrier, A132(B) Avocet, A132(NB) Avocet, A140(NB) Golden plover, A143(NB) Red knot, A149(NB) Dunlin, A151(NB) Ruff, A156(NB) Black-tailed godwit, A157(NB) Bar-tailed godwit, A162(NB) Common redshank, A195(B) Little tern, H1130 Estuaries, H1140 Intertidal mudflats and sandflats, Waterbird assemblage
 - Air pollution: impact of atmospheric nitrogen deposition is a pressure on H1310 Glasswort and other annuals colonising mud and sand, H1330 Atlantic salt meadows, H2110 Shifting dunes, H2120 Shifting dunes with marram, H2130 Dune grassland, H2160 Dunes with sea-buckthorn
 - Shooting / scaring is a pressure on A021(B) Bittern, A021(NB) Bittern, A048(NB) Common shelduck, A081(B) Marsh harrier, A082(NB) Hen harrier, A132(B) Avocet, A132(NB) Avocet, A140(NB) Golden plover, A143(NB) Red knot, A149(NB) Dunlin, A151(NB) Ruff, A156(NB) Black-tailed godwit, A157(NB) Bar-tailed godwit, A162(NB) Common redshank, A195(B) Little tern, Waterbird assemblage
 - Direct impact from 3rd party is a threat to A021(B) Bittern, A021(NB) Bittern, A048(NB) Common shelduck, A081(B) Marsh harrier, A082(NB) Hen harrier, A132(B) Avocet, A132(NB) Avocet, A140(NB) Golden plover, A143(NB) Red knot, A149(NB) Dunlin,

A151(NB) Ruff, A156(NB) Black-tailed godwit, A157(NB) Bar-tailed godwit, A162(NB) Common redshank, A195(B) Little tern, H1310 Glasswort and other annuals colonising mud and sand, Waterbird assemblage

- Inappropriate scrub control is a pressure to A081(B) Marsh harrier.

