MOTT MACDONALD

South Lincolnshire Reservoir Strategic Regional Options - Habitats Regulations Assessment

RAPID Gate 1 Submission - Habitats Regulation Assessment

June 2021

Mott MacDonald
Floor 3
1 Whitehall Riverside
Leeds LS1 4BN
United Kingdom

T +44 (0)113 394 6700
mottmac.com

South Lincolnshire Reservoir Strategic Regional Options - Habitats Regulations Assessment

RAPID Gate 1 Submission - Habitats Regulation Assessment

June 2021

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
A	15.04.21	C Figueria	R Mhathuna H Dodd	J Fookes	For client comment
B	14.06.21	H Dodd	J Fookes	P Harvey	Updated titles

Document reference: 100410795-002-06 |

Information class: Standard

Contents

Executive summary 1

1.1 Background 3
1.2 SLR Options 3
1.3 The Purpose of the Habitats Regulation Assessment 3
1.4 Purpose of this Report 4

2 HRA Stage 1 Methodology 6

2.1 Screening principles 6
2.2 Methodology 7
2.2.1 Guidance 7
2.2.2 Responsibility for Undertaking HRA 8
2.2.3 Consultation 8
2.2.4 Limitations 9
2.3 Designated sites identification 9

3 Concept Design 1 – Stage 1 Screening 10

3.1 Study area 10
3.2 Stage 1 screening 10
3.3 Summary 14

4 Concept Design 2 – Stage 1 Screening 15

4.1 Study area 15
4.2 Stage 1 screening 15
4.3 Summary 19

5 Concept Design 3 – Stage 1 Screening 20

5.1 Study area 20
5.2 Stage 1 screening 20

6 Conclusions 25

A. Map: SLR HRA Overview 26

B. Designated Site Information 28

B.1 The Wash and North Norfolk Coast SAC 28
B.2 The Wash SPA 28
B.3 The Wash Ramsar 29
B.4 Humber Estuary SAC 30

B.5 Humber Estuary SPA 30
B.6 Humber Estuary Ramsar 31
B.7 Baston Fen SAC 32

Tables

Table 2.1: SLR Options 3
Table 2.1: Potential impacts considered in this assessment 7
Table 3.1: Concept Design 1 Stage 1 screening 11
Table 4.1: Concept Design 2 Stage 1 screening 16
Table 5.1: Concept Design 3 Stage 1 screening 21

Figures - Appendices

Figure A.1: SLR Concept Design 1 26
Figure A.2: SLR Concept Design 2 27
Figure A.3: SLR Concept Design 3 27

Executive summary

This report presents the results of the Habitats Regulations Assessment (HRA) undertaken for the options considered for the South Lincolnshire Reservoir (SLR) 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 the Regulators' Alliance for Progressing Infrastructure Development for the SLR options.

In the 2019 Water Resources Management Plan (WRMP19), Anglian Water estimated an increasing deficit between water supply and demand in several Water Resource Zones over the coming decades. The development of the SLR as a strategic supply side option was identified by Anglian Water to meet the forecasted potable water demand increase and alleviate water supply shortage. The scheme was intended to increase the deployable output of the system by 150Ml/d under future climate change conditions.

During the WRMP19 process, Affinity Water and Anglian Water discussed a number of shared strategic options given the future supply deficit also identified by Affinity Water and the proximity of their areas of services. A potential transfer from Anglian Water to Affinity Water was subsequently included by both companies in their investment models as a solution directly linked to the SLR. The outputs of the initial route options appraisal, finalised in consultation with stakeholders, Affinity Water and Anglian Water, identified three exemplar sites, located within the Black Sluice catchment, to be developed as part of the the concept design and subsequently taken forward for consideration within the Gate 1 submission.

As such, the options for the SLR have been subject to a HRA Stage 1 assessment. All options where identified to have the potential to result in likely significant effects due to changes in flows in the River Witham and River Trent. All concepts designs were idetenfied as having the potential to result in Likely Siginficant Effects. The following designated sites may be affected by all three concepts designs:

- The Wash and North Norfolk Coast SAC - approximately 24 km downstream from the proposed intake point on the River Witham;
- The Wash SPA approximately 24 km downstream from the proposed intake point on the River Witham;
- The Wash Ramsar approximately 24 km downstream from the proposed intake point in the River Witham;
- Humber Estuary SAC approximately 100 km downstream from the proposed intake point in the River Trent;
- Humber Estuary SPA approximately 100 km downstream from the proposed intake point in the River Trent; and
- Humber Estuary Ramsar approximately 100 km downstream from the proposed intake point in the River Trent.

As a consequence, an Appropriate Assessment will need to be carried out to identify the potential effect on habitats and species for which these sites have been designated. This Appropriate Assessment should be informed by a hydrological modelling investigation which will identify the potential change in flows and the extent of this impact.

An HRA Stage 2 Appropriate Assessment (AA) has not been undertaken at this stage, as it requires hydraulic modelling information that is yet to be produced. This will need consideration at the next stage of the process once the relevant information has been produced.

Introduction

1.1 Background

As part of the Water Resource Management Plan 2019 (WRMP19), Anglian Water (AW) and Affinity Water (AFW) projected an increasing deficit between water supply and demand in several Water Resource Zones (WRZs) over the coming decades. The development of South Lincolnshire Reservoir (SLR), a winter storage reservoir in South Lincolnshire, was identified in AW WRMP19 as the preferred supply side option to meet their long-term demand for water.

This report supports the Environment Assessment Report (EAR) that accompanies the Gate 1 submission to Regulators' Alliance for Progressing Infrastructure Development (RAPID) for the South Lincolnshire Reservoir (SLR) Strategic Resource Option (SRO). This report presents the results of the Habitats Regulations Assessment (HRA) (HRA Stage 2) undertaken for the three options considered for the SRO, in order to assess the potential impact of the options on European designated sites in the UK's National Site Network.

1.2 SLR Options

The three options described in this report have been selected for concept design from a larger list of potential solutions in consultation with stakeholders. Following discussion with Affinity Water and Anglian Water, three exemplar sites within the Black Sluice catchment were selected for the Gate 1 submission. Figures of the options are provided in Figure A1, Figure A2 and Figure A3 found in Appendix A.

Table 2.1: SLR Options

Option name	Description overview
Concept Design Option 1 (CDO1)	This option consists of the construction of a multi-purpose reservoir. Extraction points are assumed to be located on the River Witham and South Forty Foot Drain with transfers to the reservoir via pipeline. A third indirect intake provides for transfers from the River Trent to River Witham.
Concept Design Option 2 (CDO2)	This option consists of a single purpose public water supply reservoir. The transfer of water to the reservoir is achieved through diversions from the River Witham to the South Forty Foot Drain via open water transfer with flows then transferred through the South Forty Foot Drain to the reservoir.
Concept Design Option 3 (CDO3)	This option consists of a single purpose public water supply reservoir. Extraction from the River Witham is achieved through open water transfer to the reservoir via the South Forty Foot Drain. The Trent to Witham Transfer is also included within this option.

1.3 The Purpose of the Habitats Regulation 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).

An 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 introduced by 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.

In particular, the HRA process follows the 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.

In exceptional circumstances, a plan or project having an adverse effect on the integrity of a Habitats Site can be approved under Part 6 of the Conservation of Habitats and Species Regulations 2017 (as amended) if it can be demonstrated that there is an absence of less damaging alternatives and the plan or project is necessary for imperative reasons of overriding public interest. In such cases, adequate compensation measures must be secured to ensure that the overall coherence of the Habitats Site is maintained.

The National Site Network include 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.

1.4 Purpose of this Report

This report provides the conclusions of the HRA Stage 1 Screening and includes the necessary information to allow the Competent Authority to decide whether the project may have a likely significant effect on the integrity of any Habitats Sites.

It should be noted that at this stage an in-combination assessment to identify potential cumulative effects of SLR 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 SLR 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 SLR, between different SROs and between any

other external plans or projects that may put pressure on the same water resources. As SLR 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.

2 HRA Stage 1 Methodology

2.1 Screening principles

The purpose of screening is to identify the likely significant effects that arise from the interaction between actions of the SLR options and sensitive receptors through impact pathways.

The following principles underpin this screening assessment:

- National Site Network (NSN) sites are referred to as 'Habitats Sites', in accordance with the government guidance on appropriate assessment and the National Planning Policy Framework (NPPF). Habitats sites include the following designations:
  - A Special Area of Conservation (SAC)
  - A Site of Community Importance (SCI)
  - A Special Protection Area (SPA)
  - A potential SAC (pSAC)
  - A potential/proposed SPA (pSPA)
  - A site proposed to the European Community as an SCI, i.e. a candidate SAC (cSAC)
  - Ramsar sites and proposed Ramsar sites are not within the NSN, but are nonetheless included in the assessment in accordance with the NPPF
- The sites assessed within this assessment are henceforth referred to collectively as 'Habitats Sites';
- The project or plan is not directly connected with or necessary to the conservation management of any habitats site;
- Screening is undertaken regardless of whether the project or plan is located inside or outside a Habitats Site;
- The term impact means an action "resulting in changes to an ecological feature", and effect means an "outcome to an ecological feature from an impact";
- The term Zone of Influence means "The area(s) over which ecological features may be affected by the biophysical changes caused by the proposed project and associated activities"[1];
- In the context of the precautionary principle[2] a likely significant effect exists when it cannot be excluded on the basis of objective information that the project will have a significant effect on the habitats site concerned and where the risk of a significant effect is "real" as opposed to hypothetical[3];
- The assessment of risk will be made in light of, *inter alia*, the conservation objectives, characteristics and specific environmental conditions of the habitat site concerned;

[1] CIEEM (2018). *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine*. Chartered Institute of Ecology and Environmental Management, Winchester.

[2] European Commission, 2000. Communication from the Commission on the precautionary principle/* COM/2000/0001 final */. [online] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52000DC0001 [Accessed 10 July 2020].

[3] See Sullivan L.J. in *Boggis v Natural England [2009] EWCA Civ 1061*, at paragraph 37 and see judgment of 26 May 2011, Commission v Belgium, C-538/09, EU:C:2011:349, paragraph 39 and the case-law cited.

- Mitigation measures intended to avoid or reduce the harmful effects are not considered when determining if a likely significant effect exists[4]; and
- Any likely significant effects identified through the application of the above principles will be taken forward and assessed in detail at Stage 2: Appropriate Assessment.

2.2 Methodology

2.2.1 Guidance

This assessment has been undertaken in accordance with the following guidance (with the exception of completing an in-combination assessment):

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

Following UK Water Industry Research (UKWIR) (2012) guidance and given the nature of the proposed options the potential impacts considered in this assessment are summarised in Table 2.1. 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), for example, where a pipeline transfer crosses a watercourse which runs into a habitats site, water quality and water quantity changes may affect habitats sites hydrologically connected downstream.

Table 2.1: Potential impacts considered in this 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 impacts) 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 impacts Edge impacts	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).
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

[4] See judgment of 12 April 2018, *People Over Wind and Others*, Case C-323/17, EU:C:2018:244, paragraph 40.

Broad categories of potential impacts on European sites (with examples)	Examples of operations resulting in impacts and proposed ZOI
	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 designated site or a tributary of the designated site.
Physical loss Destruction (including offsite impacts) 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)[5].

2.2.2 Responsibility for Undertaking HRA

The responsibility for undertaking HRA lies with the competent authority – Natural England in this case. Under the Habitats Regulations, the applicant (HIPL) has an obligation to provide the competent authorities with such information as the authority may reasonably require for the purposes of the assessment.

2.2.3 Consultation

No consultation with Natural England was undertaken, but the HRA documents will be submitted to them as the competent authority.

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

2.2.4 Limitations

Information provided by third parties, including publicly available information and databases, is considered correct at the time of publication. Due to the dynamic nature of the environment, conditions may change in the period between the preparation of this report, and the undertaking of the proposed works.

The HRA has been undertaken in as much detail as possible, using all available data sources where they exist. However, the conclusions drawn from this is necessarily limited by the age, type, coverage and availability of data. A HRA Stage 2 Appropriate Assessment (AA) has not been undertaken at this stage, as it requires hydraulic modelling information that is yet to be produced. This will need consideration at the next stage of the process once the relevant information has been produced.

Any uncertainties and the limitations of the assessment process are acknowledged and highlighted. Recommendations for avoidance and mitigation measures to address the potential adverse effects on the integrity of the Habitats Sites identified by this report are also based on the information available at the time of the assessment.

2.3 Designated sites identification

The area of potential effects from the proposed options was initially considered to include all Habitats Sites that could be in connection with the proposed concept design components and where a pathway has been identified that could result in direct and indirect effects.

Six Habitats Sites have been scoped in to the HRA Stage 1 Screening as they are considered to be within the Zone of Influence (ZoI) of the works. These are shown in the table below along with their distance and direction from the WwTW and/or discharge location.

3 Concept Design 1 – Stage 1 Screening

3.1 Study area

Six sites have been identified that are within the ZoI of the Concept Design 1:

- The Wash and North Norfolk Coast SAC - approximately 24 km downstream from the proposed intake point on the River Witham;
- The Wash SPA approximately 24 km downstream from the proposed intake point on the River Witham;
- The Wash Ramsar approximately 24 km downstream from the proposed intake point in the River Witham;
- Humber Estuary SAC approximately 100 km downstream from the proposed intake point in the River Trent;
- Humber Estuary SPA approximately 100 km downstream from the proposed intake point in the River Trent; and
- Humber Estuary Ramsar approximately 100 km downstream from the proposed intake point in the River Trent.

These sites are distant from the footprint of the proposed option but are in hydrological connection with watercourses that would be affected by this option. The following sections lists the potential pathways through which the designated sites may be affected by this option.

Details of these designated sites are included in Appendix B.

3.2 Stage 1 screening

Given the distance between the designated sites no pathways have been identified that could result in direct effects either during this option construction or operation. Only one pathway was identified during operation that could result in likely effects in habitats and/or species that are qualifying features of the designated sites:

- Changes to surface water levels and flows.

The Stage 1 Screening of likely significant effects on the six scoped in Habitats sites, is detailed in the Table 3.1.

Table 3.1: Concept Design 1 Stage 1 screening

Designated sites	Qualifying features	Details of any potential for impact pathways during construction/ operation phase	Likely significant effects
The Wash and North Norfolk Coast SAC (approximately 24 km downstream from the proposed intake point on the River Witham) "	Annex I habitats that are a primary reason for selection of this site: • H1110. Sandbanks which are slightly covered by sea water all the time; Subtidal sandbanks • H1140. Mudflats and sandflats not covered by seawater at low tide; Intertidal mudflats and sandflats • H1160. Large shallow inlets and bays • H1170. Reefs • H1310. Salicornia and other annuals colonising mud and sand; Glasswort and other annuals colonising mud and sand • H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) • H1420. Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*); Mediterranean saltmarsh scrub Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site • H1150. Coastal lagoons* Priority feature Annex II species that are a primary reason for selection of this site • S1365. Common seal *Phoca vitulina* Annex II species present as a qualifying feature, but not a primary reason for site selection • S1355. Otter *Lutra lutra*	This designated site is sufficiently distant from the two proposed intakes in the River Witham and the SFFD to not be within the Zone of Influence of the proposed option in regards with construction effects. During operation, water will be abstracted from the Witham and the SFFD which can result in reduced flows into The Wash. It is considered that this is a potential pathway through which the qualifying features of the site, including coastal habitats and the species they support, can be affected. For this reason an Appropriate Assessment (AA) is required to identify the significance of this effect and the need to consider mitigation measures. This assessment will be informed by hydrological modelling to identify if proposed abstraction can result in significant changes to flows entering the Wash. No other effects are identified that can significantly affect The Wash and Norfolk Coast SAC.	Yes
The Wash SPA (approximately 24 km downstream from the proposed intake point on the River Witham)	• A037 *Cygnus columbianus bewickii* Bewick's swan (Non-breeding) • A040 *Anser brachyrhynchus* Pink-footed goose (Non-breeding) • A046a *Branta bernicla bernicla* Dark-bellied brent goose (Non-breeding) • A048 *Tadorna tadorna* Common shelduck (Non-breeding) • A050 *Anas penelope* Eurasian wigeon (Non-breeding) • A051 *Anas strepera*; Gadwall (Non-breeding) • A054 *Anas acuta* Northern pintail (Non-breeding) • A065 *Melanitta nigra* Black (common) scoter (Non-breeding) • A067 *Bucephala clangula* Common goldeneye (Non-breeding) • A130 *Haematopus ostralegus* Eurasian oystercatcher (Non-breeding) • A141 *Pluvialis squatarola* Grey plover (Non-breeding) • A143 *Calidris canutus* Red knot (Non-breeding) • A144 *Calidris alba* Sanderling (Non-breeding) • A149 *Calidris alpina alpina* Dunlin (Non-breeding) • A156 *Limosa limosa islandica* Black-tailed godwit (Non-breeding) • A157 *Limosa lapponica* Bar-tailed godwit (Non-breeding) • A160 *Numenius arquata* Eurasian curlew (Non-breeding) • A162 *Tringa totanus* Common redshank (Non-breeding) • A169 *Arenaria interpres* Ruddy turnstone (Non-breeding) • A193 *Sterna hirundo* Common tern (Breeding) • A195 *Sterna albifrons* Little tern (Breeding) • Waterbird assemblage	This designated site is sufficiently distant from the two proposed intakes in the River Witham and the SFFD to not be considered within the Zone of Influence of the proposed option in regards with construction effects. During operation, water will be abstracted from the Witham and the SFFD which can result in reduced flows into The Wash. It is considered that this is a potential pathway through which the qualifying features of the site, including coastal habitats and the species they support, can be affected. For this reason, an Appropriate Assessment is required to identify the significance of this effect and the need to consider mitigation measures. This assessment will be informed by hydrological modelling to identify if proposed abstraction can result in significant changes to flows entering the Wash. No other effects are identified that can significantly affect The Wash SPA.	Yes
The Wash Ramsar (approximately 24 km downstream from the proposed intake point in the River Witham)	Ramsar criterion 1 • The Wash is a large shallow bay comprising very extensive saltmarshes, major intertidal banks of sand and mud, shallow water and deep channels. It is the largest estuarine system in Britain.	This designated site is sufficiently distant from the two proposed intakes in the River Witham and the SFFD to not be within the Zone of influence of the proposed option in regards with construction effects. During operation, water will be abstracted from the Witham and the SFFD which can result in reduced flows into The Wash. It is considered that this is a potential pathway through which the qualifying features of the site, including coastal habitats and the species they support, can be affected. For this reason, an AA is required to identify the significance of this effect and the need to consider mitigation measures. This assessment will be informed by	Yes

Designated sites	Qualifying features	Details of any potential for impact pathways during construction/ operation phase	Likely significant effects
	Ramsar criterion 3 • Qualifies because of the inter-relationship between its various components including saltmarshes, intertidal sand and mud flats and the estuarine waters. The saltmarshes and the plankton in the estuarine water provide a primary source of organic material which, together with other organic matter, forms the basis for the high productivity of the estuary. Ramsar criterion 5 Assemblages of international importance: • Species with peak counts in winter Ramsar criterion 6 Species/populations occurring at levels of international importance: • Common redshank *Tringa totanus totanus*, • Eurasian curlew *Numenius arquata arquata*, • Eurasian oystercatcher *Haematopus ostralegus ostralegus* • Grey plover *Pluvialis squatarola*, • Red knot *Calidris canutus islandica*, • Sanderling *Calidris alba*, Species with peak counts in winter: • Black-headed gull Larus ridibundus, • Common eider *Somateria mollissima mollissima*, • Bar-tailed godwit *Limosa lapponica lapponica*, • Common shelduck *Tadorna tadorna*, • Dark-bellied brent goose *Branta bernicla bernicla*, • Dunlin *Calidris alpina alpina*, • Pink-footed goose *Anser brachyrhynchus*, Criterion 6. Species with peak counts in spring/autumn: • Black-tailed godwit *Limosa limosa islandica*, • Ringed plover *Charadrius hiaticula*, • Species with peak counts in winter: Northern lapwing *Vanellus vanellus*, Europe -	hydrological modelling to identify if proposed abstraction can result in significant changes to flows entering the Wash. No other effects are identified that can significantly affect The Wash Ramsar site.	
Humber Estuary SAC (approximately 100 km downstream from the proposed intake point in the River Trent)	Annex I habitats that are a primary reason for selection of this site • 1130 Estuaries • 1140 Mudflats and sandflats not covered by seawater at low tide Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site • 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 (*Glauco-Puccinellietalia maritimae*) • 2110 Embryonic shifting dunes • 2120 "Shifting dunes along the shoreline with *Ammophila arenaria* (""white dunes"")" • 2130 "Fixed coastal dunes with herbaceous vegetation (""grey dunes"")" * Priority feature • 2160 Dunes with *Hippopha rhamnoides* Annex II species present as a qualifying feature, but not a primary reason for site selection • 1095 Sea lamprey *Petromyzon marinus* • 1099 River lamprey *Lampetra fluviatilis* • 1364 Grey seal *Halichoerus grypus*	This option proposes to add a new intake in the River Trent to transfer water from the River Trent to River Witham, with an assumed capacity of 300Ml/d. This intake will be located at East Bridgeford more than 100km upstream the Humber SAC and has the potential to 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. However, the pathway through which the reduction in flows exists and could particularly affect qualifying features such as the lamprey species. For this reason an AA needs to be undertaken to assess the potential significance of this effect on qualifying features of the Humber SAC including: S1095. *Petromyzon marinus*; Sea lamprey S1099. *Lampetra fluviatilis*; River lamprey H1130. Estuaries H1310. Salicornia and other annuals colonising mud and sand; H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) H1140. Mudflats and sandflats not covered by seawater at low tide; Intertidal mudflats and sandflats H1110. Sandbanks which are slightly covered by sea water all the time; Subtidal sandbanks This assessment will be informed by hydrological modelling to identify if proposed abstraction can result in significant changes to flows in the River Trent and entering the Humber.	Yes

Designated sites	Qualifying features	Details of any potential for impact pathways during construction/ operation phase	Likely significant effects
Humber Estuary SPA (approximately 100 km downstream from the proposed intake point in the River Trent)	• A021 *Botaurus stellaris* Great bittern (Non-breeding) • A021 *Botaurus stellaris* Great bittern (Breeding) • A048 *Tadorna tadorna* Common shelduck (Non-breeding) • A081 *Circus aeruginosus* Eurasian marsh harrier (Breeding) • A082 *Circus cyaneus* Hen harrier (Non-breeding) • A132 *Recurvirostra avosetta* Pied avocet (Non-breeding) • A132 *Recurvirostra avosetta* Pied avocet (Breeding) • A140 *Pluvialis apricaria* European golden plover (Non-breeding) • A143 *Calidris canutus* Red knot (Non-breeding) • A149 *Calidris alpina alpina* Dunlin (Non-breeding) • A151 *Philomachus pugnax* Ruff (Non-breeding) • A156 *Limosa limosa islandica* Black-tailed godwit (Non-breeding) • A157 *Limosa lapponica* Bar-tailed godwit (Non-breeding) • A162 *Tringa totanus* Common redshank (Non-breeding) • A195 *Sterna albifrons* Little tern (Breeding) • Waterbird assemblage	This option proposes to add a new intake in the River Trent to transfer water from the River Trent to River Witham, with an assumed capacity of 300Ml/d. This intake will be located at East Bridgeford more than 100km upstream the Humber SAC and 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. However the pathway through which the reduction in flows exists and could particularly affect habitats that support bird species for which the SPA is designated for. For this reason an AA needs to be undertaken to assess the potential significance of this effect on habitats that support bird species namely areas of reedbed and saltmarsh. This assessment will be informed by hydrological modelling to identify if proposed abstraction can result in significant changes to flows entering the Humber.	Yes
Humber Estuary Ramsar (approximately 100 km downstream from the proposed intake point in the River Trent)	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. 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 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. • **Common shelduck *Tadorna tadorna*** • **Eurasian golden plover *Pluvialis apricaria altifrons* subspecies** • **Red knot *Calidris canutus islandica* subspecies** • **Dunlin *Calidris alpine alpina* subspecies –** • **Black-tailed godwit *Limosa limosa islandica* subspecies** • **Bar-tailed godwit *Limosa lapponica lapponica* subspecies** • **Common redshank *Tringa tetanus brittanica* subspecies** 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.	This option proposes to add a new intake in the River Trent to transfer water from the River Trent to River Witham, with an assumed capacity of 300Ml/d. This intake will be located at East Bridgeford more than 100km upstream the Humber SAC and 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. However, the pathway through which the reduction in flows exists and could particularly affect habitats that support bird species for which the Ramsar is designated for. For this reason an AA needs to be undertaken to access 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 *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus*. This assessment will be informed by hydrological modelling to identify if proposed abstraction can result in significant changes to flows in the River Trent and entering the Humber.	Yes

3.3 Summary

Changes to flows in the River Witham and River Trent as a result of the implementation of this option were identified which could result in likely significant effects on the following designated sites:

- The Wash and North Norfolk Coast SAC - approximately 24 km downstream from the proposed intake point on the River Witham;
- The Wash SPA approximately 24 km downstream from the proposed intake point on the River Witham;
- The Wash Ramsar approximately 24 km downstream from the proposed intake point in the River Witham;
- Humber Estuary SAC approximately 100 km downstream from the proposed intake point in the River Trent;
- Humber Estuary SPA approximately 100 km downstream from the proposed intake point in the River Trent; and
- Humber Estuary Ramsar approximately 100 km downstream from the proposed intake point in the River Trent.

As a consequence, an Appropriate Assessment will need to be carried out to identify the potential effect on habitats and species for which these sites have been designated. This Appropriate Assessment should be informed by a hydrological modelling investigation which will identify the potential change in flows and the extent of this impact.

4 Concept Design 2 – Stage 1 Screening

4.1 Study area

Six sites have been identified that are within the ZoI of the Concept Design 1:

- The Wash and North Norfolk Coast SAC - approximately 24 km downstream from the proposed intake point on the River Witham;
- The Wash SPA approximately 24 km downstream from the proposed intake point on the River Witham;
- The Wash Ramsar approximately 24 km downstream from the proposed intake point in the River Witham;
- Humber Estuary SAC approximately 100 km downstream from the proposed intake point in the River Trent;
- Humber Estuary SPA approximately 100 km downstream from the proposed intake point in the River Trent; and
- Humber Estuary Ramsar approximately 100 km downstream from the proposed intake point in the River Trent.

These sites are distant from the footprint of the proposed option but are in hydrological connection with watercourses that would be affected by this option. The following sections lists the potential pathways through which the designated sites may be affected by this option.

Details of these designated sites are included in Appendix B.

4.2 Stage 1 screening

Given the distance between the designated sites no pathways have been identified that could result in direct effects either during this option construction or operation. Only one pathway was identified during operation that could result in likely effects in habitats and/or species that are qualifying features of the designated sites:

- Changes to surface water levels and flows.

The Stage 1 Screening of likely significant effects on the six scoped in Habitats sites, is detailed in the Table 3.1.

Table 4.1: Concept Design 2 Stage 1 screening

Designated sites	Qualifying features	Details of any potential for impact pathways during construction/ operation phase	Likely significant effects
The Wash and North Norfolk Coast SAC (approximately 24 km downstream from the proposed intake point on the River Witham) "	Annex I habitats that are a primary reason for selection of this site: • H1110. Sandbanks which are slightly covered by sea water all the time; Subtidal sandbanks • H1140. Mudflats and sandflats not covered by seawater at low tide; Intertidal mudflats and sandflats • H1160. Large shallow inlets and bays • H1170. Reefs • H1310. Salicornia and other annuals colonising mud and sand; Glasswort and other annuals colonising mud and sand • H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) • H1420. Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*); Mediterranean saltmarsh scrub Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site • H1150. Coastal lagoons* Priority feature Annex II species that are a primary reason for selection of this site • S1365. Common seal *Phoca vitulina* Annex II species present as a qualifying feature, but not a primary reason for site selection • S1355. Otter *Lutra lutra*	This designated site is sufficiently distant from the two proposed intakes in the River Witham and the SFFD to not be within the Zone of Influence of the proposed option in regards with construction effects. During operation, water will be abstracted from the Witham and the SFFD which can result in reduced flows into The Wash. It is considered that this is a potential pathway through which the qualifying features of the site, including coastal habitats and the species they support, can be affected. For this reason, an Appropriate Assessment (AA) is required to identify the significance of this effect and the need to consider mitigation measures. This assessment will be informed by hydrological modelling to identify if proposed abstraction can result in significant changes to flows entering the Wash. No other effects are identified that can significantly affect The Wash and Norfolk Coast SAC.	Yes
The Wash SPA (approximately 24 km downstream from the proposed intake point on the River Witham)	• A037 *Cygnus columbianus bewickii* Bewick's swan (Non-breeding) • A040 *Anser brachyrhynchus* Pink-footed goose (Non-breeding) • A046a *Branta bernicla bernicla* Dark-bellied brent goose (Non-breeding) • A048 *Tadorna tadorna* Common shelduck (Non-breeding) • A050 *Anas penelope* Eurasian wigeon (Non-breeding) • A051 *Anas strepera*; Gadwall (Non-breeding) • A054 *Anas acuta* Northern pintail (Non-breeding) • A065 *Melanitta nigra* Black (common) scoter (Non-breeding) • A067 *Bucephala clangula* Common goldeneye (Non-breeding) • A130 *Haematopus ostralegus* Eurasian oystercatcher (Non-breeding) • A141 *Pluvialis squatarola* Grey plover (Non-breeding) • A143 *Calidris canutus* Red knot (Non-breeding) • A144 *Calidris alba* Sanderling (Non-breeding) • A149 *Calidris alpina alpina* Dunlin (Non-breeding) • A156 *Limosa limosa islandica* Black-tailed godwit (Non-breeding) • A157 *Limosa lapponica* Bar-tailed godwit (Non-breeding) • A160 *Numenius arquata* Eurasian curlew (Non-breeding) • A162 *Tringa totanus* Common redshank (Non-breeding) • A169 *Arenaria interpres* Ruddy turnstone (Non-breeding) • A193 *Sterna hirundo* Common tern (Breeding) • A195 *Sterna albifrons* Little tern (Breeding) • Waterbird assemblage	This designated site is sufficiently distant from the two proposed intakes in the River Witham and the SFFD to not be considered within the Zone of Influence of the proposed option in regards with construction effects. During operation, water will be abstracted from the Witham and the SFFD which can result in reduced flows into The Wash. It is considered that this is a potential pathway through which the qualifying features of the site, including coastal habitats and the species they support, can be affected. For this reason, an Appropriate Assessment is required to identify the significance of this effect and the need to consider mitigation measures. This assessment will be informed by hydrological modelling to identify if proposed abstraction can result in significant changes to flows entering the Wash. No other effects are identified that can significantly affect The Wash SPA.	Yes
The Wash Ramsar (approximately 24 km downstream from the proposed intake point in the River Witham)	Ramsar criterion 1 • The Wash is a large shallow bay comprising very extensive saltmarshes, major intertidal banks of sand and mud, shallow water and deep channels. It is the largest estuarine system in Britain. Ramsar criterion 3 • Qualifies because of the inter-relationship between its various components including saltmarshes, intertidal sand and mud flats and the estuarine waters. The saltmarshes and the plankton in the estuarine water provide a primary source of organic material which, together with other organic matter, forms the basis for the high productivity of the estuary. Ramsar criterion 5 Assemblages of international importance: • Species with peak counts in winter Ramsar criterion 6 Species/populations occurring at levels of international importance: • Common redshank *Tringa totanus totanus*, • Eurasian curlew *Numenius arquata arquata*, • Eurasian oystercatcher *Haematopus ostralegus ostralegus* • Grey plover *Pluvialis squatarola*, • Red knot *Calidris canutus islandica*, • Sanderling *Calidris alba*, Species with peak counts in winter: • Black-headed gull Larus ridibundus, • Common eider *Somateria mollissima mollissima*, • Bar-tailed godwit *Limosa lapponica lapponica*, • Common shelduck *Tadorna tadorna*, • Dark-bellied brent goose *Branta bernicla bernicla*, • Dunlin *Calidris alpina alpina*, • Pink-footed goose *Anser brachyrhynchus*, Criterion 6. Species with peak counts in spring/autumn: • Black-tailed godwit *Limosa limosa islandica*, • Ringed plover *Charadrius hiaticula*, • Species with peak counts in winter: Northern lapwing *Vanellus vanellus*, Europe -	This designated site is sufficiently distant from the two proposed intakes in the River Witham and the SFFD to not be within the Zone of influence of the proposed option in regards with construction effects. During operation, water will be abstracted from the Witham and the SFFD which can result in reduced flows into The Wash. It is considered that this is a potential pathway through which the qualifying features of the site, including coastal habitats and the species they support, can be affected. For this reason, an AA is required to identify the significance of this effect and the need to consider mitigation measures. This assessment will be informed by hydrological modelling to identify if proposed abstraction can result in significant changes to flows entering the Wash. No other effects are identified that can significantly affect The Wash Ramsar site.	Yes

Designated sites	Qualifying features	Details of any potential for impact pathways during construction/ operation phase	Likely significant effects
Humber Estuary SAC (approximately 100 km downstream from the proposed intake point in the River Trent)	Annex I habitats that are a primary reason for selection of this site • 1130 Estuaries • 1140 Mudflats and sandflats not covered by seawater at low tide Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site • 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 (*Glauco-Puccinellietalia maritimae*) • 2110 Embryonic shifting dunes • 2120 ""Shifting dunes along the shoreline with *Ammophila arenaria* (""white dunes"")" • 2130 ""Fixed coastal dunes with herbaceous vegetation (""grey dunes"")" * Priority feature • 2160 Dunes with *Hippopha rhamnoides* Annex II species present as a qualifying feature, but not a primary reason for site selection • 1095 Sea lamprey *Petromyzon marinus* • 1099 River lamprey *Lampetra fluviatilis* • 1364 Grey seal *Halichoerus grypus*	This option proposes to add a new intake in the River Trent to transfer water from the River Trent to River Witham, with an assumed capacity of 300Ml/d. This intake will be located at East Bridgeford more than 100km upstream the Humber SAC and has the potential to 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. However, the pathway through which the reduction in flows exists and could particularly affect qualifying features such as the lamprey species. For this reason, an AA needs to be undertaken to assess the potential significance of this effect on qualifying features of the Humber SAC including: S1095. *Petromyzon marinus*; Sea lamprey S1099. *Lampetra fluviatilis*; River lamprey H1130. Estuaries H1310. Salicornia and other annuals colonising mud and sand; H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) H1140. Mudflats and sandflats not covered by seawater at low tide; Intertidal mudflats and sandflats H1110. Sandbanks which are slightly covered by sea water all the time; Subtidal sandbanks This assessment will be informed by hydrological modelling to identify if proposed abstraction can result in significant changes to flows in the River Trent and entering the Humber.	Yes
Humber Estuary SPA (approximately 100 km downstream from the proposed intake point in the River Trent)	• A021 *Botaurus stellaris* Great bittern (Non-breeding) • A021 *Botaurus stellaris* Great bittern (Breeding) • A048 *Tadorna tadorna* Common shelduck (Non-breeding) • A081 *Circus aeruginosus* Eurasian marsh harrier (Breeding) • A082 *Circus cyaneus* Hen harrier (Non-breeding) • A132 *Recurvirostra avosetta* Pied avocet (Non-breeding) • A132 *Recurvirostra avosetta* Pied avocet (Breeding) • A140 *Pluvialis apricaria* European golden plover (Non-breeding) • A143 *Calidris canutus* Red knot (Non-breeding) • A149 *Calidris alpina alpina* Dunlin (Non-breeding) • A151 *Philomachus pugnax* Ruff (Non-breeding) • A156 *Limosa limosa islandica* Black-tailed godwit (Non-breeding) • A157 *Limosa lapponica* Bar-tailed godwit (Non-breeding) • A162 *Tringa totanus* Common redshank (Non-breeding) • A195 *Sterna albifrons* Little tern (Breeding) • Waterbird assemblage	This option proposes to add a new intake in the River Trent to transfer water from the River Trent to River Witham, with an assumed capacity of 300Ml/d. This intake will be located at East Bridgeford more than 100km upstream the Humber SAC and 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. However the pathway through which the reduction in flows exists and could particularly affect habitats that support bird species for which the SPA is designated for. For this reason an AA needs to be undertaken to assess the potential significance of this effect on habitats that support bird species namely areas of reedbed and saltmarsh. This assessment will be informed by hydrological modelling to identify if proposed abstraction can result in significant changes to flows entering the Humber.	Yes
Humber Estuary Ramsar (approximately 100 km downstream from the proposed intake point in the River Trent)	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. 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 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. • Common shelduck *Tadorna tadorna* • Eurasian golden plover *Pluvialis apricaria altifrons* subspecies • Red knot *Calidris canutus islandica* subspecies • Dunlin *Calidris alpine alpina* subspecies – • Black-tailed godwit *Limosa limosa islandica* subspecies • Bar-tailed godwit *Limosa lapponica lapponica* subspecies • Common redshank *Tringa tetanus brittanica* subspecies	This option proposes to add a new intake in the River Trent to transfer water from the River Trent to River Witham, with an assumed capacity of 300Ml/d. This intake will be located at East Bridgeford more than 100km upstream the Humber SAC and 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. However, the pathway through which the reduction in flows exists and could particularly affect habitats that support bird species for which the Ramsar is designated for. For this reason, an AA needs to be undertaken 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 *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus*. This assessment will be informed by hydrological modelling to identify if	Yes

Designated sites	Qualifying features	Details of any potential for impact pathways during construction/ operation phase	Likely significant effects
	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.	proposed abstraction can result in significant changes to flows in the River Trent and entering the Humber.	

4.3 Summary

Changes to flows in the River Witham and River Trent as a result of the implementation of this option were identified which could result in likely significant effects on the following designated sites:

- The Wash and North Norfolk Coast SAC - approximately 24 km downstream from the proposed intake point on the River Witham;
- The Wash SPA approximately 24 km downstream from the proposed intake point on the River Witham;
- The Wash Ramsar approximately 24 km downstream from the proposed intake point in the River Witham;
- Humber Estuary SAC approximately 100 km downstream from the proposed intake point in the River Trent;
- Humber Estuary SPA approximately 100 km downstream from the proposed intake point in the River Trent; and
- Humber Estuary Ramsar approximately 100 km downstream from the proposed intake point in the River Trent.

As a consequence, an Appropriate Assessment will need to be carried out to identify the potential effect on habitats and species for which these sites have been designated. This Appropriate Assessment should be informed by a hydrological modelling investigation which will identify the potential change in flows and the extent of this impact.

5 Concept Design 3 – Stage 1 Screening

5.1 Study area

Six sites have been identified that are within the ZoI of the Concept Design 1:

- The Wash and North Norfolk Coast SAC - approximately 24 km downstream from the proposed intake point on the River Witham;
- The Wash SPA approximately 24 km downstream from the proposed intake point on the River Witham;
- The Wash Ramsar approximately 24 km downstream from the proposed intake point in the River Witham;
- Humber Estuary SAC approximately 100 km downstream from the proposed intake point in the River Trent;
- Humber Estuary SPA approximately 100 km downstream from the proposed intake point in the River Trent;
- Humber Estuary Ramsar approximately 100 km downstream from the proposed intake point in the River Trent; and
- Baston fen SAC.

These sites are distant from the footprint of the proposed option but are in hydrological connection with watercourses that would be affected by this option. The following sections lists the potential pathways through which the designated sites may be affected by this option.

Details of these designated sites are included in Appendix B.

5.2 Stage 1 screening

Given the distance between the designated sites no pathways have been identified that could result in direct effects either during this option construction or operation. Only one pathway was identified during operation that could result in likely effects in habitats and/or species that are qualifying features of the designated sites:

- Changes to surface water levels and flows.

The Stage 1 Screening of likely significant effects on the six scoped in Habitats sites, is detailed in the **Table 5.1**

Table 5.1: Concept Design 3 Stage 1 screening

Designated sites	Qualifying features	Details of any potential for impact pathways during construction/ operation phase	Likely significant effects
The Wash and North Norfolk Coast SAC (approximately 24 km downstream from the proposed intake point on the River Witham) "	Annex I habitats that are a primary reason for selection of this site: • H1110. Sandbanks which are slightly covered by sea water all the time; Subtidal sandbanks • H1140. Mudflats and sandflats not covered by seawater at low tide; Intertidal mudflats and sandflats • H1160. Large shallow inlets and bays • H1170. Reefs • H1310. Salicornia and other annuals colonising mud and sand; Glasswort and other annuals colonising mud and sand • H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) • H1420. Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*); Mediterranean saltmarsh scrub Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site • H1150. Coastal lagoons* Priority feature Annex II species that are a primary reason for selection of this site • S1365. Common seal *Phoca vitulina* Annex II species present as a qualifying feature, but not a primary reason for site selection • S1355. Otter *Lutra lutra*	This designated site is sufficiently distant from the two proposed intakes in the River Witham and the SFFD to not be within the Zone of Influence of the proposed option in regards with construction effects. During operation, water will be abstracted from the Witham and the SFFD which can result in reduced flows into The Wash. It is considered that this is a potential pathway through which the qualifying features of the site, including coastal habitats and the species they support, can be affected. For this reason, an Appropriate Assessment (AA) is required to identify the significance of this effect and the need to consider mitigation measures. This assessment will be informed by hydrological modelling to identify if proposed abstraction can result in significant changes to flows entering the Wash. No other effects are identified that can significantly affect The Wash and Norfolk Coast SAC.	Yes
The Wash SPA (approximately 24 km downstream from the proposed intake point on the River Witham)	• A037 *Cygnus columbianus bewickii* Bewick's swan (Non-breeding) • A040 *Anser brachyrhynchus* Pink-footed goose (Non-breeding) • A046a *Branta bernicla bernicla* Dark-bellied brent goose (Non-breeding) • A048 *Tadorna tadorna* Common shelduck (Non-breeding) • A050 *Anas penelope* Eurasian wigeon (Non-breeding) • A051 *Anas strepera*; Gadwall (Non-breeding) • A054 *Anas acuta* Northern pintail (Non-breeding) • A065 *Melanitta nigra* Black (common) scoter (Non-breeding) • A067 *Bucephala clangula* Common goldeneye (Non-breeding) • A130 *Haematopus ostralegus* Eurasian oystercatcher (Non-breeding) • A141 *Pluvialis squatarola* Grey plover (Non-breeding) • A143 *Calidris canutus* Red knot (Non-breeding) • A144 *Calidris alba* Sanderling (Non-breeding) • A149 *Calidris alpina alpina* Dunlin (Non-breeding) • A156 *Limosa limosa islandica* Black-tailed godwit (Non-breeding) • A157 *Limosa lapponica* Bar-tailed godwit (Non-breeding) • A160 *Numenius arquata* Eurasian curlew (Non-breeding) • A162 *Tringa totanus* Common redshank (Non-breeding) • A169 *Arenaria interpres* Ruddy turnstone (Non-breeding) • A193 *Sterna hirundo* Common tern (Breeding) • A195 *Sterna albifrons* Little tern (Breeding) • Waterbird assemblage	This designated site is sufficiently distant from the two proposed intakes in the River Witham and the SFFD to not be considered within the Zone of Influence of the proposed option in regards with construction effects. During operation, water will be abstracted from the Witham and the SFFD which can result in reduced flows into The Wash. It is considered that this is a potential pathway through which the qualifying features of the site, including coastal habitats and the species they support, can be affected. For this reason, an Appropriate Assessment is required to identify the significance of this effect and the need to consider mitigation measures. This assessment will be informed by hydrological modelling to identify if proposed abstraction can result in significant changes to flows entering the Wash. No other effects are identified that can significantly affect The Wash SPA.	Yes
The Wash Ramsar (approximately 24 km downstream from the proposed intake point in the River Witham)	Ramsar criterion 1 • The Wash is a large shallow bay comprising very extensive saltmarshes, major intertidal banks of sand and mud, shallow water and deep channels. It is the largest estuarine system in Britain.	This designated site is sufficiently distant from the two proposed intakes in the River Witham and the SFFD to not be within the Zone of influence of the proposed option in regards with construction effects. During operation, water will be abstracted from the Witham and the SFFD which can result in reduced flows into The Wash. It is considered that this is a potential pathway through which the qualifying features of the site, including coastal habitats and the species they support, can be affected. For this reason, an AA is required to identify the significance of this effect and the need to consider mitigation measures. This assessment will be informed by	Yes

Designated sites	Qualifying features	Details of any potential for impact pathways during construction/ operation phase	Likely significant effects
	Ramsar criterion 3 • Qualifies because of the inter-relationship between its various components including saltmarshes, intertidal sand and mud flats and the estuarine waters. The saltmarshes and the plankton in the estuarine water provide a primary source of organic material which, together with other organic matter, forms the basis for the high productivity of the estuary. Ramsar criterion 5 Assemblages of international importance: • Species with peak counts in winter Ramsar criterion 6 Species/populations occurring at levels of international importance: • Common redshank *Tringa totanus totanus*, • Eurasian curlew *Numenius arquata arquata*, • Eurasian oystercatcher *Haematopus ostralegus ostralegus* • Grey plover *Pluvialis squatarola*, • Red knot *Calidris canutus islandica*, • Sanderling *Calidris alba*, Species with peak counts in winter: • Black-headed gull Larus ridibundus, • Common eider *Somateria mollissima mollissima*, • Bar-tailed godwit *Limosa lapponica lapponica*, • Common shelduck *Tadorna tadorna*, • Dark-bellied brent goose *Branta bernicla bernicla*, • Dunlin *Calidris alpina alpina*, • Pink-footed goose *Anser brachyrhynchus*, Criterion 6. Species with peak counts in spring/autumn: • Black-tailed godwit *Limosa limosa islandica*, • Ringed plover *Charadrius hiaticula*, • Species with peak counts in winter: Northern lapwing *Vanellus vanellus*, Europe -	hydrological modelling to identify if proposed abstraction can result in significant changes to flows entering the Wash. No other effects are identified that can significantly affect The Wash Ramsar site.	
Humber Estuary SAC (approximately 100 km downstream from the proposed intake point in the River Trent)	Annex I habitats that are a primary reason for selection of this site • 1130 Estuaries • 1140 Mudflats and sandflats not covered by seawater at low tide Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site • 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 (*Glauco-Puccinellietalia maritimae*) • 2110 Embryonic shifting dunes • 2120 "Shifting dunes along the shoreline with *Ammophila arenaria* (""white dunes"")" • 2130 "Fixed coastal dunes with herbaceous vegetation (""grey dunes"")" * Priority feature • 2160 Dunes with *Hippopha rhamnoides* Annex II species present as a qualifying feature, but not a primary reason for site selection • 1095 Sea lamprey *Petromyzon marinus* • 1099 River lamprey *Lampetra fluviatilis* • 1364 Grey seal *Halichoerus grypus*	This option proposes to add a new intake in the River Trent to transfer water from the River Trent to River Witham, with an assumed capacity of 300Ml/d. This intake will be located at East Bridgeford more than 100km upstream the Humber SAC and has the potential to 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. However, the pathway through which the reduction in flows exists and could particularly affect qualifying features such as the lamprey species. For this reason, an AA needs to be undertaken to access the potential significance of this effect on qualifying features of the Humber SAC including: S1095. *Petromyzon marinus*; Sea lamprey S1099. *Lampetra fluviatilis*; River lamprey H1130. Estuaries H1310. Salicornia and other annuals colonising mud and sand; H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) H1140. Mudflats and sandflats not covered by seawater at low tide; Intertidal mudflats and sandflats H1110. Sandbanks which are slightly covered by sea water all the time; Subtidal sandbanks This assessment will be informed by hydrological modelling to identify if proposed abstraction can result in significant changes to flows in the River Trent and entering the Humber.	Yes

Designated sites	Qualifying features	Details of any potential for impact pathways during construction/ operation phase	Likely significant effects
Humber Estuary SPA (approximately 100 km downstream from the proposed intake point in the River Trent)	• A021 *Botaurus stellaris* Great bittern (Non-breeding) • A021 *Botaurus stellaris* Great bittern (Breeding) • A048 *Tadorna tadorna* Common shelduck (Non-breeding) • A081 *Circus aeruginosus* Eurasian marsh harrier (Breeding) • A082 *Circus cyaneus* Hen harrier (Non-breeding) • A132 *Recurvirostra avosetta* Pied avocet (Non-breeding) • A132 *Recurvirostra avosetta* Pied avocet (Breeding) • A140 *Pluvialis apricaria* European golden plover (Non-breeding) • A143 *Calidris canutus* Red knot (Non-breeding) • A149 *Calidris alpina alpina* Dunlin (Non-breeding) • A151 *Philomachus pugnax* Ruff (Non-breeding) • A156 *Limosa limosa islandica* Black-tailed godwit (Non-breeding) • A157 *Limosa lapponica* Bar-tailed godwit (Non-breeding) • A162 *Tringa totanus* Common redshank (Non-breeding) • A195 *Sterna albifrons* Little tern (Breeding) • Waterbird assemblage	This option proposes to add a new intake in the River Trent to transfer water from the River Trent to River Witham, with an assumed capacity of 300Ml/d. This intake will be located at East Bridgeford more than 100km upstream the Humber SAC and 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. However the pathway through which the reduction in flows exists and could particularly affect habitats that support bird species for which the SPA is designated for. For this reason an AA needs to be undertaken to access the potential significance of this effect on habitats that support bird species namely areas of reedbed and saltmarsh. This assessment will be informed by hydrological modelling to identify if proposed abstraction can result in significant changes to flows entering the Humber.	Yes
Humber Estuary Ramsar (approximately 100 km downstream from the proposed intake point in the River Trent)	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. 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 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. • Common shelduck *Tadorna tadorna* • Eurasian golden plover *Pluvialis apricaria altifrons* subspecies • Red knot *Calidris canutus islandica* subspecies • Dunlin *Calidris alpine alpina* subspecies – • Black-tailed godwit *Limosa limosa islandica* subspecies • Bar-tailed godwit *Limosa lapponica lapponica* subspecies • Common redshank *Tringa tetanus brittanica* subspecies 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.	This option proposes to add a new intake in the River Trent to transfer water from the River Trent to River Witham, with an assumed capacity of 300Ml/d. This intake will be located at East Bridgeford more than 100km upstream the Humber SAC and 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. However, the pathway through which the reduction in flows exists and could particularly affect habitats that support bird species for which the Ramsar is designated for. For this reason an AA needs to be undertaken 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 *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus*. This assessment will be informed by hydrological modelling to identify if proposed abstraction can result in significant changes to flows in the River Trent and entering the Humber.	Yes
Baston Fen SAC	1149 Spined loach *Cobitis taenia*	This option includes an intake from the River Glen which is in hydrological connection with the Counter Drain and therefore Baston Fen. A reduction in flows may affect the flow regime in the Counter Drain and consequently the Spined loach habitat suitability in Baston Fen. However, abstraction will only be undertaken during high flows periods, proposed abstraction regime will be such that it will only occur once in every five years. Effects are therefore not considered significant.	**No**

5.3 Summary

Changes to flows in the River Witham and River Trent as a result of the implementation of this option were identified which could result in likely significant effects on the following designated sites:

- The Wash and North Norfolk Coast SAC - approximately 24 km downstream from the proposed intake point on the River Witham;
- The Wash SPA approximately 24 km downstream from the proposed intake point on the River Witham;
- The Wash Ramsar approximately 24 km downstream from the proposed intake point in the River Witham;
- Humber Estuary SAC approximately 100 km downstream from the proposed intake point in the River Trent;
- Humber Estuary SPA approximately 100 km downstream from the proposed intake point in the River Trent; and
- Humber Estuary Ramsar approximately 100 km downstream from the proposed intake point in the River Trent.

As a consequence, an Appropriate Assessment will need to be carried out to identify the potential effect on habitats and species for which these sites have been designated. This Appropriate Assessment should be informed by a hydrological modelling investigation which will identify the potential change in flows and the extent of this impact.

6 Conclusions

All options where identified to have the potential to result in likely significant effects due to changes in flows in the River Witham and River Trent.

The following designated sites may be affected:

- The Wash and North Norfolk Coast SAC - approximately 24 km downstream from the proposed intake point on the River Witham;
- The Wash SPA approximately 24 km downstream from the proposed intake point on the River Witham;
- The Wash Ramsar approximately 24 km downstream from the proposed intake point in the River Witham;
- Humber Estuary SAC approximately 100 km downstream from the proposed intake point in the River Trent;
- Humber Estuary SPA approximately 100 km downstream from the proposed intake point in the River Trent; and
- Humber Estuary Ramsar approximately 100 km downstream from the proposed intake point in the River Trent.

As a consequence, an Appropriate Assessment will need to be carried out to identify the potential effect on habitats and species for which these sites have been designated. This Appropriate Assessment should be informed by a hydrological modelling investigation which will identify the potential change in flows and the extent of this impact.

A. Map: SLR HRA Overview

Figure A.1: SLR Concept Design 1

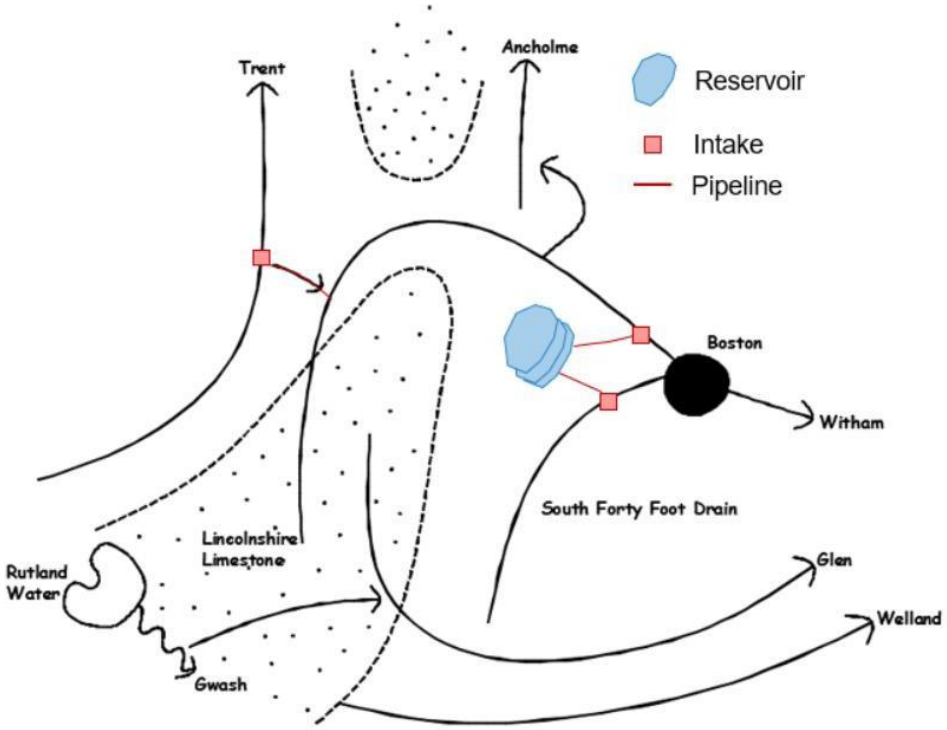


Figure A.2: SLR Concept Design 2

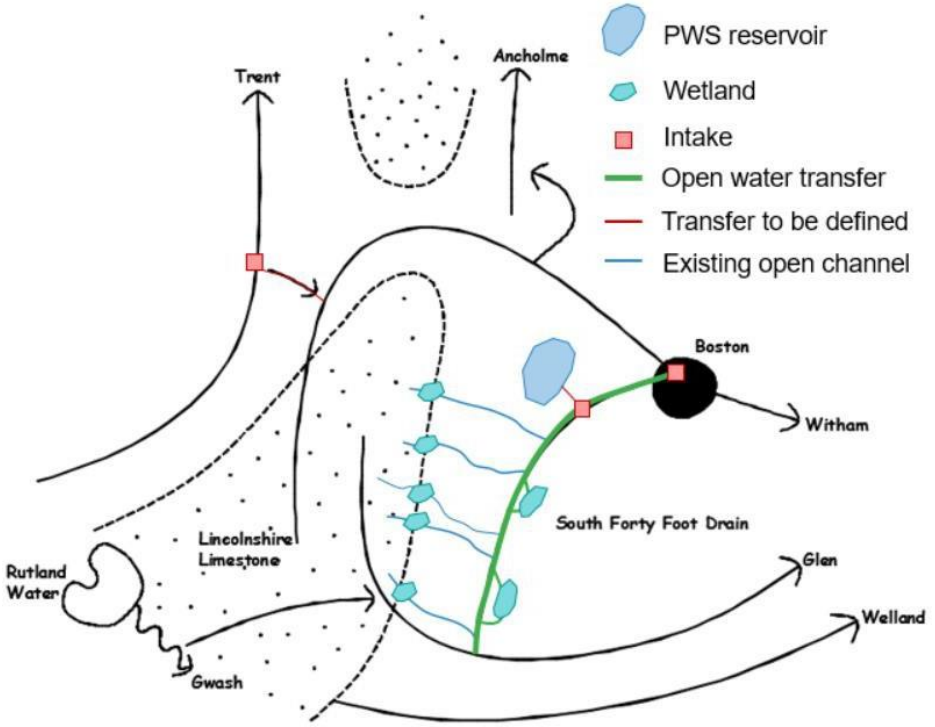
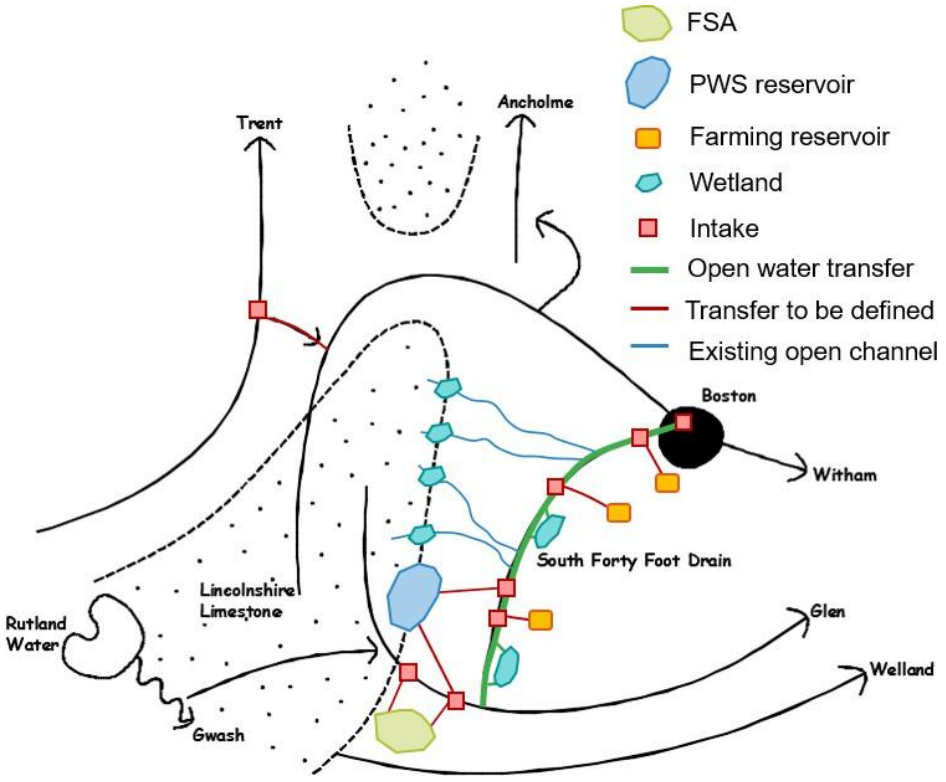


Figure A.3: SLR Concept Design 3



B. Designated Site Information

B.1 The Wash and North Norfolk Coast SAC

Onservation objectives

B.1.1 Qualifying features

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

- H1110. Sandbanks which are slightly covered by sea water all the time; Subtidal sandbanks
- H1140. Mudflats and sandflats not covered by seawater at low tide; Intertidal mudflats and sandflats
- H1160. Large shallow inlets and bays
- H1170. Reefs
- H1310. Salicornia and other annuals colonising mud and sand; Glasswort and other annuals colonising mud and sand
- H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- H1420. Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*); Mediterranean saltmarsh scrub

Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site

H1150. Coastal lagoons* Priority feature

Annex II species that are a primary reason for selection of this site

- S1365. Common seal Phoca vitulina

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

- S1355. Otter *Lutra lutra*

B.2 The Wash SPA

B.2.1 Qualifying features

- A037 *Cygnus columbianus bewickii* Bewick’ s swan (Non-breeding)
- A040 *Anser brachyrhynchus* Pink-footed goose (Non-breeding)
- A046a *Branta bernicla bernicla* Dark-bellied brent goose (Non-breeding)
- A048 *Tadorna tadorna* Common shelduck (Non-breeding)
- A050 *Anas penelope* Eurasian wigeon (Non-breeding)
- A051 *Anas strepera*; Gadwall (Non-breeding)
- A054 *Anas acuta* Northern pintail (Non-breeding)
- A065 *Melanitta nigra* Black (common) scoter (Non-breeding)
- A067 *Bucephala clangula* Common goldeneye (Non-breeding)
- A130 *Haematopus ostralegus* Eurasian oystercatcher (Non-breeding)
- A141 *Pluvialis squatarola* Grey plover (Non-breeding)
- A143 *Calidris canutus* Red knot (Non-breeding)
- A144 Calidris alba Sanderling (Non-breeding)

- A149 *Calidris alpina alpina* Dunlin (Non-breeding)
- A156 *Limosa limosa islandica* Black-tailed godwit (Non-breeding)
- A157 *Limosa lapponica* Bar-tailed godwit (Non-breeding)
- A160 *Numenius arquata* Eurasian curlew (Non-breeding)
- A162 *Tringa totanus* Common redshank (Non-breeding)
- A169 *Arenaria interpres* Ruddy turnstone (Non-breeding)
- A193 *Sterna hirundo* Common tern (Breeding)
- A195 *Sterna albifrons* Little tern (Breeding)
- Waterbird assemblage

B.3 The Wash Ramsar

B.3.1 Qualifying features

Ramsar criterion 1

The Wash is a large shallow bay comprising very extensive saltmarshes, major intertidal banks of sand and mud, shallow water and deep channels. It is the largest estuarine system in Britain.

Ramsar criterion 3

Qualifies because of the inter-relationship between its various components including saltmarshes, intertidal sand and mud flats and the estuarine waters. The saltmarshes and the plankton in the estuarine water provide a primary source of organic material which, together with other organic matter, forms the basis for the high productivity of the estuary.

Ramsar criterion 5

Assemblages of international importance: Species with peak counts in winter

Ramsar criterion 6

Species/populations occurring at levels of international importance:

- Common redshank *Tringa totanus totanus*
- Eurasian curlew *Numenius arquata arquata*
- Eurasian oystercatcher *Haematopus ostralegus ostralegus*
- Grey plover *Pluvialis squatarola*
- Red knot *Calidris canutus islandica*
- Sanderling *Calidris alba*

Species with peak counts in winter:

- Black-headed gull *Larus ridibundus*
- Common eider *Somateria mollissima mollissima*
- Bar-tailed godwit *Limosa lapponica lapponica*
- Common shelduck *Tadorna tadorna*
- Dark-bellied brent goose *Branta bernicla bernicla*
- Dunlin *Calidris alpina alpina*
- Pink-footed goose *Anser brachyrhynchus*

Criterion 6.

Species with peak counts in spring/autumn:

- Black-tailed godwit *Limosa limosa islandica*
- Ringed plover *Charadrius hiaticula*

Species with peak counts in winter:

- Northern lapwing *Vanellus vanellus*

B.4 Humber Estuary SAC

B.4.1 Qualifying features

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

1130 Estuaries

1140 Mudflats and sandflats not covered by seawater at low tide

Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site

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 (*Glauco-Puccinellietalia maritimae*)

2110 Embryonic shifting dunes

2120 "Shifting dunes along the shoreline with *Ammophila arenaria* (""white dunes"")"

2130 "Fixed coastal dunes with herbaceous vegetation (""grey dunes"")" * Priority feature

2160 Dunes with *Hippopha rhamnoides*

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

1095 Sea lamprey *Petromyzon marinus*

1099 River lamprey *Lampetra fluviatilis*

1364 Grey seal *Halichoerus grypus*

B.5 Humber Estuary SPA

B.5.1 Qualifying features

A021 *Botaurus stellaris* Great bittern (Non-breeding)

A021 *Botaurus stellaris* Great bittern (Breeding)

A048 *Tadorna tadorna* Common shelduck (Non-breeding)

A081 *Circus aeruginosus* Eurasian marsh harrier (Breeding)

A082 *Circus cyaneus* Hen harrier (Non-breeding)

A132 *Recurvirostra avosetta* Pied avocet (Non-breeding)

A132 *Recurvirostra avosetta* Pied avocet (Breeding)

A140 *Pluvialis apricaria* European golden plover (Non-breeding)

A143 *Calidris canutus* Red knot (Non-breeding)

A149 *Calidris alpina alpina* Dunlin (Non-breeding)

A151 *Philomachus pugnax* Ruff (Non-breeding)

A156 *Limosa limosa* islandica Black-tailed godwit (Non-breeding)

A157 *Limosa lapponica* Bar-tailed godwit (Non-breeding)

A162 *Tringa totanus* Common redshank (Non-breeding)

A195 *Sterna albifrons* Little tern (Breeding)

Waterbird assemblage

B.6 Humber Estuary Ramsar

B.6.1 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.

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

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.

- Common shelduck *Tadorna tadorna*
- Eurasian golden plover *Pluvialis apricaria altifrons* subspecies
- Red knot *Calidris canutus islandica* subspecies
- Dunlin *Calidris alpine alpina* subspecies
- Black-tailed godwit *Limosa limosa islandica* subspecies
- Bar-tailed godwit *Limosa lapponica lapponica* subspecies
- Common redshank *Tringa tetanus brittanica* subspecies

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.

B.7 Baston Fen SAC

B.7.1 Qualifying features

1149 Spined loach *Cobitis taenia*

mottmac.com