HABITATS REGULATIONS ASSESSMENT – VOLUME 3 - APPENDIX 2

European Site Conservation Objectives

Drax Bioenergy with Carbon Capture and Storage

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations, 2009 - Regulation 5(2)(g)

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European Site Conservation Objectives for Humber Estuary Special Area of Conservation Site Code: UK0030170

With regard to the natural habitats and/or species for which the site has been designated (the 'Qualifying Features' listed below), and subject to natural change;

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.**

This document should be read in conjunction with the accompanying *Supplementary Advice* document, which provides more detailed advice and information to enable the application and achievement of the Objectives set out above.

Qualifying Features:

H1110. Sandbanks which are slightly covered by sea water all the time; Subtidal sandbanks

H1130. Estuaries

H1140. Mudflats and sandflats not covered by seawater at low tide; Intertidal mudflats and sandflats

H1150. Coastal lagoons*

H1310. *Salicornia* and other annuals colonising mud and sand; Glasswort and other annuals colonising mud and sand

H1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)

H2110. Embryonic shifting dunes

H2120. Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); Shifting dunes with marram

H2130. Fixed dunes with herbaceous vegetation ("grey dunes"); Dune grassland*

H2160. Dunes with *Hippophae rhamnoides*; Dunes with sea-buckthorn

S1095. *Petromyzon marinus*; Sea lamprey

S1099. *Lampetra fluviatilis*; River lamprey

S1364. *Halichoerus grypus*; Grey seal

* denotes a priority natural habitat or species (supporting explanatory text on following page)

This is a European Marine Site

This site is a part of the Humber Estuary European Marine Site. These Conservation Objectives should be used in conjunction with the Conservation Advice document for the EMS. Natural England's formal Conservation Advice for European Marine Sites can be found via GOV.UK.

*** Priority natural habitats or species**

Some of the natural habitats and species for which UK SACs have been selected are considered to be particular priorities for conservation at a European scale and are subject to special provisions in the Habitats Regulations. These priority natural habitats and species are denoted by an asterisk (*) in Annex I and II of the Habitats Directive. The term 'priority' is also used in other contexts, for example with reference to particular habitats or species that are prioritised in UK Biodiversity Action Plans. It is important to note however that these are not necessarily the priority natural habitats or species within the meaning of the Habitats Regulations.

Explanatory Notes: European Site Conservation Objectives

These Conservation Objectives are those referred to in the Conservation of Habitats and Species Regulations 2017 as amended from time to time (the "Habitats Regulations"). They must be considered when a competent authority is required to make a 'Habitats Regulations Assessment', including an Appropriate Assessment, under the relevant parts of this legislation.

These Conservation Objectives and the accompanying Supplementary Advice (where available) will also provide a framework to inform the measures needed to conserve or restore the European Site and the prevention of deterioration or significant disturbance of its qualifying features.

These Conservation Objectives are set for each habitat or species of a Special Area of Conservation (SAC). Where the objectives are met, the site will be considered to exhibit a high degree of integrity and to be contributing to achieving Favourable Conservation Status for that species or habitat type at a UK level. The term 'favourable conservation status' is defined in regulation 3 of the Habitats Regulations.

Publication date: 27 November 2018 (version 3). This document updates and replaces an earlier version dated 31 March 2014 to reflect the consolidation of the Habitats Regulations in 2017.

Humber Estuary SAC

Last updated: 13th September 2019

Supplementary advice

The Supplementary Advice on Conservation Objectives (SACOs) present attributes which are ecological characteristics or requirements of the designated species and habitats within a site. The listed attributes are considered to be those which best describe the site's ecological integrity and which if safeguarded will enable achievement of the Conservation Objectives. These attributes have a target which is either quantified or qualified depending on the available evidence.

The target identifies as far as possible the desired state to be achieved for the attribute. In many cases, the attribute targets show if the current objective is to either 'maintain' or 'restore' the attribute. The targets given for each attribute do not represent thresholds to assess the significance of any given impact in Habitats Regulation Assessments. You will need to assess this on a case-by-case basis using the most current information available.

Where there is no evidence to determine a marine feature's condition, a vulnerability assessment, which includes sensitivity and exposure information for features and activities in a site, has been used as a proxy for condition. Evidence used in preparing the SACO has been cited with hyperlinks included where possible. Where references have not been provided, Natural England has applied ecological knowledge and expert judgement.

Some, but not all, of these attributes can also be used for regular monitoring of the condition of the designated features. The attributes selected for monitoring the features, and the standards used to assess their condition, are listed in separate monitoring documents, which will be available from Natural England. As condition assessment information becomes available, the conservation advice package will be reviewed accordingly.

When to use

You should use this information, along with the conservation objectives and case-specific advice issued by Natural England when developing, proposing or assessing an activity, plan or project that may affect the site.

Any proposals or operations which may affect the site or its features should be designed so they do not adversely affect any of the attributes in the SACO or achievement of the conservation objectives.

Please note: The conservation advice for marine features has been completed for this site. Natural England is in the process of developing Conservation Advice for the terrestrial features, which will be added here in due course. Whilst the additional feature information is being developed, the associated SACO target and site specific information will appear blank. Please contact your local area team adviser for further information.

Features:

Choose one or more features and/or their sub-features below by selecting the applicable boxes in the tree. This will show the relevant targets. Where a feature has sub-features this will be indicated with a greyed out triangle below, which can be expanded.

- ☑ Atlantic salt meadows (Glauco-Puccinellietalia maritimae)
- ☑ Coastal lagoons
- ☑ Dunes with Hippophae rhamnoides
- ☑ Embryonic shifting dunes
- ☑ Estuaries
  - ☑ Atlantic salt meadows (Glauco-Puccinellietalia maritimae)
  - ☑ Intertidal mixed sediments
  - ☑ Intertidal mud
  - ☑ Intertidal sand and muddy sand
  - ☑ Intertidal seagrass beds
  - ☑ Salicornia and other annuals colonising mud and sand
  - ☑ Subtidal coarse sediment
  - ☑ Subtidal mixed sediments
  - ☑ Subtidal mud
  - ☑ Subtidal sand
- ☑ Fixed dunes with herbaceous vegetation ("Grey dunes")
- ☑ Grey seal (Halichoerus grypus)
- ☑ Mudflats and sandflats not covered by seawater at low tide
  - ☑ Intertidal mixed sediments
  - ☑ Intertidal mud
  - ☑ Intertidal sand and muddy sand
  - ☑ Intertidal seagrass beds
- ☑ River lamprey (Lampetra fluviatilis)
- ☑ Salicornia and other annuals colonising mud and sand
- ☑ Sandbanks which are slightly covered by sea water all the time
  - ☑ Subtidal sand
- ☑ Sea lamprey (Petromyzon marinus)
- ☑ Shifting dunes along the shoreline with Ammophila arenaria ("White dunes")

Reset | Select all | Show attributes and targets for selected features

Attributes:

You can filter to show only targets for certain attributes by selecting one or more attributes from the list below (use ctrl click to select multiple). Note that only attributes for the features you have chosen are shown.

Distribution of the feature, including associated transitional habitats, within the site
Distribution: presence and spatial distribution of biological communities
Disturbance caused by human activity
Extent and distribution
Extent of habitat and associated transitions within the site
Extent of supporting habitat (habitat)

Feature target

'Maintain' targets do not preclude the need for management, now or in the future, to avoid a significant risk of damage or deterioration to the feature. The supporting and/or explanatory notes in the SACOs set out why the target was chosen and any relevant site based supporting information. This is based on the best available information, including that gathered during monitoring of the feature's current condition.

Feature/Subfeature name	Attribute	Target	Season	Supporting notes
Dunes with	Distribution of	Maintain the	N/A	This target has been included because a contraction in the range, or geographic spread, of the feature (and its

rhamnoides	including associated transitional habitats, within the site	and continuity of the feature, including where applicable its component vegetation types and associated transitional vegetation types, across the site.		variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. This may also reduce and break up the continuity of a habitat within a site and how well its typical species are able to move around the site to occupy and use habitat. Such fragmentation can impact their viability and the wider ecological composition of the Annex I habitat. Smaller fragments of habitat can typically support smaller and more isolated populations that are more vulnerable to extinction. These fragments also have a greater amount of open edge habitat that will differ in the amount of light, temperature, wind, and even noise that it receives compared to its interior. These conditions may not be suitable for some of the typical and more specialist species associated with the Annex I habitat feature. Site-specifics: Dune scrub is found abundantly in areas where sand dune occurs in the Humber Estuary SAC, and often dominates the upper end of the zonation. It occurs in the outer estuary on both north and south bank dune systems, especially at Spurn and between Cleethorpes and Tetney Marsh. Field observations suggest this feature is distributed in a typical fashion within the Humber SAC. A survey of the feature has been commissioned and this advice may be updated after the publication of a sand dune monitoring report, expected in autumn 2020. The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	Distribution of the feature, including associated transitional habitats, within the site	Maintain the range and continuity of the habitat and its natural transitions within saltmarsh types and to other habitats seaward and landward.	N/A	This target has been included because a contraction in the range, or geographic spread, of the feature (and its component vegetation and typical species) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. This may also reduce and break up the continuity of a habitat within a site and how well its typical species are able to move around the site to occupy and use habitat. Such fragmentation can impact on their viability and the wider ecological composition of the Annex I habitat. Smaller fragments of habitat can typically support smaller and more isolated populations that are more vulnerable to extinction. These fragments also have a greater amount of open edge habitat that will differ in the amount of light, temperature, wind, and even noise that it receives compared to its interior. These conditions may not be suitable for some of the typical and more specialist species associated with the Annex I habitat feature. Site-specifics: In 2001 the distribution of saltmarsh, ranging from pioneer species to the transitional reedbeds, within the Humber Estuary was mapped (Bullen Consultants, 2001), (Dargie, 2001). The composition of the Humber's saltmarshes is unusual compared to other UK estuaries. Over half the marsh is dominated by common reed *Phragmites australis* and sea club-rush *Scirpus maritimus*. Typical saltmarsh communities pioneer marsh and low, mid and upper marsh communities are scarce, amounting to less than 1% of the total estuarine area (English Nature, 2003). The Humber Estuary supports saltmarsh on both its northern and southern banks in varying degrees of diversity. On the north bank of the estuary notable areas including Cherry Cob Sands, Spurn Bight and Welwick, all of which display several clear successional communities ranging from low to mid-upper marsh communities. On the south bank of the estuary key areas include Cleethorpes and North Somercotes. In contrast to rest of England, the upper marsh in the outer estuary is dominated by a species poor sea couch *Elytrigia atherica* (*Elymus pycanthus*) saltmarsh community (SM24), and other transition communities are scarce. The inner part of the Humber Estuary recorded a narrow strip of vegetation of low-mid communities (SM11, SM12) around South Ferriby, Winteringham Haven. Small patches of mid-upper marsh communities (SM16) were recorded around North & South Ferriby and Brough Roads. In the inner estuary from Trent Falls down to the King George V bridge at Gunness, the tidal marsh community is dominated by the common reed *Phragmites australis* (S4) and sea club-rush *Bulboschoenus maritimus* swamp (S21), with the couch grass *Elymus repens* saltmarsh community (SM28). These habitats account for more than 50% of the total tidal vegetation in this area of the inner estuary. Saltmarsh may also be found in tributary mouths and sheltered sections of the estuary, as at Pyewipe and Skitter Ness where low marsh communities (SM10-SM12) were recorded. (Allen et al., 2003), (Bullen Consultants, 2001), (Dargie, 2001), (English Nature, 2003) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Salicornia and other annuals colonising mud and sand	Distribution of the feature, including associated transitional habitats, within the site	Maintain the range of the habitat and natural transitions within saltmarsh types and to other habitats seaward and landward.	N/A	This target has been included because a contraction in the range, or geographic spread, of the feature (and its component vegetation and typical species) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. These habitats can exist both in extensive continuous stands, or in more discrete patches within intertidal sediments depending on the site and reflecting the tidal processes and sediment characteristics. They may be present at upper and lower levels of the marsh. Site-specifics: Within the Humber Estuary SAC, glasswort *Salicornia* spp. (SM8) and annual sea blite *Suaeda maritime* (SM9) communities are the primary colonising saltmarsh species present. These communities are more dominant in the outer estuary on both the north and south banks with the highest concentrations found along the North Lincolnshire and the Pyewipe-to-Cleethorpes Coasts. On the North Lincolnshire coast these communities largely form a mosaic with common saltmarsh grass *Puccinellia maritima* (SM10). This is a combination which is also found on the north bank from Spurn Head to Saltend Flats but with reduced extent, and where common cord-grass *Spartina anglica* (SM6) is a more dominant colonising species. *Spartina* spp. is also found further upstream at The Grues and Barton to Barrow rather than the SM8 and SM9 communities. As a non-native species, *Spartina* spp. is not a designated feature of the SAC; however, as a pioneer species it colonises areas of mudflat enabling the introduction and establishment of Atlantic salt meadows (Bullen Consultants, 2001), (Dargie, 2001), (Allen et al., 2003). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.

herbaceous vegetation ("Grey dunes")	the feature, including associated transitional habitats, within the site	distribution and continuity of the feature, including where applicable its component vegetation types and associated transitional vegetation types, across the site.		component vegetation and typical species) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. This may also reduce and break up the continuity of a habitat within a site and how well its typical species are able to move around the site to occupy and use habitat. Such fragmentation can impact on their viability and the wider ecological composition of the Annex I habitat. Smaller fragments of habitat can typically support smaller and more isolated populations that are more vulnerable to extinction. These fragments also have a greater amount of open edge habitat which will differ in the amount of light, temperature, wind, and even noise, that it receives compared to its interior. These conditions may not be suitable for some of the typical and more specialist species associated with the Annex I habitat feature. For this feature it is also important to maintain transitions between fixed / semi-fixed dunes and other dune / terrestrial habitats to seaward or landward. Site-specifics: Fixed dunes are found frequently in areas where sand dunes occur in the Humber SAC, and often dominate the zonation. They occur in the outer estuary on both north and south bank dune systems. Field observations suggest a range of SD NVC communities make up the fixed dune features. Where dunes develop naturally and are extensive some transitional habitat is apparent. Given a lack of recent data a precautionary approach has been adopted and a 'Restore' target has been set until appropriate management measures can be identified. A survey of the feature has been commissioned and this advice may be updated after the publication of a sand dune monitoring report, expected in autumn 2020. Field observations suggest that the extent of this feature could be in decline. Given this, and considering that air quality levels also significantly exceed nitrogen deposition thresholds for sand dune habitat, a precautionary approach has been adopted and a 'Restore' target has been set until appropriate management measures can be identified.
Embryonic shifting dunes	Distribution of the feature, including associated transitional habitats, within the site	Restore the distribution and continuity of the feature, including where applicable its component vegetation types and associated transitional vegetation types, across the site.	N/A	This target has been included because a contraction in the range, or geographic spread, of the feature (and its component vegetation and typical species) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. This zone of shifting dunes occurs between the beach plane and the usually more stable and fully vegetated older dunes. Communities may be dynamic in their distribution and are linked to the sedimentary processes operating at the site. Site-specifics: The feature occurs in the outer estuary and is thought to be quite scarce. Where zonation does occur the transitional bands of habitat are typically very narrow and quickly succeed to fixed dunes or dune scrub. Field observations indicate a lack of continuity for this feature and so a precautionary approach has been adopted and a 'Restore' target has been set until appropriate management measures can be identified. A survey of the feature has been commissioned and this advice may be updated after the publication of a sand dune monitoring report, expected in autumn 2020.
Shifting dunes along the shoreline with Ammophila arenaria ("White dunes")	Distribution of the feature, including associated transitional habitats, within the site	Restore the distribution and continuity of the feature, including where applicable its component vegetation types and associated transitional vegetation types, across the site.	N/A	This target has been included because a contraction in the range, or geographic spread, of the feature (and its component vegetation and typical species) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. This may also reduce and break up the continuity of a habitat within a site and how well its typical species are able to move around the site to occupy and use habitat. Such fragmentation can impact on their viability and the wider ecological composition of the Annex I habitat. Smaller fragments of habitat can typically support smaller and more isolated populations that are more vulnerable to extinction. These fragments also have a greater amount of open edge habitat that will differ in the amount of light, temperature, wind, and even noise that it receives compared to its interior. These conditions may not be suitable for some of the typical and more specialist species associated with the Annex I habitat feature. For this feature, this strongly relates to the coastal processes (sand deposition by wind, tideline debris to initiate sand trapping and lack of disturbance during growing season) as well as seed / propagule supply that determine the presence of the habitat. Distribution of habitat relates to the availability of blown sand from the beach plain, as well as seed / propagule supply that determine the presence of the habitat. Ammophila arenaria (marram grass) plants also have a mycorrhizal association. Annex I habitat to be present where relevant sedimentary and wind conditions occur. Site-specifics: The feature occurs sparsely across the estuary, occurring occasionally in outer areas. Where zonation occurs the transitional bands of habitat as typically very narrow and quickly succeed to fixed dunes or dune scrub. The lack of continuity that has been observed for this feature means a restore target has been selected precautionarily. This target may be reviewed after the publication of the 2019 sand dune survey report, expected in autumn 2020. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Coastal lagoons	Distribution: presence and spatial distribution of biological communities	Maintain the presence and spatial distribution of coastal lagoon communities.	N/A	A variety of communities make up the habitat. Listed component communities reflect the habitat's overall character and conservation interest. Communities are described as biotopes using EUNIS or the Marine Habitat Classification. Communities include, but are not limited to, those that are notable or representative of the feature. Representative communities include, for example, those covering large areas and notable communities include those that are rare, scarce or particularly sensitive to pressure. Changes to the spatial distribution of communities across the feature, could highlight changes to the overall feature (Joint Nature Conservation Committee (JNCC), 2004). There are some unique communities in lagoons, including some species of plants and, notably, specialist invertebrates that are adapted to the lagoon environment. Site-specifics: Humberston Fitties is diverse for a lagoon and is comprised of many lagoon specialist species, making it the third most important lagoon in Great Britain in terms of community composition. *Gammarus insensibilis* has been recorded at Humberston Fitties Lagoon which is the most northerly population of this species in Great Britain. The population of *G. insensibilis* is entirely confined upon the alga *Chaetomorpha linum* for which Humberston Fitties is one of the most northerly sites in Great Britain, possibly Europe, for this species. This association is well known and *G. insensibilis* does not occur in Great Britain without this plant. A relatively diverse community has been recorded at Northcoates Lagoon, reflecting the progression from marine to brackish habitats through the system.

				(Seaton, 2001), (Worsfold, 2001), (Allen et al., 2003), (English Nature, 2003) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Estuaries	Distribution: presence and spatial distribution of biological communities	Maintain the presence and spatial distribution of estuary communities.	N/A	A variety of communities make up the habitat. Listed component communities reflect the habitat's overall character and conservation interest. Communities are described as biotopes using EUNIS or the Marine Habitat Classification. Communities include, but are not limited to, those that are notable or representative of the feature. Representative communities include, for example, those covering large areas and notable communities include those that are rare, scarce or particularly sensitive to pressure. Changes to the spatial distribution of communities across the feature, could highlight changes to the overall feature (Joint Nature Conservation Committee (JNCC), 2004), (Joint Nature Conservation Committee (JNCC), 2004), (Davies et al., 2001), (Dyer, 1997), (Hiscock et al., 2006), (Environment Agency (EA), 2011), (Davidson and Buck, 1997). Site-specifics: The Humber Estuary SAC estuary comprises of the following sub-features: Subtidal coarse sediment (A5.1), subtidal sand (A5.2) subtidal mud (A5.3) subtidal mixed sediments (A5.4) intertidal sand and muddy sand (A2.2) intertidal mud (A2.3) intertidal mixed sediment (A2.4) intertidal seagrass beds (A2.61) Tidal reed bed (A5.541) Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) (H1330) and *Salicornia* and other annuals colonising mud and sand (H1310) The Humber Flood Risk Management Strategy HRA predicts that approximately 300ha of intertidal habitat, notably saltmarsh and intertidal mudflats and sandflats, will be lost to coastal squeeze by 2056 (Enviroment Agency (EA), 2011). This was modelled in 2008 and will be reviewed as part of the comprehensive review of the Humber FRMS, scheduled for completion in 2020. Please refer to the relevant feature and sub-feature supporting notes for more information. (Enviroment Agency (EA), 2011) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal mixed sediments	Distribution: presence and spatial distribution of biological communities	Maintain the presence and spatial distribution of intertidal mixed sediment communities.	N/A	A variety of communities comprise the habitat. Listed component communities reflect the habitat's overall character and conservation interest. Communities are described as biotopes using EUNIS or the Marine Habitat Classification. Communities include but are not limited to those which are notable or representative of the feature. Representative communities include, for example, those covering large areas and notable communities include those that are rare, scarce or particularly sensitive to pressure. Changes to the spatial distribution of communities across the feature, could highlight changes to the overall feature (Joint Nature Conservation Committee (JNCC), 2004). Site-specifics: The only biotope found on Mixed Sediment in the most recent survey was A2.4115 *Hediste diversicolor* and *Corophium volutator* in littoral gravelly sandy mud (LS.LMx.GvMu.HedMx.CvoI) this biotope is primarily characterised by *Hediste diversicolor* and *Corophium volutator* in littoral gravelly sandy mud. This biotope is typically found in sheltered conditions, such as those in the Inner Humber. The 2014 report found that overall biotope distribution was ‘favourable –maintained’, based on figures from the 2009 survey(Franco et al., 2015),(Frost et al., 2010). With regard to the attribute ‘Extent and Distribution’ and its target of ‘Restore’: this attribute target acknowledges the loss of the extent and associated reduction in abundance of communities. The sediment regime in the Humber means that Mixed Sediments are naturally scarce and so their associated communities also exist in small numbers. For this reason, the target ‘Maintain' has been selected for this attribute of the subfeature, as a lack of evidence means the loss cannot be directly associated with a change in presence and distribution. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal mud	Distribution: presence and spatial distribution of biological communities	Maintain the presence and spatial distribution of intertidal mud communities.	N/A	A variety of communities make up the habitat. Listed component communities reflect the habitat's overall character and conservation interest. Communities are described as biotopes using EUNIS or the Marine Habitat Classification. Communities include, but are not limited to, those that are notable or representative of the feature. Representative communities include, for example, those covering large areas and notable communities include those that are rare, scarce or particularly sensitive to pressure. Changes to the spatial distribution of communities across the feature could highlight changes to the overall feature (Joint Nature Conservation Committee (JNCC), 2004). Site-specifics: Intertidal mud communities (A2.3) are the most common intertidal community in the Humber Estuary. This habitat is found across the whole estuary, inner, mid, outer and North and South banks in one form or another. Within this, A2.312 *Hediste diversicolor* and *Limecola balthica* in littoral sandy mud (LS.LMu.MEst.HedMac) is predominant, accounting for 3641ha (Franco et al., 2015). Other A2.3 communities include, but are not limited to: A2.313 *Nephtys hombergii*, *Limecola balthica* and *Streblospio shrubsolii*in littoral sandy mud (LS.LMu.MEst.NhomMacScr), A2.3222 *Hediste diversicolor*and *Corophium volutator* in littoral mud (LS.LMu.UEst.Hed.CvoI) and A2.3223 *Hediste diversicolor* and oligochaetes in littoral mud (LS.LMu.UEst.Hed.OI) which are representative of the feature. The community A2.323 *Tubificoides benedii* and other oligochaetes in littoral mud (LS.LMu.UEst.Tben) is one of the most scarce intertidal mud communities, accounting for 1ha of the total feature. With regard to the attribute ‘Extent and Distribution’ and its target of ‘Restore’: this attribute acknowledges the loss of the extent and associated reduction in abundance of communities. However, for this attribute, the overall spread of mud communities is acceptable. For example, the distribution of communities across the elevation gradient is as

				The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal sand and muddy sand	Distribution: presence and spatial distribution of biological communities	Maintain the presence and spatial distribution of intertidal sand and muddy sand communities.	N/A	A variety of communities make up the habitat. Listed component communities reflect the habitat's overall character and conservation interest. Communities are described as biotopes using EUNIS or the Marine Habitat Classification. Communities include, but are not limited to, those that are notable or representative of the feature. Representative communities include, for example, those covering large areas and notable communities include those that are rare, scarce or particularly sensitive to pressure. Changes to the spatial distribution of communities across the feature could highlight changes to the overall feature (Joint Nature Conservation Committee (JNCC), 2004). Site-specifics: There are a wide range of Sand and Muddy Sand biotopes in the Humber Estuary including, but not limited to A2.231 Polychaetes in littoral fine sand (LS.LSa.FiSa.Po) which accounts for the largest area at 1616ha, as well as A2.244 *Bathyporeia pilosa* and *Corophium Arenarium* in littoral muddy sand (LS.LSa.MuSa.BatCare) at 889ha. A2.241 *Limecola balthica* and *Arenicola marina* in littoral muddy Sand (LS.LSa.MuSa.MacAre) is relatively scarce at 62ha. (Franco et al., 2015),(Frost et al., 2010) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal seagrass beds	Distribution: presence and spatial distribution of biological communities	Maintain the presence and spatial distribution of intertidal seagrass bed communities.	N/A	A variety of communities make up the habitat. Listed component communities reflect the habitat's overall character and conservation interest. Communities are described as biotopes using EUNIS or the Marine Habitat Classification. Communities include, but are not limited to, those that are notable or representative of the feature. Representative communities include, for example, those covering large areas and notable communities include those that are rare, scarce or particularly sensitive to pressure. Changes to the spatial distribution of communities across the feature, could highlight changes to the overall feature (Joint Nature Conservation Committee (JNCC), 2004). The communities supported by seagrass can vary enormously as seagrass can colonise any sediment from muddy to coarse. The unique sets of variables can support very different groups of infauna and epifauna communities. Site-specifics: There is currently no site specific biotope data on the intertidal seagrass bed communities at Spurn Point or from historical records from elsewhere within the site. Further survey work is needed to increase the confidence level of this target (Yorkshire Wildlife Trust, 2014),(Yorkshire Wildlife Trust, 2013),(Stoutt, 2013). The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Mudflats and sandflats not covered by seawater at low tide	Distribution: presence and spatial distribution of biological communities	Maintain the presence and spatial distribution of mudflat and sandflat communities.	N/A	A variety of communities make up the habitat. Listed component communities reflect the habitat's overall character and conservation interest. Communities are described as biotopes using EUNIS or the Marine Habitat Classification. Communities include, but are not limited to, those that are notable or representative of the feature. Representative communities include, for example, those covering large areas and notable communities include those that are rare, scarce or particularly sensitive to pressure. Changes to the spatial distribution of communities across the feature, could highlight changes to the overall feature (Joint Nature Conservation Committee (JNCC), 2004). Site-specifics: The intertidal mudflats and sand flats feature in the Humber Estuary is comprised of the following habitat types: A2.2 Littoral sand and muddy sand (Intertidal sand and muddy sand subfeature; A2.3 Littoral mud (Intertidal mud subfeature); A2.4 Littoral mixed sediments (Intertidal mixed sediment subfeature); A2.61; Eelgrass (Intertidal Seagrass Beds subfeature). Please refer to the attributes of these sub-features for more detailed information on the intertidal communities present within the site. Representative communities include: A2.312 *Hediste diversicolor* and *Limecola balthica* in littoral sandy mud (LS. LMu.MEst.HedMac) which accounts for 3641ha for the feature A2.231 Polychaetes in littoral fine sand (LS.LSa.FiSa.Po) which covers 1616ha These two communities make up around half of the feature but over 20 communities were identified at last survey. Littoral Mixed Sediments are relatively scarce in the Humber, accounting for 29ha and are found in the inner estuary. Eelgrass communities are nationally rare and are present in the Humber in highly sheltered areas on the landward side of Spurn Point. A 2014 survey described 1ha of large eelgrass beds around Spurn Point, as well as a small number of isolated patches. Historically this figure is thought to have been much higher. The 2014 report found that overall biotope distribution in the Humber was 'favourable –maintained', based on figures from the 2009 survey. (Yorkshire Wildlife Trust, 2013); (Franco et al., 2015); (Frost et al., 2010) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal coarse sediment	Distribution: presence and spatial distribution of biological communities	Maintain the presence and spatial distribution of subtidal coarse sediment communities.	N/A	A variety of communities make up the habitat. Listed component communities reflect the habitat's overall character and conservation interest. Communities are described as biotopes using EUNIS or the Marine Habitat Classification. Communities include, but are not limited to, those that are notable or representative of the feature. Representative communities include, for example, those covering large areas and notable communities include those that are rare, scarce or particularly sensitive to pressure. Changes to the spatial distribution of communities across the feature could highlight changes to the overall feature (Joint Nature Conservation Committee (JNCC), 2004). Site-specifics: Subtidal coarse sediment is mobile and subject to physical disturbance as a result of wave action and strong tidal

				disturbed areas, and for the most part consists of the more actively-swimming amphipods and polychaete worms. The polychaete worms *Nephtys cirrosa, Nemertea, Capitella capitata, Aphelochaeta marioni* and *Scoloplos armiger* are found in these areas of the Humber Estuary , along with the bryozoan *Einhornia crustulenta* and *Electra monostachys* ABPmer, 2008 Enviroment Agency (EA), 2016 The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal mixed sediments	Distribution: presence and spatial distribution of biological communities	Maintain the presence and spatial distribution of subtidal mixed sediment communities.	N/A	A variety of communities make up the habitat. Listed component communities reflect the habitat's overall character and conservation interest. Communities are described as biotopes using EUNIS or the Marine Habitat Classification. Communities include, but are not limited to, those that are notable or representative of the feature. Representative communities include, for example, those covering large areas and notable communities include those that are rare, scarce or particularly sensitive to pressure. Changes to the spatial distribution of communities across the feature could highlight changes to the overall feature (Joint Nature Conservation Committee (JNCC), 2004). Site-specifics: There is limited evidence on the presence and spatial distribution of subtidal mixed sediment communities within the Humber Estuary. However, grab samples have found mixed sediment within the middle estuary (Coddington and Leighton, 2010). The polychaete *Capitella capitata* and flatworm Platyhelminthes, along with the bryozoans *Bicellariella ciliate* and *Flustra foliacea*, were present in the samples (Burdon et al., 2010). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal mud	Distribution: presence and spatial distribution of biological communities	Maintain the presence and spatial distribution of subtidal mud communities.	N/A	A variety of communities make up the habitat. Listed component communities reflect the habitat's overall character and conservation interest. Communities are described as biotopes using EUNIS or the Marine Habitat Classification. Communities include, but are not limited to, those that are notable or representative of the feature. Representative communities include, for example, those covering large areas and notable communities include those that are rare, scarce or particularly sensitive to pressure. Changes to the spatial distribution of communities across the feature could highlight changes to the overall feature (Joint Nature Conservation Committee (JNCC), 2004). Site-specifics: The 2010 subtidal sediment survey recorded the biotope SS.SMu.SMuVS.AphTubi (*Aphelochaeta marioni* and *Tubificoides* spp. in variable salinity infralittoral mud), found in more muddy sediments in the outer estuary. The grab samples in the inner/mid estuary included one muddy sample assigned to SS.Smu.SMuVS.NhomTubi (*Nephtys hombergii* and *Tubificoides* spp. In variable salinity infralittoral soft mud) (Pears et al., 2010). This information will be updated following the data analysis of recent subtidal sediment survey undertaken in April 2016. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal sand	Distribution: presence and spatial distribution of biological communities	Maintain the presence and spatial distribution of subtidal sand communities.	N/A	A variety of communities make up the habitat. Listed component communities reflect the habitat's overall character and conservation interest. Communities are described as biotopes using EUNIS or the Marine Habitat Classification. Communities include, but are not limited to, those that are notable or representative of the feature. Representative communities include, for example, those covering large areas and notable communities include those that are rare, scarce or particularly sensitive to pressure. Changes to the spatial distribution of communities across the feature could highlight changes to the overall feature (Joint Nature Conservation Committee (JNCC), 2004). Site-specifics: Representative subtidal sand biotopes in the Humber range from SS.SSa.IFiSa.NcirBat (*Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand) in the outer estuary to SS.SSa.SSaVS.NintGam (*Neomysis integer* and *Gammarus* spp. in fluctuating low salinity infralittoral mobile sand) and SS.SSa.SSaVS.MoSaVS (infralitoral mobile sand in variable saliny-estuariesin the mid and inner parts of the estuary (Pears et al., 2010). This information will be updated following the analysis of the subtidal sediment data gathered during the 2016 subtidal sediment survey. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Sandbanks which are slightly covered by sea water all the time	Distribution: presence and spatial distribution of biological communities	Maintain the presence and spatial distribution of subtidal sandbank communities.	N/A	A variety of communities make up the habitat. Listed component communities reflect the habitat's overall character and conservation interest. Communities are described as biotopes using EUNIS or the Marine Habitat Classification. Communities include, but are not limited to, those that are notable or representative of the feature. Representative communities include, for example, those covering large areas and notable communities include those that are rare, scarce or particularly sensitive to pressure. Changes to the spatial distribution of communities across the feature could highlight changes to the overall feature (Joint Nature Conservation Committee (JNCC), 2004). Site-specifics: The subtidal sandbanks feature in the Humber Estuary is comprised of sublittoral sand (A5.2). The benthic communities are dominated by *Nephtys cirrosa* and *Gastrosaccus spinifer* in mobile, clean, fine to medium sand. The representative biotope associated with the subtidal sandbanks features is SS.SSa.IFiSa.NcirBat (*Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand) (Pears et al., 2010),(ABPmer, 2008) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.

(Halichoerus grypus)	caused by human activity			The nature, scale, timing and duration of some human activities can result in disturbance (defined as any human-induced activity sufficient to disrupt normal behaviours and / or distribution of seals in the absence of the activity) at a level that may substantially affect their behaviour, and consequently affect the long-term viability of a population (Gill et al., 2001). Such disturbing effects can, for example, result in changes to the alert response, initiate threat displays, increase energy expenditure through flushing into the water, loss of resting/digestion time, and stress (Granquist and Sigurjonsdottir, 2014), (Seal Conservation Society, 2011). During the breeding season it can also result in interrupted suckling of pups and separation of pups from mothers (Osinga et al., 2012), and disturbance within a few hours of giving birth can undermine successful bonding between mother and pup and cause temporary or permanent separation (Reijnders, 1980), (Henry and Hammill, 2001). This disruption will affect lactation and milk intake of pups, which can be detrimental to their condition (Osinga et al., 2012) and impact rearing success (Granquist and Sigurjonsdottir, 2014). During moulting, haul-out time is maximised to facilitate higher skin temperatures, which are necessary to promote hair growth (Ashwell-Erikson et al., 1986), (Henry and Hammill, 2001), and animals may not show an overt response at this time to avoid energetic cost, but still suffer physiological responses, increased stress and potential health impacts (Gill et al., 2001). Once disturbed seals may be reluctant to haul-out again, and seek alternative haul-out locations (Henry and Hammill, 2001), (Osinga et al., 2012). Disturbance associated with human activity may take a variety of forms including presence of people, animals, vessels (powered and non-motorised), and aircraft (Henry and Hammill, 2001). Disturbance is defined by the Seal Conservation Society (Seal Conservation Society, 2011): “Human interaction with individuals or colonies of seals, sea lions and fur seals can be considered to cause disturbance if the interaction disrupts or alters the animals’ normal behaviour.” From a conservation perspective disturbance is important if it results in decreased survival, reproductive rate, population shifts or declines (Gill et al., 2001). (Groothedde, 2011); (Thompson et al., 2001); (Wilson, Unknown) --- Site-specifics: To be completed.
Subtidal coarse sediment	Extent and distribution	Maintain the total extent and spatial distribution of subtidal coarse sediment.	N/A	The extent describes the presence and area of the habitat. It’s the total area of the habitat across the site as a whole, even where it’s patchy. The distribution describes the more detailed location(s) and pattern of habitat across the site. The distribution will influence the component communities present, and also help increase the health and resilience of the feature (Joint Nature Conservation Committee (JNCC), 2004). A reduction in extent would alter the biological and physical functioning of the feature (Elliott et al., 1998). It's difficult to put an extent objective on a mobile, changing feature. An understanding of the supporting processes will be more helpful in determining site integrity. However, the extent can also be defined where the proportion of sediment-sensitive invertebrates (PSI) indicates a change to the sediment character. (Klein, 2006) --- Site-specifics: Sediment composition and distribution is highly variable within the Humber Estuary. Towards the mouth of the estuary, the proportion of silt drops and is generally replaced by more coarse sediments, due to the increased mobility of the sediments. The subtidal coarse sediments of the Humber are mainly found in the main exposed channels where the strong tidal currents have scoured the estuary floor. Grab samples have identified coarse sediment in the channel waters off Immingham (Coddington and Leighton, 2010) and Sunk Island. Allen et al., 2003 ABPmer, 2008 Coddington and Leighton, 2010 ABP Marine Environmental Research Ltd (ABPmer), 2011 Enviroment Agency (EA), 2016 The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal mixed sediments	Extent and distribution	Maintain the total extent and spatial distribution of subtidal mixed sediment.	N/A	The extent describes the presence and area of the habitat. It’s the total area of the habitat across the site as a whole, even where it’s patchy. The distribution describes the more detailed location(s) and pattern of habitat across the site. The distribution will influence the component communities present, and also help increase the health and resilience of the feature (Joint Nature Conservation Committee (JNCC), 2004). A reduction in extent would alter the biological and physical functioning of the feature (Elliott et al., 1998). It's difficult to put an extent objective on a mobile, changing feature. An understanding of the supporting processes will be more helpful in determining site integrity. However, the extent can also be defined where the proportion of sediment-sensitive invertebrates (PSI) indicates a change to the sediment character. (Klein, 2006) --- Site-specifics: The subtidal environment is highly dynamic and subtidal sediments in the Humber Estuary range from muddy sands dominated by silt/clay through to coarse sand and gravel (Allen et al., 2003),(Hemingway et al., 2008). Grab samples have found subtidal mixed sediment in the channel waters off Immingham (Coddington and Leighton, 2010). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal mud	Extent and distribution	Maintain the total extent and spatial distribution of subtidal mud.	N/A	The extent describes the presence and area of the habitat. It’s the total area of the habitat across the site as a whole, even where it’s patchy. The distribution describes the more detailed location(s) and pattern of habitat across the site. The distribution will influence the component communities present, and also help increase the health and resilience of the feature (Joint Nature Conservation Committee (JNCC), 2004). A reduction in extent would alter the biological and physical functioning of the feature (Elliott et al., 1998). It's difficult to put an extent objective on a mobile, changing

				extent can also be defined where the proportion of sediment-sensitive invertebrates (PSI) indicates a change to the sediment character. (Klein, 2006) Site-specifics: Within the Humber Estuary SAC, subtidal mud is found predominantly in the outer estuary and, to a lesser extent, in the mid estuary (Allen et al., 2003), (Pears et al., 2010), (ABPmer, 2008). However, initial results from the 2016 subtidal sediment survey found subtidal mud in outer, middle and inner estuary. This information will be updated following the data analysis of recent subtidal sediment survey undertaken in April 2016. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal sand	Extent and distribution	Maintain the total extent and spatial distribution of subtidal sand.	N/A	The extent describes the presence and area of the habitat. It's the total area of the habitat across the site as a whole, even where it's patchy. The distribution describes the more detailed location(s) and pattern of habitat across the site. The distribution will influence the component communities present, and also help increase the health and resilience of the feature (Joint Nature Conservation Committee (JNCC), 2004). A reduction in extent would alter the biological and physical functioning of the feature (Elliott et al., 1998). It's difficult to put an extent objective on a mobile, changing feature. An understanding of the supporting processes will be more helpful in determining site integrity. However, the extent can also be defined where the proportion of sediment-sensitive invertebrates (PSI) indicates a change to the sediment character. (Klein, 2006) Site-specifics: Within the Humber Estuary subtidal sand is variably distributed throughout the estuary. Results from the subtidal sediment survey undertaken in 2010 showed that the estuary is generally dominated by fine sand, with varying secondary components of medium sand in the outer estuary and very fine sand in the inner and middle estuary (Allen et al., 2003), (ABPmer, 2008), (Pears et al., 2010) Results from the 2016 subtidal sediment survey also show that subtidal sand is distributed across the whole estuary (Enviroment Agency (EA), 2016). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Sandbanks which are slightly covered by sea water all the time	Extent and distribution	Maintain the total extent and spatial distribution of subtidal sandbanks to ensure no loss of integrity, while allowing for natural change and succession.	N/A	The extent describes the presence and area of the habitat. It's the total area of the habitat across the site as a whole, even where it's patchy. The distribution describes the more detailed location(s) and pattern of habitat across the site. The distribution will influence the component communities present, and also help increase the health and resilience of the feature (Joint Nature Conservation Committee (JNCC), 2004). A reduction in extent would alter the biological and physical functioning of the feature (Elliott et al., 1998). It's difficult to put an extent objective on a mobile, changing feature. An understanding of the supporting processes will be more helpful in determining site integrity. However, the extent can also be defined where the proportion of sediment-sensitive invertebrates (PSI) indicates a change to the sediment character. (Klein, 2006) Site-specifics: Within the Humber Estuary subtidal sandbanks are mainly located in the outer estuary, east of Grimsby, in the regions of Grimsby Middle, Middle Shoal and Bull Sand. The sandbanks features are relatively mobile and vary greatly in their location due to the high energy nature of the estuary system. The existing sandbanks extents (data from 2000 – 2007) are in the following ranges: Grimsby Middle, 206-236 Ha; Middle Shoal, 252-340 Ha; Bull Sand, 355-486 Ha. (ABPmer, 2008) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Coastal lagoons	Extent and distribution	Maintain the total extent and spatial distribution of the lagoons to ensure no loss of integrity, allowing for natural succession and cyclical change from coastal processes.	N/A	The extent describes the presence and area of the habitat. It's the total area of the habitat across the site as a whole, even where it's patchy. The distribution describes the more detailed location(s) and pattern of habitat across the site. The distribution will influence the component communities present, and also help increase the health and resilience of the feature. The extent of lagoons influences the sensitivity of the habitat, and combined with their shape, the biological communities present. An increased variation in shape (or islands) results in sites with more diverse communities (Joint Nature Conservation Committee (JNCC), 2004). Site-specifics: Humberston Fitties lies south of Cleethorpes and is comprised of one main lagoon covering 1.7ha. Northcoates Lagoon lies south of Humberston Fitties and is an extensive and narrow lagoon system. There are two main lagoons; Northcoates Point A covering 1.8ha and Northcoates point B covering 2.2ha. North Somercoates lagoon system lies to the north of Saltfleet. This system consists of eight borrow pits. It is not currently considered to qualify as part of the Humber Estuary SAC saline lagoon feature. Coastal lagoons are dynamic features and this advice may be reviewed as new data becomes available. (Black & Veatch Ltd., 2005), (Allen et al., 2003) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal mixed sediments	Extent and distribution	Restore the total extent and spatial distribution of	N/A	The extent describes the presence and area of the habitat. It's the total area of the habitat across the site as a whole, even where it's patchy. The distribution describes the more detailed location(s) and pattern of habitat across the site. The distribution will influence the component communities present, and also help increase the health and resilience of the feature (Joint Nature Conservation Committee (JNCC), 2004). A reduction in extent would alter the biological and

		intertidal mixed sediment.		physical functioning of the feature (Elliott et al., 1998). It's difficult to put an extent objective on a mobile, changing feature. An understanding of the supporting processes will be more helpful in determining site integrity. However, the extent can also be defined where the proportion of sediment-sensitive invertebrates (PSI) indicates a change to the sediment character. If there is insufficient evidence, the existing extent occurring at any one time should be the focus of an assessment due to the natural variation, and a fresh survey is likely to be required at the point of assessment, to ascertain what the existing extent is. (Joint Nature Conservation Committee (JNCC), 2004) Site-specifics: The dynamic nature of the estuary is constrained by coastal squeeze along almost its entire length, restricting the natural development of intertidal mudflats and sand flats. Mixed sediments are scarce in the Humber Estuary, but are found primarily in the inner estuary on both the North and South banks. Small patches may occur in the middle estuary. They are typically a mix of mud and gravel (LS.MX.GrMu./ A2.41). Mixed sediments account for up to 29ha of the main mudflats and sandflats feature – around 0.3%. This figure is from the 2014 survey. Specific figures on loss of extent are not available for the subfeature but it is likely that some of the overall loss to the main Mudflat and sand flats feature (detailed separately) could have included some loss of this subfeature(Franco et al., 2015). The target has been set due to the overall loss of total feature extent since designation combined with the likelihood that these impacts result from anthropogenic activities The target is based on the best evidence available as well as expert judgement.
Intertidal mud	Extent and distribution	Restore the total extent and spatial distribution of intertidal mud.	N/A	The extent describes the presence and area of the habitat. It's the total area of the habitat across the site as a whole, even where it's patchy. The distribution describes the more detailed location(s) and pattern of habitat across the site. The distribution will influence the component communities present, and also help increase the health and resilience of the feature (Joint Nature Conservation Committee (JNCC), 2004). A reduction in extent would alter the biological and physical functioning of the feature (Elliott et al., 1998). It's difficult to put an extent objective on a mobile, changing feature. An understanding of the supporting processes will be more helpful in determining site integrity. However, the extent can also be defined where the proportion of sediment-sensitive invertebrates (PSI) indicates a change to the sediment character. If there is insufficient evidence, the existing extent occurring at any one time should be the focus of an assessment due to the natural variation, and a fresh survey is likely to be required at the point of assessment, to ascertain what the existing extent is. (Joint Nature Conservation Committee (JNCC), 2004) Site-specifics: The dynamic nature of the estuary is constrained by coastal squeeze along almost its entire length, restricting the natural development of intertidal mudflats and sand flats. At the time of designation the extent for intertidal mudflats and sand flats in the Humber estuary was 9382.46ha at low tide. (Franco et al., 2015),(Frost et al., 2010), (Enviroment Agency (EA), 2011),(Franco et al., 2015) The most recent survey of the whole feature described the total extent of all recorded biotopes as 8997ha. This suggests a loss of 385.46ha since designation. The EA monitor coastal squeeze on the Humber. Currently the intertidal area is monitored but not split in to features or subfeatures. The Humber Flood Risk Management Strategy HRA predicts a total loss of habitat across the estuary of 286ha by 2056, a large percentage of this will likely be mudflat and sand flats. This was modelled in 2008 and will be reviewed in 2017. Intertidal mud is present across the Humber Estuary, but is most common in the middle and outer areas, with smaller patches occurring in strips along the banks of the inner estuary. Intertidal mud accounts for 5000ha of the main feature, around 55%. This figure is from the 2014 survey and shows no significant change since the previous survey in 2009. Specific figures are not available for the subfeature since designation but it is likely that some of the overall loss to the Mudflat and sand flats feature could have included loss of this Intertidal Mud. The target has been set due to the overall loss of total feature extent since designation combined with the likelihood that these impacts result from anthropogenic activities The target is based on the best evidence available as well as expert judgement.
Intertidal sand and muddy sand	Extent and distribution	Restore the total extent and spatial distribution of intertidal sand and muddy sand.	N/A	The extent describes the presence and area of the habitat. It's the total area of the habitat across the site as a whole, even where it's patchy. The distribution describes the more detailed location(s) and pattern of habitat across the site. The distribution will influence the component communities present, and also help increase the health and resilience of the feature (Joint Nature Conservation Committee (JNCC), 2004). A reduction in extent would alter the biological and physical functioning of the feature (Elliott et al., 1998). It's difficult to put an extent objective on a mobile, changing feature. An understanding of the supporting processes will be more helpful in determining site integrity. However, the extent can also be defined where the proportion of sediment-sensitive invertebrates (PSI) indicates a change to the sediment character. If there is insufficient evidence, the existing extent occurring at any one time should be the focus of an assessment due to the natural variation, and a fresh survey is likely to be required at the point of assessment, to ascertain what the existing extent is. Site-specifics: The dynamic nature of the estuary is constrained by coastal squeeze along almost its entire length, restricting the natural development of intertidal mudflats and sand flats. Intertidal Sand and Muddy Sand accounts for around 44% for the total feature. Specific figures are not available for the subfeature but it is likely that some of the overall loss to the Mudflat and sand flats feature (detailed separately) could have included loss of this subfeature (Franco et al., 2015),(Frost et al., 2010). Intertidal Sand and Muddy Sand are present across the Humber Estuary, but are most common in the outer estuary where they dominate, particularly on the South bank. A small amount is also found in the inner estuary near Winteringham as part of mixed sediments. The target has been set due to the overall loss of total feature extent since designation combined with the likelihood

				expert judgement.
Intertidal seagrass beds	Extent and distribution	Restore the total extent and spatial distribution of seagrass beds.	N/A	The extent describes the presence and area of the habitat. It's the total area of the habitat across the site as a whole, even where it's patchy. The distribution describes the more detailed location(s) and pattern of habitat across the site. The distribution will influence the component communities present, and also help increase the health and resilience of the feature. In the UK, Zostera is nationally scarce and a World Wildlife Fund marine health check reported that UK seagrass beds were in severe decline (estimated at between 25-49% over the last 25 years) (Hiscock et al., 2005), although an update downgraded this status to degraded (Wilding et al., 2009). Improvements in water quality are starting to counteract negative pressures (Jackson et al., 2013), but seagrass beds have not recovered to the extent reported before the large-scale die-offs from wasting disease in the 1920s and 1990s (Den Hartog, 1994). The aim in Marine Protected Areas should be to recover its extent to known historical levels. Patchiness in the distribution of seagrass can be naturally induced, or driven by human activities. Increasing patchiness should be avoided across and within the seagrass bed. The core area is the most consistently dense area (with the least fragmentation), and is essential for long-term resilience and recovery. However, the more sparse edge areas are usually more vulnerable and may be patchy due to environmental pressures (Jackson et al., 2013), (Jackson et al., 2013). Site-specifics: The west side of the spit at Spurn Point consists of substantial intertidal mudflats, supporting communities of sea grass beds (*Zostera* spp). In 1997, it was reported that there were extensive beds of *Zostera noltei* (dwarf eelgrass) and *Zostera marina* (common eelgrass) on Spurn Bight, as well as small patches in the Grimsby area. Subsequently, sea grass beds at Spurn appeared to decline; a search of possible areas of seagrass beds undertaken in 2002 and 2012 at Spurn Point failed to record any beds present. However, surveys undertaken in 2013 and 2014 by YWT and NEIFCA confirmed the presence of *Zostera* species at Spurn in places where beds have been recorded historically (see feature description). Results from consecutive years of surveys indicate that seagrass beds have shown a net increase in size between 2013 and 2016. This is attributable to the effect of NEIFCA Humber Estuary Fishing Bylaw which was put in place to protect seagrass in this area from trampling by activities such as bait digging, potting, trapping, netting and dredging. The area of the bylaw box is mapped in the Yorkshire Wildlife Trust (YWT) and North Eastern Inshore Fisheres and Conservation Authority(NEIFCA) reports and the bylaw document. It covers the area in which the seagrass is currently found, with a substantial area around it for future growth. Increased turbidity and sea level rise may have contributed to the decline in seagrass beds, as well as anthropogenic causes. Activities including bait digging and human trampling will inevitably pose a threat to the seagrass present at Spurn outside the byelaw box, or in instances in which the byelaw is not observed. Further monitoring and research is needed to better understand seagrass habitat on the Humber as data is currently limited. (Scott and Page, 2012),(Yorkshire Wildlife Trust, 2013),(Yorkshire Wildlife Trust, 2014),(Allen et al., 2003),(Stoutt, 2013) Seagrass extent at Spurn has increased between 2013 and 2016 within the protection of the NEIFCA bylaw area. There is still potential for fuller seagrass beds to develop both in and around the protected area and for this reason the target has been set to 'Restore'.
Estuaries	Extent and distribution	Restore the total extent and spatial distribution of the estuary to ensure no loss of integrity, while allowing for natural change and succession.	N/A	The extent describes the presence and area of the habitat. It's the total area of the habitat across the site as a whole, even where it's patchy. The distribution describes the more detailed location(s) and pattern of habitat across the site. The distribution will influence the component communities present, and also help increase the health and resilience of the feature. In an estuary, the extent helps describe the outer limits of the feature. The existing extent occurring at any one time should be the focus of an assessment due to the natural variation, and a fresh survey is likely to be required at the point of assessment, to ascertain what the existing extent is. A reduction in extent would alter the biological and physical functioning of the feature (Elliott et al., 1998). It's difficult to put an extent objective on a mobile changing feature. The supporting processes, and an understanding of these, will be more helpful in determining site integrity (Joint Nature Conservation Committee (JNCC), 2004), (Davies et al., 2001), (Environment Agency (EA), 2011), (European Commission, 2002), (Manning, 2012), (Defra, 2005), (Davidson and Buck, 1997), (Environment Agency (EA), 2009), (Townend and Wright, 2005). Site-specifics: The estuary feature of the Humber SAC was designated with an area of 36,657.15 ha. Saline intrusions define the up-estuary estuary SAC limits and reach as far as Boothferry on the River Ouse and Keadby on the River Trent. The seaward extent of the estuary feature extends between Spurn Head in East Riding of Yorkshire and Saltfleet in Lincolnshire. The Humber Flood Risk Management Strategy HRA predicts that approximately 300ha of intertidal habitat will be lost to coastal squeeze by 2056 (Enviroment Agency (EA), 2011) This was modelled in 2008 and will be reviewed as part of the comprehensive review of the Humber FRMS, scheduled for completion in 2020 (Enviroment Agency (EA), 2011), (Joint Nature Conservation Committee (JNCC), 2011). The target has been set as restore due to the loss of habitat to coastal flood defences and commercial developments.
Mudflats and sandflats not covered by seawater at low tide	Extent and distribution	Restore the total extent, spatial distribution and types of mudflats and sandflats.	N/A	The extent describes the presence and area of the habitat. It's the total area of the habitat across the site as a whole, even where it's patchy. The distribution describes the more detailed location(s) and pattern of habitat across the site. The distribution will influence the component communities present, and also help increase the health and resilience of the feature (Joint Nature Conservation Committee (JNCC), 2004). A reduction in extent would alter the biological and physical functioning of the feature (Elliott et al., 1998). It's difficult to put an extent objective on a mobile, changing feature. An understanding of the supporting processes will be more helpful in determining site integrity. However, the extent can also be defined where the proportion of sediment-sensitive invertebrates (PSI) indicates a change to the sediment character. If there is insufficient evidence, the existing extent occurring at any one time should be the focus of an assessment due to the natural variation, and a fresh survey is likely to be required at the point of assessment, to ascertain what the existing extent is. (Joint Nature Conservation Committee (JNCC), 2004) Site-specifics: At the time of designation the extent of intertidal mudflats and sand flats in the Humber estuary was 9382.46ha at low tide. The most recent survey of the whole feature described the total extent of all recorded biotopes as 8997ha. This suggests a loss of 385.46ha since designation.

				At low tide, nearly 50% of the area of the Humber Estuary is exposed, and the intertidal flats extend from the confluence of the Rivers Trent and Ouse to the western outskirts of Hull and are dissected by two main channels. There are also extensive areas of mudflats in the outer estuary, particularly inside Spurn Bight and Cherry Cobb and there are smaller muddy embayments at Saltend/Paull on the north bank and at Pyewipe on the south. Near the sand capped shingle spit of Spurn Point, there are beds of dwarf eelgrass *Zostera noltei.* The dynamic nature of the estuary is constrained by coastal squeeze along almost its entire length, restricting the natural development of intertidal mudflats and sand flats. The EA monitor coastal squeeze on the Humber. At this point the intertidal area is monitored but not split in to the subfeatures presented in the rest of this advice. The Humber Flood Risk Management Strategy HRA predicts a total loss of habitat across the estuary of 286ha by 2056, a large percentage of this is likely to be mudflat and sand flats. This was modelled in 2008 and will be reviewed as part of the comprehensive review of the Humber FRMS, scheduled for completion in 2020. (Berry et al., 2009); (Franco et al., 2015); (English Nature, 2003);(Enviroment Agency (EA), 2011) The target has been set as restore due to the loss of habitat to coastal flood defences and commercial developments.
Dunes with Hippophae rhamnoides	Extent of habitat and associated transitions within the site	Maintain the total extent of the feature subject to natural changes.	N/A	This target is included because there should be no measurable reduction (excluding any trivial loss) in the extent and area of this feature and, in some cases, the full extent of the feature may need to be restored. The baseline value of extent given has been generated using data gathered from the listed site-based surveys. Area measurements given may be approximate depending on the methods, age and accuracy of data collection, and as a result this value may be updated in future to reflect more accurate information. The extent of an Annex I habitat feature covers the sum extent of all of the component vegetation communities present and may include transitions and mosaics with other closely associated habitat features. Where a feature is susceptible to natural dynamic processes, there may be acceptable variations in its extent through natural fluctuations. Where a reduction in the extent of a feature is considered necessary to meet the Conservation Objective for another Annex I feature, Natural England will advise on this on a case-by-case basis. For this feature, this habitat is only considered native on the east coast and there are two key locations for it where it is a SAC feature. Both areas are NNRs and the relevant NNR management plan should be consulted to determine the targets for this habitat. Site-specifics: At classification the extent of all sand dune habitat within the SAC was estimated at 172.07 hectares. (Natural England (NE), 2018). Dune scrub with *Hippophae rhamnoides* is thought to comprise a significant proportion of dune habitat with the Humber SAC based on field observations and aerial photography. On this basis the target has been set to maintain. A survey of the feature has been commissioned and this advice may be updated after the publication of a sand dune monitoring report, expected in autumn 2020. The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Intertidal seagrass beds	Extent of supporting habitat (habitat)	Maintain the area of habitat that is likely to support the subfeature.	N/A	Seagrass is completely reliant on the supporting habitat, and the processes that influence it. The supporting habitat is likely to extend beyond the seagrass itself, but other limitations such as exposure and depth affect the extent (Jackson et al., 2013). However, where seagrass has previously been damaged the extent could recover. Over time, supporting processes and exposure can change and improve, allowing opportunities for extent expansion or recovery. A buffer zone around seagrass beds will prevent the erosion of bed edges, and is advised. Activity around the edge of a bed may result in changes to the sediment composition and exposure, and erosion can occur leaving rhizomes uncovered and vulnerable, reducing the extent (Collins et al., 2010). Site-specifics: The NEIFCA bylaw box protects the area that currently supports seagrass, as well as a substantial area around it. The byelaw box, and any mudflat habitat beyond it should be maintained to allow the restoration of seagrass to continue(Yorkshire Wildlife Trust, 2014). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	Extent of the feature within the site	Restore the total extent of the feature	N/A	This target is included because there should be no measurable reduction (excluding any trivial loss) in the extent and area of this feature and, in some cases, the full extent of the feature may need to be restored. The baseline value of the extent given has been generated using data gathered from the listed site-based surveys. Area measurements given may be approximate depending on the methods, age and accuracy of data collection, and as a result this value may be updated in future to reflect more accurate information. The extent of an Annex I habitat feature covers the sum extent of all of the component vegetation communities present and may include transitions and mosaics with other closely associated habitat features. Where a feature is susceptible to natural dynamic processes, there may be acceptable variations in its extent through natural fluctuations. Where a reduction in the extent of a feature is considered necessary to meet the Conservation Objective for another Annex I feature, Natural England will advise on this on a case-by-case basis. For this feature, this habitat may form overlapping transitions with annual vegetation of drift lines at the seaward extent. Increases in extent at the seaward edge due to accretion of sediment may occur, the spatial extent objective must allow for natural changes: increase at the seaward edge does not mean that losses can occur elsewhere. Site-specifics: At the time of designation the extent of Atlantic salt meadows within the Humber Estuary SAC was 784 ha (Jennings, 2007),(Joint Nature Conservation Committee (JNCC), 2011). Atlantic salt-meadow within the Humber estuary is at a high exposure to loss of extent due to coastal squeeze, whereby intertidal habitats are trapped by artificial structures i.e. sea defences and rising sea levels. The EA monitor coastal squeeze on the Humber and the current understanding is that loss of intertidal habitat due to coastal squeeze is occurring unevenly around the estuary with certain areas being affected more than others. For example saltmarshes in the outer estuary (north Lincolnshire coast on the southern bank of the estuary) are experiencing stability or, in places, slight increase in terms of extent. The Humber Flood Risk Management Strate(HFRMS) HRA predicts that approximately 300ha of intertidal habitat will be lost to coastal squeeze by 2056 and a percentage of this will likely be saltmarsh. This was modelled in 2008; the

				The EA have a number of existing and planned managed realignments sites on the Humber to compensate for the loss of intertidal habitat and allow for the natural migration of intertidal habitats. Examples of these are at Alkborough, Paull Holme Strays and Donna Nook, with more sites planned in future. (Jennings, 2007), (Joint Nature Conservation Committee (JNCC), 2011), ,(Jukes and Pawley, 2019) Vegetation zonation and NVC communities present were found to be similar to those previously mapped in 2001, with some changes due to loss from erosion, as well as expansion from colonisation of accreting areas.(Jukes and Pawley, 2019) The target has been set as restore due to the loss of habitat to coastal flood defences and commercial developments.
Salicornia and other annuals colonising mud and sand	Extent of the feature within the site	Restore the total extent of the feature.	N/A	This target is included because there should be no measurable reduction (excluding any trivial loss) in the extent and area of this feature and, in some cases, the full extent of the feature may need to be restored. The baseline value of extent given has been generated using data gathered from the listed site-based surveys. Area measurements given may be approximate depending on the methods, age and accuracy of data collection, and as a result this value may be updated in future to reflect more accurate information. The extent of an Annex I habitat feature covers the sum extent of all of the component vegetation communities present and may include transitions and mosaics with other closely associated habitat features. Where a feature is susceptible to natural dynamic processes, there may be acceptable variations in its extent through natural fluctuations. Where a reduction in the extent of a feature is considered necessary to meet the Conservation Objective for another Annex I feature, Natural England will advise on this on a case-by-case basis. There may be natural changes and fluxes to the extent of this habitat, often from / to other saltmarsh or intertidal Annex I habitats and with intermediate stages, any such changes should be identified through monitoring to determine trends and the scale of change that may or may not trigger management measures. Some fluctutations will occur that are directly attributable to coastal processes without major human interference: in such instances there is potential for recovery. Evidence of changes to extent should not justify further loss to development. A sustained increase in the extent of this habitat into areas formerly occupied by H1330 may indicate a response to sea level rise and increasing tidal inundation. Site-specifics: Within the Humber Estuary SAC, glasswort *Salicornia* spp. (SM8) and annual sea blite *Suaeda maritima* (SM9) communities are the primary colonising saltmarsh species present (Allen et al., 2003), (English Nature, 2003). Together, they covered an area of 47.29ha at the time of designation (Jennings, 2007). Saltmarsh within the Humber estuary is at a high exposure to loss of extent due to coastal squeeze, whereby intertidal habitats are trapped by artificial structures i.e. sea defences and rising sea levels. The EA monitor coastal squeeze on the Humber and the current understanding is that loss of intertidal habitat due to coastal squeeze is occurring unevenly around the estuary with certain areas being affected more than others. The Humber Flood Risk Management Strategy HRA predicts that approximately 300ha of intertidal habitat will be lost to coastal squeeze by 2056 (Enviroment Agency (EA), 2011); a percentage of this will likely be saltmarsh. This was modelled in 2008 and will be reviewed in 2017. The EA have a number of existing and planned managed realignments sites on the Humber to compensate for the loss of intertidal habitat and allow for the natural migration of intertidal habitats (Allen et al., 2003), (English Nature, 2003), (Jennings, 2007), (Enviroment Agency (EA), 2011) The target has been set as restore due to the loss of habitat to coastal flood defences and commercial developments.
Embryonic shifting dunes	Extent of the feature within the site	Restore the total extent of the feature.	N/A	This target is included because there should be no measurable reduction (excluding any trivial loss) in the extent and area of this feature and, in some cases, the full extent of the feature may need to be restored. The baseline value of extent given has been generated using data gathered from the listed site-based surveys. Area measurements given may be approximate depending on the methods, age and accuracy of data collection, and as a result this value may be updated in future to reflect more accurate information. The extent of an Annex I habitat feature covers the sum extent of all of the component vegetation communities present and may include transitions and mosaics with other closely associated habitat features. Where a feature is susceptible to natural dynamic processes, there may be acceptable variations in its extent through natural fluctuations. Where a reduction in the extent of a feature is considered necessary to meet the Conservation Objective for another Annex I feature, Natural England will advise on this on a case-by-case basis. (Radley, 1994) This is the most dynamic, naturally changing zone of the dune system. Its extent may vary seasonally and through the years. This natural functioning is critically dependent on no interruption of sand movement to and from the foredunes and the beach. Where beaches are narrow or prevailing winds are not onshore, this Annex 1 habitat may be limited in extent. Evidence of natural changes to extent should not justify further loss to development. Site-specifics: At classification the extent of all sand dune habitat within the SAC was estimated at 172.07 hectares. (Natural England (NE), 2018). Of this habitat, embryonic dunes currently appear to be relatively rare. Field observations suggest that where they exist they occur in narrow bands or patches between the shoreline and fixed dune habitat. Field observations suggest that the extent of this feature is likely to be in decline. Given this, and considering that air quality levels also significantly exceed nitrogen deposition thresholds for sand dune habitat, a precautionary approach has been adopted and a 'Restore' target has been set until appropriate management measures can be identified. A survey of the feature has been commissioned and this advice may be updated after the publication of a sand dune monitoring report, expected in autumn 2020.
Shifting dunes along the shoreline with Ammophila arenaria (“White dunes”)	Extent of the feature within the site	Restore the total extent of the feature.	N/A	This target is included because there should be no measurable reduction (excluding any trivial loss) in the extent and area of this feature and, in some cases, the full extent of the feature may need to be restored. The baseline value of extent given has been generated using data gathered from the listed site-based surveys. Area measurements given may be approximate depending on the methods, age and accuracy of data collection, and as a result this value may be updated in future to reflect more accurate information. The extent of an Annex I habitat feature covers the sum extent of all of the component vegetation communities present and may include transitions and mosaics with other

				acceptable variations in its extent through natural fluctuations. Where a reduction in the extent of a feature is considered necessary to meet the Conservation Objective for another Annex I feature, Natural England will advise on this on a case-by-case basis. Site-specifics: At classification the extent of all sand dune habitat within the SAC was estimated at 172.07 hectares. (Natural England (NE), 2018). Of this habitat, shifting dunes comprise a relatively small proportion. Where they exist they occur rarely, in narrow bands or patches between the shoreline and fixed dune habitat. Field observations suggest that the extent of this feature is likely to be in decline. Given this, and considering that air quality levels also significantly exceed nitrogen deposition thresholds for sand dune habitat, a precautionary approach has been adopted and a 'Restore' target has been set until appropriate management measures can be identified. A survey of the feature has been commissioned and this advice may be updated after the publication of a sand dune monitoring report, expected in autumn 2020.
Fixed dunes with herbaceous vegetation ("Grey dunes")	Extent of the feature within the site	Restore the total extent of the feature.	N/A	This target is included because there should be no measurable reduction (excluding any trivial loss) in the extent and area of this feature and, in some cases, the full extent of the feature may need to be restored. The baseline value of extent given has been generated using data gathered from the listed site-based surveys. Area measurements given may be approximate depending on the methods, age and accuracy of data collection, and as a result this value may be updated in future to reflect more accurate information. The extent of an Annex I habitat feature covers the sum extent of all of the component vegetation communities present and may include transitions and mosaics with other closely associated habitat features. Where a feature is susceptible to natural dynamic processes, there may be acceptable variations in its extent through natural fluctuations. Where a reduction in the extent of a feature is considered necessary to meet the Conservation Objective for another Annex I feature, Natural England will advise on this on a case-by-case basis. For this feature if loss (or gain) of area is from natural causes dynamism this is not a decline in condition, but any significant loss due to human interference (eg sand extraction, visitor impacts, ploughing or conversion to improved grassland) is to be regarded as unfavourable. Increase in area is favourable unless related to coast protection. In a naturally functioning dune system there is likely to be varying proportions of fixed and mobile dune communities over time. Site-specifics: At classification the extent of all sand dune habitat within the SAC was estimated at 172.07 hectares. (Natural England (NE), 2018). Of this habitat, fixed dunes are understood to be a significant component. They are frequently occurring at Spurn and also a major component of the south bank dunes systems. Field observations suggest that the extent of this feature could be in decline. Given this, and considering that air quality levels also significantly exceed nitrogen deposition thresholds for sand dune habitat, a precautionary approach has been adopted and a 'Restore' target has been set until appropriate management measures can be identified. A survey of the feature has been commissioned and this advice may be updated after the publication of a sand dune monitoring report, expected in autumn 2020.
Coastal lagoons	Extent of water	Maintain the cyclical (annual) extent of water in the lagoon.	N/A	Water extent is critical to the maintenance of a lagoon and to the biological communities it supports. The extent of the water in late winter / early spring can be taken as a baseline, and at least 60% of the water (from high tide) should be present at all times of the year (Joint Nature Conservation Committee (JNCC), 2004). Site-specifics: The water at both Humberston Fitties and Northcoates Lagoon decreases in extent throughout the summer. At Northcoates Lagoon the two lagoons occasionally dry out completely in the late summer, although the channel system that provides the in-flow of seawater from the estuary is deeper and usually retains water throughout the summer. (Seaton, 2001), (English Nature, 2003) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Estuaries	Function: connectivity	Restore connectivity of estuarine features to surrounding rivers, freshwater, marine and coastal habitats, to ensure larval dispersal and recruitment, maintain nursery grounds for mobile species, and to allow movement of migratory	N/A	The connectivity of an estuary to rivers and the sea is important. Estuaries are valuable as a nursery ground, connecting habitat for migratory species. They rely on connection with the sea for the dispersal and recruitment of the planktonic phases of some species (Hiscock et al., 2006), (Fletcher et al., 2012). Site-specifics: It is widely acknowledged that man-made structures and barriers have contributed to the decline of migratory fish populations in Britain, including river and sea lamprey. There is an abundance of low-head weirs in the catchment of the Humber Estuary due to the region's rich industrial heritage. If river levels and flow conditions are not suitable many of these barriers can become impassable to lamprey (and other migratory fish), therefore preventing them from migrating upstream to spawning grounds; preventing them from completing their life cycle and reproducing. Please refer to the river lamprey and sea lamprey supporting notes for more information. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Salicornia and other annuals colonising mud and sand	Future extent of habitat within the site and ability to respond to seasonal changes	Restore the ability for colonisation each year of the annual species that comprise the habitat.	N/A	This target is included to recognise the need to allow for natural fluctuations in the extent and the distribution of this habitat feature, often during particular seasons and usually as a result of natural coastal processes. Colonisation of annual species must be possible: this will reflect elevation of the marsh surface and degree of tidal exposure. The presence of the remains of previous years' plants can provide shelter for seed establishment. Site-specifics: Intertidal habitat within the Humber estuary is at a high exposure to loss of extent due to coastal squeeze, whereby intertidal habitats are trapped by artificial structures i.e. sea defences and rising sea levels. The EA monitor coastal

				occurring unevenly around the estuary with certain areas being affected more than others. The Humber Flood Risk Management Strategy HRA predicts that approximately 300ha of intertidal habitat will be lost to coastal squeeze by 2056; this was modelled in 2008 and will be reviewed in 2017. This could have impacts on the colonisation of annual species. The EA have a number of existing and planned managed realignments sites on the Humber to compensate the loss of intertidal habitat and allow for the natural migration of intertidal habitats (Enviroment Agency (EA), 2011) The target has been set as restore due to the loss of habitat to coastal flood defences and commercial developments.
Embryonic shifting dunes	Future extent of habitat within the site and ability to respond to seasonal changes	Restore the ability to absorb seasonal and periodic fluctuations in the extent of the habitat.	N/A	This target is included to recognise the need to allow for natural fluctuations in the extent and the distribution of this habitat feature, often during particular seasons and usually as a result of natural coastal processes. This ability depends on a continuing linkage between the beach and this Annex 1 habitat, together with the ability of dune building grasses to respond in periods of net sand input. (Rogers et al., 2010), (Hesp, 1989) Site-specifics: Field observations of the sand dune features on the Humber suggest that this feature may be in decline, restricting its ability to adapt to seasonal variations. For this reason a precautionary approach has been adopted and a 'Restore' target has been set until appropriate management measures can be identified. A survey of the feature has been commissioned and this advice may be updated after the publication of a sand dune monitoring report, expected in autumn 2020.
Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	Future extent of habitat within the site and ability to respond to seasonal changes	Restore the ability to achieve long-term fluctuations in the extent of habitat in response to coastal processes.	N/A	This target is included to recognise the need to allow for natural fluctuations in the extent and the distribution of this habitat feature, often during particular seasons and usually as a result of natural coastal processes. Colonisation of species, particularly annuals, must be possible: this will reflect elevation of the marsh surface and degree of tidal exposure. Site-specifics: Saltmarsh within the Humber estuary is at a high exposure to loss of extent due to coastal squeeze, whereby intertidal habitats are trapped by artificial structures e.g. sea defences and rising sea levels. The EA monitor coastal squeeze on the Humber.The Humber Flood Risk Management Strate(HFRMS) HRA predicts that approximately 300ha of intertidal habitat will be lost to coastal squeeze by 2056 and a percentage of this will likely be saltmarsh. This was modelled in 2008; the HFRMS is currently being reviewed, with conclusions expected by 2021, after which time the advice is likely to change. The EA have a number of existing and planned managed realignments sites on the Humber to compensate the loss of intertidal habitat and allow for the natural migration of intertidal habitats. Examples of these are at Alkborough, Paull Holme Strays and Donna Nook, with more sites planned in future. . (Allen et al., 2003), (English Nature, 2003), (Enviroment Agency (EA), 2011) The target has been set as restore due to the loss of habitat to coastal flood defences and commercial developments.
River lamprey (Lampetra fluviatilis)	Population: Estuarine population	Maintain the unrestricted usage of the estuary by adult and juvenile river lamprey including for migratory passage and juvenile development.	N/A	The abundance of individuals using the estuary may vary spatially and temporarily but overall should be reflective of the population status and trends in any upstream designated river systems if appropriate. Any exploitation should be undertaken sustainably without compromising the population. Mortality of lampreys may occur as a result of entrainment (water diversions) (Henderson, 2003), (Nunn et al., 2008), (Potter et al., 2001). Screening of intakes and discharges may be necessary. Site-specifics: At the time of writing there are no barriers present in the estuary itself that are known to restrict passage of lamprey. This attribute is not considered applicable to the Humber Estuary SAC due to the difficulty in monitoring lamprey within the estuarine environment. Please see the 'Structure and function: biological connectivity' attribute for more details regarding the sensitivity of lamprey migratory movements. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Sea lamprey (Petromyzon marinus)	Population: Estuarine population	Maintain the unrestricted usage of the estuary by adult and juvenile sea lamprey including for migratory passage and juvenile development.	N/A	The abundance of individuals using the estuary may vary spatially and temporarily but overall should be reflective of the population status and trends in any upstream designated river systems if appropriate. Any exploitation should be undertaken sustainably without compromising the population. Mortality of lampreys may occur as a result of entrainment (water diversions) (Henderson, 2003), (Nunn et al., 2008), (Potter et al., 2001). Screening of intakes and discharges may be necessary. Site-specifics: At the time of writing there are no barriers present in the estuary itself that are known to restrict passage of lamprey. This attribute is not considered applicable to the Humber Estuary SAC due to the difficulty in monitoring lamprey within the estuarine environment. Please see the 'Structure and function: biological connectivity' attribute for more details regarding the sensitivity of lamprey migratory movements. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.

(Halichoerus grypus)	population size	population size within the site.		local, national and bio-geographic scale. Population size relates to the abundance of a species, and those seals within sites are important to, and contribute to the viability of the wider population (JNCC, 2015). Abundance may vary spatially and temporally. Site-specifics: Grey seals are present on the Donna Nook reserve throughout the year. Annual pup counts are carried out by the Lincolnshire wildlife Trust (LWT). The current population estimate is 1959 with an estimated c6850 individuals associated with this breeding colony. The resident population recorded at designation was c1800. The colony at this site has shown a rapid and continual increase since the early 1980s. It is thought that this increase is mostly due to the immigration and recruitment of females from the Farne Islands and Isle of May. Pup production at Donna Nook and East Anglia increased by 14.4% and those at the Farne Islands by 3.4% over the same period). However, future trends are uncertain and the carrying capacity of the colony is unknown. (Special Committee on Seals (SCOS), 2014), (Yorkshire Wildlife Trust (YWT) and North Eastern Inshore Fisheries and Conservation Authority (NEIFCA), 2016), (Thompson and Duck, 2010) There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Grey seal (Halichoerus grypus)	Population: recruitment and reproductive capability	Maintain the reproductive and recruitment capability of the species.	N/A	Recruitment and reproductive capability reflect the health and success of the population in terms of maintaining and / or restoring numbers. A reduction in the availability of individuals able to successfully reproduce, and survival rates, may impact the overall size and age-structure of the population. The balance of males to females within the grey seal population will determine the breeding success and ability of the population to maintain / restore numbers. Pup production is an important indicator of breeding female abundance and breeding success that can be used to assess population trends. Site-specifics: Grey seals are present on the Donna Nook reserve throughout the year. Annual pup counts are carried out by the Lincolnshire Wildlife Trust (LWT) pup production at Donna Nook and East Anglia colonies has increased by 14.4% between 2010 and 2012. The most current population estimate based on annual pup counts for 2016 is 1959 with an estimated c6850 individuals associated with this breeding colony (Lincolnshire Wildlife Trust, 2014), (Special Committee on Seals (SCOS), 2014) There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
River lamprey (Lampetra fluviatilis)	Population: recruitment and reproductive capability	Maintain the reproductive and recruitment capability of the species.	N/A	Recruitment and reproductive capability reflect the health and success of the population in terms of maintaining and / or restoring numbers. A reduction in the availability of individuals able to successfully reproduce, and survival rates, may impact the overall size and age-structure of the population. The reproduction and recruitment of lampreys is dependent, to a large degree, on processes that occur outside the site. Site-specifics: A study in 2008 which looked at lamprey populations in the Yorkshire Ouse catchment concluded that the five main rivers in the catchment (Derwent, Swale, Wharfe, Nidd and Ure) all supported healthy populations of river lamprey ammocoetes, with two or more age classes usually present. The age of the study limits its reliability and basis on which to make an accurate judgment of condition of river lamprey in the catchment. Natural England acknowledge that this study is currently the best available evidence but endeavour to carry out a condition assessment in the near future; therefore there is potential for the target to be reassessed and amended. Furthermore, there are a number of structures and activities which may have negative impacts on the recruitment and reproductive capability of river lamprey in the Humber catchments. These include weirs and dams, unsuitable fish passes, entrainment and impingement from intakes and abstraction, hydropower and commercial exploitation. (Nunn et al., 2008), (Harvey and Cowx, 2003) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Sea lamprey (Petromyzon marinus)	Population: recruitment and reproductive capability	Restore the reproductive and recruitment capability of the species.	N/A	Recruitment and reproductive capability reflect the health and success of the population in terms of maintaining and / or restoring numbers. A reduction in the availability of individuals able to successfully reproduce, and survival rates, may impact the overall size and age-structure of the population. The reproduction and recruitment of lampreys is dependent, to a large degree, on processes that occur outside the site. Site-specifics: Sea lamprey presence is very low compared to river lamprey. A spawning survey carried out in 2011 recorded only 1 sea lamprey on the river Ure with no sightings or redds identified on any of the other major rivers. Spawning surveys in 2015 recorded no adults, although 45 had been tagged below Naburn weir, and only 5 redds were observed at Boroughbridge on the River Ure. This is amongst the lowest numbers of spawning sea lamprey recorded in recent years and together with the 2011 data raises further concerns as to the status of sea lamprey within the Humber catchment. The Environment Agency hold more detailed data on physic-chemical properties. Prior to the significant improvements in the tidal Yorkshire Ouse, water quality was deemed as the principal factor which limited lamprey populations in the catchment. There have been vast improvements in water quality over the last two decades however sea lamprey numbers still remain low. There is still the possibility that poor quality inputs from other rivers and sources may pose a barrier to sea lamprey migration, especially during low flow conditions. (The Bellflask Ecological Survey Team, 2011), (Bubb, 2015)

				are occurring / have occurred on the site.
Sea lamprey (Petromyzon marinus)	Presence and spatial distribution of the species	Maintain the presence and spatial distribution of the species and their ability to undertake key life cycle stages and behaviours.	N/A	The presence describes the mobile species occurrence, with the spatial distribution providing a more detailed overview of the location(s) and pattern of occurrence within a site. It is important to consider the key life stages and behaviours of a species as this may influence its distribution and ultimately population abundance. Disturbance, including noise, caused by human activities should not adversely affect the species. Site-specifics: It is difficult and expensive to monitor the presence and spatial distribution of sea lamprey in the Humber Estuary itself and therefore targets are set using evidence gathered from freshwater spawning habitats. Sea lamprey spawning sites are widely distributed across the Ouse catchment with lamprey redds recorded on major river tributaries including the river Ure, Swale, Wharfe and Nidd. The availability of spawning habitat depends on biological influences including water levels, flows and sediment rates. Sea lamprey presence is very low compared to river lamprey. A spawning survey carried out in 2011 recorded only 1 sea lamprey on the river Ure with no sightings or redds identified on any of the other major rivers. A sea lamprey tagging survey carried out in 2015 caught 45 sea lamprey downstream of Naburn weir on the River Ure, although none were recorded upstream at the spawning sites. The lack of data for sea lamprey presence and spatial distribution makes it difficult to conclude with an accurate target. A 'Maintain' target has been used due to ongoing sea lamprey work which is being undertaken in collaboration with key partners and stakeholders. A 5-year spawning study commissioned by the Environment Agency will report in early 2017, alongside another tagging survey. Once the data from these surveys have been assessed the target may be updated and amended if necessary. (The Bellflask Ecological Survey Team, 2011), (Bubb, 2015) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Grey seal (Halichoerus grypus)	Presence and spatial distribution of the species	Maintain the presence and spatial distribution of the species and their ability to undertake key life cycle stages and behaviours.	N/A	The presence describes the mobile species occurrence, with the spatial distribution providing a more detailed overview of the location(s) and pattern of occurrence within a site. It's important to consider the key life stages and behaviours of a species as this may influence its distribution and ultimately population abundance. Disturbance caused by human activities should not adversely affect the species. Changes in distribution of adult seals can lead to density-dependent effects, eg more seals utilising a smaller area (Joint Nature Conservation Committee (JNCC), 2005). Site-specifics: Within the Humber SAC there is only one haul out site for Grey seals which is located at Donna Nook. It is used throughout the year as a haul out site and breeding occurs here once a year between October and December. At this site the seals are generally protected as the beach is owned privately by the MoD and managed by the Lincolnshire Wildlife Trust (LWT). A seasonal warden is employed to help prevent disturbance of the seals (Allen et al., 2003). The LWT have produced a site specific pup distribution map showing three distinct pupping areas known as "Range", "Dunes" and "Skidbrook Ridge". Its proximity to a Royal Air Force bombing range and large influx of visitors each year does not appear to affect breeding success suggesting that this colony has habituated to current levels of disturbance. An agreement with the RAF to restrict bombing practices within the breeding season is in place to reduce the disturbance impacts on the colony (Allen et al., 2003),(Special Committee on Seals (SCOS), 2011) There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
River lamprey (Lampetra fluviatilis)	Presence and spatial distribution of the species	Maintain the presence and spatial distribution of the species and their ability to undertake key life cycle stages and behaviours.	N/A	The presence describes the mobile species occurrence, with the spatial distribution providing a more detailed overview of the location(s) and pattern of occurrence within a site. It is important to consider the key life stages and behaviours of a species as this may influence its distribution and ultimately population abundance. Disturbance, including noise, caused by human activities should not adversely affect the species. Site-specifics: It is difficult and expensive to monitor the presence and spatial distribution of river lamprey in the Humber Estuary itself and therefore targets are set using evidence gathered from freshwater spawning habitats. River lamprey spawning sites are widely distributed across the Ouse catchment with river lamprey nests or redds evident on major river tributaries including the river Ure, Swale, Wharfe and Nidd. The availability of spawning habitat depends on biological influences including water levels, flows and sediment rates. A study in 2008 which looked at lamprey populations in the Yorkshire Ouse catchment concluded that the five main rivers in the catchment (Derwent, Swale, Wharfe, Nidd and Ure) all supported healthy populations of river lamprey ammocoetes, with two or more age classes usually present. The age of the study limits its reliability and basis on which to make an accurate judgment of condition of river lamprey in the catchment. Natural England acknowledge that this study is currently the best available evidence but endeavour to carry out a condition assessment in the near future; therefore there is potential for the target to be reassessed and amended. (The Bellflask Ecological Survey Team, 2008) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Fixed dunes with herbaceous vegetation ("Grey dunes")	Structure and function (including its typical species): key		N/A	Some plant or animal species (or related groups of such species) make a particularly important contribution to the necessary structure, function and/or quality of an Annex I habitat feature at a particular site. These species will include; Structural species which form a key part of the Annex I habitat's structure or help to define that habitat on a particular SAC (see also the attribute for 'vegetation community composition'). Influential species which are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of soil/sediment),

	influential and distinctive species			distinctive species which are considered to be a particularly special and distinguishing component of an Annex I habitat on a particular SAC. There may be natural fluctuations in the frequency and cover of each of these species. The relative contribution made by them to the overall ecological integrity of a site may vary, and Natural England will provide bespoke advice on this as necessary. The list of species given here for this Annex I habitat feature at this SAC is not necessarily exhaustive. The list may evolve, and species may be added or deleted, as new information about this site becomes available. For this feature, characteristic vascular plants may include Aira praecox and A. caryophyllea, Anacamptis pyramidalis, Bromus hordeaceus, Carex arenaria, Cerastium spp., Corynephorus canescens, Erodium glutinosum, Erodium lebelii, Galium verum, Gentiana campestris, Gentiana cruciata, Koeleria spp., Milium scabrum, Myosotis ramosissima, Ononis repens, Phleum arenarium, Polygala vulgaris var. dunensis, Silene conica, Silene otites, Trifolium scabrum, Tuberaria guttata, Viola curtisii, and Viola rupestris var. arenaria. The mosses Tortula ruraliformis, Racomitrium canescens, Polytrichum juniperium and P. piliferum and lichens of Cladonia spp. are also characteristic (European Commission (EC), 2013), (McLeod et al., 2008) (CSM) Calcareous dune grasslands (SD7, 8, 9, 19) Aira praecox, Arrhenatherum elatius (SD 9b only), Astragalus danicus, Carex arenaria, Carex flacca, Cerastium fontanum, Crepis capillaris, Cladonia spp., Erodium cicutarium, Euphrasia officinalis, Festuca rubra, Galium verum, Geranium molle, Hypnum cupressiforme, Hypochaeris radicata, Linum catharticum, Lotus corniculatus, Luzula campestris, Odontites verna, Ononis repens, Peltigera spp., Pilosella officinarum, Plantago lanceolata, Prunella vulgaris, Rhinanthus minor, Rhytidiadelphus squarrosus, Rhytidiadelphus triquetrus, Thymus praecox, Tortula muralis, Trifolium repens, Sedum acre, Veronica chamaedrys, Viola canina, Viola riviniana, Viola tricolor. (CSM) Acidic dune grasslands (SD12) Aira praecox, Agrostis capillaries, Astragalus danicus, Carex arenaria, Carex pilulifera, Cladonia spp, Deschampsia flexuosa, Dicranum scoparium, Festuca ovina, Galium saxatile, Hylocomium splendens, Hypochaeris radicata, Lotus corniculatus, Luzula campestris, Pilosella officinarum, Polygala serpyllifolia, Plantago lanceolata, Pleurozium schreberi, Potentilla erecta, Scleropodium purum, Thymus praecox, Trifolium repens, Veronica chamaedrys, Viola canina. A number of characteristic dune species are supported by the habitat and, more importantly, the habitat mosaic of dune systems. Both Lacerta agilis (sand lizard) and Bufo calamita (natterjack toad) – listed in the Habitats Directive - depend on the open character of the fixed dune habitat for at least part of their range. Management guidelines for both species have been prepared in the United Kingdom as part of a national 'Species Recovery Programme' (Beebee and Denton, 1996), (Moulton and Corbett, 1999). Site-specifics: Data to support the setting of a target for this attribute will be available after the publication of the 2019 sand dune report. This report is expected in autumn 2020.
Dunes with Hippophae rhamnoides	Structure and function (including its typical species): key structural, influential and distinctive species		N/A	Some plant or animal species (or related groups of such species) make a particularly important contribution to the necessary structure, function and/or quality of an Annex I habitat feature at a particular site. These species will include; Structural species which form a key part of the Annex I habitat's structure or help to define that habitat on a particular SAC (see also the attribute for 'vegetation community composition'). Influential species which are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of soil/sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat) Site-distinctive species which are considered to be a particularly special and distinguishing component of an Annex I habitat on a particular SAC. There may be natural fluctuations in the frequency and cover of each of these species. The relative contribution made by them to the overall ecological integrity of a site may vary, and Natural England will provide bespoke advice on this as necessary. The list of species given here for this Annex I habitat feature at this SAC is not necessarily exhaustive. The list may evolve, and species may be added or deleted, as new information about this site becomes available. The typical species of this feature will vary with the site, age and maturity of the vegetation and the degree of past disturbance. These may include: Arrhenatherum elatius, Silene uniflora, Geranium purpureum, Geranium robertianum, Solanum dulcamara, Polygonum maritimum, Crithmum maritimum, Sedum anglicum, Lathyrus japonicas, Vicia lutea, Atriplex glabriuscula, Crambe maritima, Glaucium flavum, Lactuca saligna, Festuca rubra arenaria, Sedum acre, Elytrigia juncea, Honckenya peploides, Corynephorus canescens, Desmazeria marina, Aira praecox, Calystegia soldanella, Polygonum oxyspermum, Trifolium scabrum, Atriplex laciniata, Cakile maritima, Tripleurospermum maritimum, Galium aparine, Potentilla anserina, Rumex crispus var. trigranulatus, Armeria maritima, Atriplex spp., Beta vulgaris ssp. maritima, Calluna vulgaris, plus a wide range of lichens, especially Cladonia lichens. Site-specifics: Data to support the setting of a target for this attribute will be available after the publication of the 2019 sand dune report. This report is expected in autumn 2020.
Shifting dunes along the shoreline with Ammophila arenaria ("White dunes")	Structure and function (including its typical species): key structural, influential and distinctive species		N/A	Some plant or animal species (or related groups of such species) make a particularly important contribution to the necessary structure, function and/or quality of an Annex I habitat feature at a particular site. These species will include; Structural species which form a key part of the Annex I habitat's structure or help to define that habitat on a particular SAC (see also the attribute for 'vegetation community composition'). Influential species which are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of soil/sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat) Site-distinctive species which are considered to be a particularly special and distinguishing component of an Annex I habitat on a particular SAC. There may be natural fluctuations in the frequency and cover of each of these species. The relative contribution made by them to the overall ecological integrity of a site may vary, and Natural England will provide bespoke advice on this as necessary. The list of species given here for this Annex I habitat feature at this SAC is not necessarily exhaustive. The list may evolve, and species may be added or deleted, as new information about this site becomes available. (Joint Nature Conservation Committee (JNCC), 2004), (Natural England, 2015), (Evans and Arvela, 2011) Site-specifics: Species data to support the setting of a target for this attribute will be available after the publication of the 2019 sand dune survey report. This report is expected in autumn 2020.
Embryonic shifting dunes	Structure and function (including its typical species): key structural, influential and distinctive species		N/A	Some plant or animal species (or related groups of such species) make a particularly important contribution to the necessary structure, function and/or quality of an Annex I habitat feature at a particular site. These species will include; Structural species which form a key part of the Annex I habitat's structure or help to define that habitat on a particular SAC (see also the attribute for 'vegetation community composition'). Influential species which are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of soil/sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat) Site-distinctive species which are considered to be a particularly special and distinguishing component of an Annex I habitat on a particular SAC. There may be natural fluctuations in the frequency and cover of each of these species. The relative contribution made by them to the overall ecological integrity of a site may vary, and Natural England will

				is not necessarily exhaustive. The list may evolve, and species may be added or deleted, as new information about this site becomes available. (Joint Nature Conservation Committee (JNCC), 2004), (Natural England, 2015), (Evans and Arvela, 2011) Site-specifics: Data to support the setting of a target for this attribute will be available after the publication of the 2019 sand dune survey report. This report is expected in autumn 2020.
Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	Structure and function (including its typical species): key structural, influential and distinctive species	Maintain the abundance of the species listed to enable each of them to be a viable component of the Annex I habitat feature	N/A	Some plant or animal species (or related groups of such species) make a particularly important contribution to the necessary structure, function and/or quality of an Annex I habitat feature at a particular site. These species will include; Structural species which form a key part of the Annex I habitat's structure or help to define that habitat on a particular SAC (see also the attribute for 'vegetation community composition'). Influential species which are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of soil/sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat) Site-distinctive species which are considered to be a particularly special and distinguishing component of an Annex I habitat on a particular SAC. There may be natural fluctuations in the frequency and cover of each of these species. The relative contribution made by them to the overall ecological integrity of a site may vary, and Natural England will provide bespoke advice on this as necessary. The list of species given here for this Annex I habitat feature at this SAC is not necessarily exhaustive. The list may evolve, and species may be added or deleted, as new information about this site becomes available. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Salicornia and other annuals colonising mud and sand	Structure and function (including its typical species): key structural, influential and distinctive species	Maintain the abundance of the species listed to enable each of them to be a viable component of the Annex I habitat feature	N/A	Some plant or animal species (or related groups of such species) make a particularly important contribution to the necessary structure, function and/or quality of an Annex I habitat feature at a particular site. These species will include; Structural species which form a key part of the Annex I habitat's structure or help to define that habitat on a particular SAC (see also the attribute for 'vegetation community composition'). Influential species which are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of soil/sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat) Site-distinctive species which are considered to be a particularly special and distinguishing component of an Annex I habitat on a particular SAC. There may be natural fluctuations in the frequency and cover of each of these species. The relative contribution made by them to the overall ecological integrity of a site may vary, and Natural England will provide bespoke advice on this as necessary. The list of species given here for this Annex I habitat feature at this SAC is not necessarily exhaustive. The list may evolve, and species may be added or deleted, as new information about this site becomes available. (Joint Nature Conservation Committee (JNCC), 2004), (Natural England, 2015), (Evans and Arvela, 2011) Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Grey seal (Halichoerus grypus)	Structure and function: biological connectivity	Maintain connectivity of the habitat within sites and the wider environment to ensure recruitment, and / or to allow movement of migratory species.	N/A	Connectivity is the extent to which populations in different parts of a species' range are linked by the movement of juveniles or adults (Palumbi, 2003). The availability of suitable habitats for seals throughout the year to allow natural behaviours is important. Areas used for breeding / by pups may differ to those used for general rest during foraging. Habitats that are made inaccessible will reduce the ability of the site to support seals. Seals utilise a variety of habitats, including sediments and rock, to forage for a variety of prey. They may use different areas at different times of the year to target seasonally variable prey. Maintaining connectivity within and outside the site, allows access to different areas for feeding, and potentially helps to reduce competition. Seals haul out during periods of breeding and moulting and also during the non-breeding season for rest. Seals may have a number of preferred haulout areas on rock or intertidal sediments. Maintaining connectivity may help avoid competition for space between nursing mothers (Joint Nature Conservation Committee (JNCC), 2005). Site-specifics: Seals are known to range widely outside the SAC and can travel considerably long distances whilst feeding. Tagged studies have demonstrated that seals born locally are distributed throughout the North Sea and within the estuary, although most feeding activity has been found to be within 50km of the haul out site (Allen et al., 2003). Individuals from this breeding colony have been tracked in the Humber Estuary west of Kingston upon Hull and as far north as the area between Sunk Island Sands and Kilnsea. The main haulout/breeding site within the SAC is generally protected as the beach is managed by the Lincolnshire Wildlife Trustwhere there is limited access to the public (Allen et al., 2003) There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
River lamprey (Lampetra fluviatilis)	Structure and function: biological connectivity	Restore connectivity of estuarine features to surrounding rivers, freshwater, marine and coastal habitats, to ensure larval dispersal and recruitment, maintain	N/A	Connectivity is the extent to which populations in different parts of a species' range are linked by the movement of eggs, larvae or other propagules, juveniles or adults (Palumbi, 2003). Connectivity of an estuary to the rivers and the sea is important. Estuaries are valuable as a nursery ground, connecting habitat for migratory species (both adult access to spawning grounds and seaward migration of juveniles). Physical obstructions are becoming increasingly recognised as major factors influencing the migrations, distributions and population structures of lampreys (Lucas et al., 2009), (Nunny and Smith, 2008). Considerable information is available about the biology of the river lamprey in fresh water, although much less is known about its habits in estuaries and the sea. During the marine phase of its lifecycle the critical habitat requirements for river lamprey include: suitable estuarine conditions, free from pollution, with suitable prey fish species; and a clear migration route from the estuary to the spawning grounds, with suitable river flows and no barriers (Maitland, 2003). An important factor determining the abundance of river lamprey in marine and estuarine waters is almost certainly the proximity to accessible rivers with good quality freshwater spawning grounds and suitable habitat for larvae (ammocoetes) (Henderson, 2003). River lampreys live as adults and juveniles in estuaries and marine coastal waters, and only enter freshwaters to breed. They feed in estuaries and coastal waters for 1-2 years, stop feeding in the autumn and move upstream, usually migrating into fresh water from

		grounds for mobile species, and to allow movement of migratory		migration route free of obstacles (eg dams, weirs or pollution barriers) (Maitland, 2003). After metamorphosis (July–September) at 3-5 years, the young adults migrate at night to estuaries (Maitland, 2003). Site-specifics: It is widely acknowledged that man-made structures and barriers have contributed to the decline of river lamprey populations in Britain. There is an abundance of low-head weirs in the Humber catchment due to the regions rich industrial heritage. If river levels and flow conditions are not suitable many of these barriers can become impassable to river lamprey and therefore prevent them from migrating upstream to spawning grounds; preventing them from completing their life cycle and reproducing. Barmby barrage, found at the confluence of the River Derwent poses a significant barrier to river lamprey, followed by 5 low-head weirs upstream of the tidal barrage along the lower 50km of the river; Elvington, Stamford Bridge, Buttercrambe, Howsham and Kirkham. Distribution of river lamprey in the River Trent is severely limited by Cromwell weir, which is considered as impassable to river lamprey. A new fish bypass channel has been developed at Naburn weir on the River Ouse to improve migratory fish passage. Further upstream on the River Ouse, Linton weir is a known barrier to migrating river lamprey. Boroughbridge weir on the River Ure and Topcliffe weir on the River Swale are known to have impeded river lamprey migration; however these are deemed as passable in high flows. Westwick weir on the River Ouse is also known to cause a barrier to river lamprey migration, thus preventing them from reaching optimal spawning habitats upstream. (Maitland, 2003), (Foulds, 2013), (Foulds, 2013) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Sea lamprey (Petromyzon marinus)	Structure and function: biological connectivity	Restore connectivity of estuarine features to surrounding rivers, freshwater, marine and coastal habitats, to ensure larval dispersal and recruitment, maintain nursery grounds for mobile species, and to allow movement of migratory	N/A	Connectivity is the extent to which populations in different parts of a species' range are linked by the movement of eggs, larvae or other propagules, juveniles or adults (Palumbi, 2003). Connectivity of an estuary to the rivers and the sea is important. Physical obstructions are becoming increasingly recognised as major factors influencing the migrations, distributions and population structures of lampreys (Lucas et al., 2009), (Nunny and Smith, 2008). Little is known about the marine life-history phase of the sea lamprey (Silva et al., 2013), (Maitland, 2003). The rarity of capture in coastal and estuarine waters suggests that sea lampreys are solitary hunters and widely dispersed. It's quite possible that they often feed in deeper offshore waters, as they have been caught at considerable depths (Henderson, 2003). A key factor determining the abundance of sea lamprey in marine and estuarine waters is almost certainly the proximity to accessible rivers with good quality freshwater spawning grounds and suitable habitat for larvae (Henderson, 2003). Mature adults enter the estuaries of many North Atlantic rivers from April onwards, and migrate some distance upstream, providing there are no obstacles (Maitland, 2003). After spawning they die. The larvae (ammocoetes) live in freshwater for about 5 years before undergoing metamorphosis, taking on the adult characteristics and migrating to the sea where they feed on fish (Henderson, 2003). Site-specifics: It is widely acknowledged that man-made structures and barriers have contributed to the decline of lamprey populations in Britain. There is an abundance of low-head weirs in the Humber catchment due to the regions rich industrial heritage. If river levels and flow conditions are not suitable many of these barriers can become impassable to sea lamprey and therefore prevent them from migrating upstream to spawning grounds; preventing them from completing their life cycle and reproducing. Barmby barrage, found at the confluence of the River Derwent poses a significant barrier to lamprey, followed by 5 low-head weirs upstream of the tidal barrage along the lower 50km of the river; Elvington, Stamford Bridge, Buttercrambe, Howsham and Kirkham. Distribution of sea lamprey in the River Trent is unknown however it is thought that distribution of the species is severely limited by Cromwell weir, which is considered as impassable. A new fish bypass channel has been developed at Naburn weir on the River Ouse to improve migratory fish passage. Further upstream on the River Ouse, Linton weir is a known barrier to migrating lamprey. Boroughbridge weir on the River Ure and Topcliffe weir on the River Swale are known to have impeded lamprey migration; however these are deemed as passable in high flows. Westwick weir on the River Ouse is also known to cause a barrier to lamprey migration, thus preventing them from reaching optimal spawning habitats upstream. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Embryonic shifting dunes	Structure and function: dune topography	Restore a natural dune topography, and allow natural change that is wind driven (some change may be necessary to maintain the continuity of slacks).	N/A	Dune topography in this zone can change seasonally and through the years due to wind and tidal events. Accumulations of driftline organic material are important for trapping sand and initiating dune formation. See also 'Functional connectivity with wider coastal sedimentary system' and 'Within-site sedimentary processes' components. Site-specifics: Field observations of the sand dune features on the Humber suggest that that this feature may be in decline, with possible restrictions to its natural topographic development. For this reason a precautionary approach has been adopted and a 'Restore' target has been set until appropriate management measures can be identified. A survey of the feature has been commissioned and this advice may be updated after the publication of a sand dune monitoring report, expected in autumn 2020.
Shifting dunes along the shoreline with Ammophila arenaria ("White dunes")	Structure and function: functional connectivity with landscape	Any supporting features within the local landscape which provide a critical functional connection with the site are restored in terms of their	N/A	This attribute and target has been included to recognise the potential need at this site to maintain or restore the connectivity of the site to its wider landscape in order to meet the conservation objectives. These connections may take the form of landscape features, such as habitat patches, hedges, watercourses and verges, outside of the designated site boundary that are important for the migration, dispersal and genetic exchange of those typical species closely associated with qualifying Annex I habitat features of the site. These features may also be important to the operation of the supporting ecological processes on which the designated site and its features may rely. In most cases, increasing actual and functional landscape-scale connectivity would be beneficial. Where there is a lack of detailed knowledge of the connectivity requirements of the qualifying feature, Natural England will advise as to whether these are applicable on a case-by-case basis. (Lawton et al., 2010), (Kettunen et al., 2007) Site-specifics:

		quality and function.		Field observations during the 2019 Humber SAC sand dunes survey suggested that this feature may be in decline. For this reason a 'Restore' target has been set as a precaution. This target may be reviewed after the publication of the 2019 sand dune survey results, expected in summer 2020.
Fixed dunes with herbaceous vegetation ("Grey dunes")	Structure and function: functional connectivity with landscape	Any supporting features within the local landscape which provide a critical functional connection with the site are restored in terms of their overall extent, quality and function.	N/A	This attribute and target has been included to recognise the potential need at this site to maintain or restore the connectivity of the site to its wider landscape in order to meet the conservation objectives. These connections may take the form of landscape features, such as habitat patches, hedges, watercourses and verges, outside of the designated site boundary that are important for the migration, dispersal and genetic exchange of those typical species closely associated with qualifying Annex I habitat features of the site. These features may also be important to the operation of the supporting ecological processes on which the designated site and its features may rely. In most cases increasing actual and functional landscape-scale connectivity would be beneficial. Where there is a lack of detailed knowledge of the connectivity requirements of the qualifying feature, Natural England will advise as to whether these are applicable on a case-by-case basis. (Lawton et al., 2010), (Kettunen et al., 2007) Site-specifics: In some areas of the SAC field observations suggest that fixed dune may be lacking adequate connectivity to the wider landscape. For this reason a precautionary approach has been adopted and a 'Restore' target has been set until appropriate management measures can be identified. A survey of the feature has been commissioned and this advice may be updated after the publication of a sand dune monitoring report, expected in autumn 2020. Field observations suggest that the extent of this feature could be in decline. Given this, and considering that air quality levels also significantly exceed nitrogen deposition thresholds for sand dune habitat, a precautionary approach has been adopted and a 'Restore' target has been set until appropriate management measures can be identified. A survey of the feature has been commissioned and this advice may be updated after the publication of a sand dune monitoring report, expected in autumn 2020.
Dunes with Hippophae rhamnoides	Structure and function: invasive, non-native and / or introduced species	Invasive and introduced non-native species should be rare or absent, but if present are causing minimal damage to the feature.	N/A	Invasive or introduced non-native species can be a serious potential threat to the structure and function of these habitats, because they are able to exclude, damage or suppress the growth of their associated typical species, reduce structural diversity of the habitat and prevent the natural regeneration of characteristic site-native species. Once established, the measures to control such species may also impact negatively on the features of interest (eg use of broad-spectrum pesticides). Site-specifics: Data to support the setting of a target for this attribute will be available after the publication of the 2019 sand dune report. This report is expected in autumn 2020. Field observations suggest that *Rosa rugosa* is establishing in patches in some areas. It is understood that the RSPB takes measure to manage this at their Tetney Marshes site. The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Coastal lagoons	Structure and function: presence and abundance of key structural and influential species	[Maintain OR Recover OR Restore] the abundance of listed species*, to enable each of them to be a viable component of the habitat.	N/A	Natural England has included an attribute for the abundance of key structural and influential species for habitat features. Structural species are those that form part of the habitat structure or help to define a key biotope. Influential species are those that are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat). These will be identified at a national level in accordance with the criteria defined in the key structural and influential species paper (Covey et al., 2016). *For each species listed the reason for its inclusion as structural or influential and the information supporting its presence within the community of this site will be provided. Site-specifics:
Estuaries	Structure and function: presence and abundance of key structural and influential species	[Maintain OR Recover OR Restore] the abundance of listed species*, to enable each of them to be a viable component of the habitat.	N/A	Natural England has included an attribute for the abundance of key structural and influential species for habitat features. Structural species are those that form part of the habitat structure or help to define a key biotope. Influential species are those that are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat). These will be identified at a national level in accordance with the criteria defined in the key structural and influential species paper (Covey et al., 2016). *For each species listed the reason for its inclusion as structural or influential and the information supporting its presence within the community of this site will be provided. Site-specifics:
Mudflats and sandflats not covered by seawater at low tide	Structure and function: presence and abundance of key structural and influential species	[Maintain OR Recover OR Restore] the abundance of listed species*, to enable each of them to be a viable component of the habitat.	N/A	Natural England has included an attribute for the abundance of key structural and influential species for habitat features. Structural species are those that form part of the habitat structure or help to define a key biotope. Influential species are those that are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat). These will be identified at a national level in accordance with the criteria defined in the key structural and influential species paper (Covey et al., 2016). *For each species listed the reason for its inclusion as structural or influential and the information supporting its presence within the community of this site will be provided.

Intertidal mixed sediments	Structure and function: presence and abundance of key structural and influential species	[Maintain OR Recover OR Restore] the abundance of listed species*, to enable each of them to be a viable component of the habitat.	N/A	Natural England has included an attribute for the abundance of key structural and influential species for habitat features. Structural species are those that form part of the habitat structure or help to define a key biotope. Influential species are those that are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat). These will be identified at a national level in accordance with the criteria defined in the key structural and influential species paper (Covey et al., 2016). *For each species listed the reason for its inclusion as structural or influential and the information supporting its presence within the community of this site will be provided. Site-specifics:
Intertidal seagrass beds	Structure and function: presence and abundance of key structural and influential species	[Maintain OR Recover OR Restore] the abundance of listed species*, to enable each of them to be a viable component of the habitat.	N/A	Natural England has included an attribute for the abundance of key structural and influential species for habitat features. Structural species are those that form part of the habitat structure or help to define a key biotope. Influential species are those that are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat). These will be identified at a national level in accordance with the criteria defined in the key structural and influential species paper (Covey et al., 2016). *For each species listed the reason for its inclusion as structural or influential and the information supporting its presence within the community of this site will be provided. Site-specifics:
Subtidal coarse sediment	Structure and function: presence and abundance of key structural and influential species	[Maintain OR Recover OR Restore] the abundance of listed species*, to enable each of them to be a viable component of the habitat.	N/A	Natural England has included an attribute for the abundance of key structural and influential species for habitat features. Structural species are those that form part of the habitat structure or help to define a key biotope. Influential species are those that are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat). These will be identified at a national level in accordance with the criteria defined in the key structural and influential species paper (Covey et al., 2016). *For each species listed the reason for its inclusion as structural or influential and the information supporting its presence within the community of this site will be provided. Site-specifics:
Intertidal sand and muddy sand	Structure and function: presence and abundance of key structural and influential species	[Maintain OR Recover OR Restore] the abundance of listed species*, to enable each of them to be a viable component of the habitat.	N/A	Natural England has included an attribute for the abundance of key structural and influential species for habitat features. Structural species are those that form part of the habitat structure or help to define a key biotope. Influential species are those that are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat). These will be identified at a national level in accordance with the criteria defined in the key structural and influential species paper (Covey et al., 2016). *For each species listed the reason for its inclusion as structural or influential and the information supporting its presence within the community of this site will be provided. Site-specifics:
Intertidal mud	Structure and function: presence and abundance of key structural and influential species	[Maintain OR Recover OR Restore] the abundance of listed species*, to enable each of them to be a viable component of the habitat.	N/A	Natural England has included an attribute for the abundance of key structural and influential species for habitat features. Structural species are those that form part of the habitat structure or help to define a key biotope. Influential species are those that are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat). These will be identified at a national level in accordance with the criteria defined in the key structural and influential species paper (Covey et al., 2016). *For each species listed the reason for its inclusion as structural or influential and the information supporting its presence within the community of this site will be provided. Site-specifics:
Sandbanks which are slightly covered by sea water all the time	Structure and function: presence and abundance of key structural	[Maintain OR Recover OR Restore] the abundance of listed species*, to enable each	N/A	Natural England has included an attribute for the abundance of key structural and influential species for habitat features. Structural species are those that form part of the habitat structure or help to define a key biotope.

	species	of them to be a viable component of the habitat.		as bioturbators (mixers of sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat). These will be identified at a national level in accordance with the criteria defined in the key structural and influential species paper (Covey et al., 2016). *For each species listed the reason for its inclusion as structural or influential and the information supporting its presence within the community of this site will be provided. Site-specifics:
Subtidal mixed sediments	Structure and function: presence and abundance of key structural and influential species	[Maintain OR Recover OR Restore] the abundance of listed species*, to enable each of them to be a viable component of the habitat.	N/A	Natural England has included an attribute for the abundance of key structural and influential species for habitat features. Structural species are those that form part of the habitat structure or help to define a key biotope. Influential species are those that are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat). These will be identified at a national level in accordance with the criteria defined in the key structural and influential species paper (Covey et al., 2016). *For each species listed the reason for its inclusion as structural or influential and the information supporting its presence within the community of this site will be provided. Site-specifics:
Subtidal sand	Structure and function: presence and abundance of key structural and influential species	[Maintain OR Recover OR Restore] the abundance of listed species*, to enable each of them to be a viable component of the habitat.	N/A	Natural England has included an attribute for the abundance of key structural and influential species for habitat features. Structural species are those that form part of the habitat structure or help to define a key biotope. Influential species are those that are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat). These will be identified at a national level in accordance with the criteria defined in the key structural and influential species paper (Covey et al., 2016). *For each species listed the reason for its inclusion as structural or influential and the information supporting its presence within the community of this site will be provided. Site-specifics:
Subtidal mud	Structure and function: presence and abundance of key structural and influential species	[Maintain OR Recover OR Restore] the abundance of listed species*, to enable each of them to be a viable component of the habitat.	N/A	Natural England has included an attribute for the abundance of key structural and influential species for habitat features. Structural species are those that form part of the habitat structure or help to define a key biotope. Influential species are those that are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat). These will be identified at a national level in accordance with the criteria defined in the key structural and influential species paper (Covey et al., 2016). *For each species listed the reason for its inclusion as structural or influential and the information supporting its presence within the community of this site will be provided. Site-specifics:
Salicornia and other annuals colonising mud and sand	Structure and function: presence and patterning of creeks and salt pans	Maintain naturally-occurring patterns of creeks and salt pans.	N/A	Creeks provide the mechanism for water and sediment flows into and out of the marsh and help dissipate tidal energy. Changes in headward erosion, width, degree of dissection and creek density can indicate a response to sea level rise. Plan and cross-sectional form of creeks represent the balance between ebb and flood tide forces: truncating, blocking or altering morphology can impact on the energy dissipated by creeks. Stands of H1310 may be found on creek sides, even high up in the saltmarsh. Site-specifics: No site specific information is currently available for this attribute. The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	Structure and function: presence and patterning of creeks and salt pans	Maintain naturally-occurring patterns of creeks and salt pans.	N/A	Creeks provide the mechanism for water and sediment flows into and out of the marsh and help dissipate tidal energy. Changes in headward erosion, width, degree of dissection and creek density can indicate a response to sea level rise. Plan and cross-sectional form of creeks represent the balance between ebb and flood tide forces: truncating, blocking or altering morphology can impact on the energy dissipated by creeks. In managed realignment (MR) sites, creek patterns may need to be artificially engineered at the start of the works to ensure they can function. MR may also affect creeks within the existing system, this will require a good understanding of likely changes. Site-specifics: Although there have been no obvious recent anthropogenic changes to creeks or pans in units surveyed there have been some change due to sea wall realignments, with associated channels from breaches in the old sea wall.(Jukes and Pawley, 2019) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.

Fixed dunes with herbaceous vegetation (“Grey dunes”)	Structure and function: presence of unvegetated surfaces		N/A	Patches of bare sand are essential for a wide range of typical dune invertebrates and ‘dune annual’ plants. For semi-fixed / fixed dunes the range of bare ground / sand is typically between 5-20%. Areas of bare sand which are maintained by frequent human disturbance should not increase in extent. Site-specifics: Data to support the setting of a target for this attribute will be available after the publication of the 2019 sand dune survey report. This report is expected in autumn 2020.
Shifting dunes along the shoreline with Ammophila arenaria (“White dunes”)	Structure and function: presence of unvegetated surfaces		N/A	In these developing, dynamic zones, bare sand should be expected. Lack of bare sand would suggest an artificially stabilised system. Blow-throughs are a natural element of this zone. If the extent of sand is towards the upper end of the range, it will become important to assess whether recreational pressures are overriding natural dynamics. Site-specifics: Quantitative data to support the setting of a target for this attribute will be available after the publication of the 2019 sand dune report. This report is expected in autumn 2020.
Embryonic shifting dunes	Structure and function: presence of unvegetated surfaces		N/A	In these developing, dynamic zones, bare sand should be expected. Lack of bare sand would suggest an artificially stabilised system. Blow-throughs are a natural element of this zone. If extent of sand is towards the upper end of the range, it will become important to assess whether recreational pressures are over-riding natural dynamics. Site-specifics: Quantitative data to support the setting of a target for this attribute will be available after the publication of the 2019 sand dune report. This report is expected in autumn 2020.
Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	Structure and function: presence of unvegetated surfaces	Maintain the degree of patterning of patches of bare mud of varying sizes in a mosaic with saltmarsh vegetation.	N/A	Patches of bare mud will vary seasonally, generally more open in winter and after storm events. These are important to provide the structural diversity that can be important for species typical of this habitat feature. Site-specifics: No site specific information is currently available for this attribute. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Salicornia and other annuals colonising mud and sand	Structure and function: presence of unvegetated surfaces	Maintain the degree of patterning of patches of bare mud of varying sizes in a mosaic with saltmarsh vegetation.	N/A	Patches of bare mud will vary seasonally, generally more open in winter and after storm events. These are important to provide structural diversity that can be important for species typical of this habitat feature. Site-specifics: No site specific information is currently available for this attribute. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Salicornia and other annuals colonising mud and sand	Structure and function: sediment size and availability	Maintain the availability and size range of those sediments typical of the feature at the site.	N/A	Sediment size influences the establishment of vegetation and types of vegetation. The amount of fine material determines vegetation composition: this should be allowed to develop naturally and not have any additions of soil or other fine material or organic matter. Site-specifics: Sediment enters the Humber Estuary from three main pathways: the North Sea; the Holderness coastline; and from fluvial sources. A net southward longshore drift supplies sediment to the mouth of the estuary where it is then re-distributed within the estuarine system. The estuary supports a large area of intertidal habitats ranging from gravels and sands, to muddy sands and mud, reflecting varying degrees of exposure to waves, currents and inflowing rivers. (Allen et al., 2003), (Hemingway et al., 2008), (ABP Marine Environmental Research Ltd (ABPmer), 2011) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	Structure and function: sediment size and availability	Maintain the availability and size range of those sediments typical of the feature at the site.	N/A	Sediment size influences the establishment of vegetation and types of vegetation. Saltmarsh sediments are typically fine-grained clay, and silt particles that are small enough to be carried in suspension. Other material includes organic matter and fine sands. These will vary between sites. Site-specifics: Sediment enters the Humber Estuary from three main pathways: the North Sea, the Holderness coastline, and from fluvial sources. A net southward longshore drift along the Holderness Coast supplies sediment to the mouth of the estuary where it is then re-distributed within the estuarine system. The estuary supports a large area of intertidal habitats ranging from gravels and sands, to muddy sands and mud, reflecting varying degrees of exposure to waves, currents and inflowing rivers. (Allen et al., 2003), (Hemingway et al., 2008), (ABP Marine Environmental Research Ltd (ABPmer), 2011) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.

Embryonic shifting dunes	Structure and function: soils, substrate and nutrient cycling		N/A	This target is included because soil is the foundation of basic ecosystem function and a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species that together form vegetation types, and therefore provide a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the ecological structure, function and processes associated with this Annex I feature. This Annex 1 habitat has essentially raw soils with little humus and low nutrient status. (UK Research on Eutrophication and Acidification of Terrestrial Ecosystems (UKREATE), 2008), (Jones et al., 2002), (Jones et al., 2002), (Emmett et al., 2011), (Bobbink and Hettelingh, 2011), (UR and Natura 2000 Programme Directorate of Ministry of Economic Affairs, 2012), (Whitfield and McIntosh, 2014), (Jones et al., 2004), (Jones et al., 2009), (Jones et al., 2007) Site-specifics: Appropriate NVC communities may be used as a proxy for this attribute. Data to support the setting of a target for this attribute will be available after the publication of the 2019 sand dune survey report. This report is expected in autumn 2020.
Shifting dunes along the shoreline with Ammophila arenaria ("White dunes")	Structure and function: soils, substrate and nutrient cycling		N/A	This target is included because soil is the foundation of basic ecosystem function and a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species that together form vegetation types, and therefore provide a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the ecological structure, function and processes associated with this Annex I feature. This Annex I habitat has essentially raw soils with little humus and low nutrient status. Site-specifics: Appropriate NVC communities may be used as a proxy for this attribute. Data to support the setting of a target for this attribute will be available after the publication of the 2019 sand dune survey report. This report is expected in autumn 2020.
Fixed dunes with herbaceous vegetation ("Grey dunes")	Structure and function: soils, substrate and nutrient cycling		N/A	This target is included because soil is the foundation of basic ecosystem function and a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species which together form vegetation types, and therefore provide a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the ecological structure, function and processes associated with this Annex I feature. (Natural England, 2005) Site-specifics: Appropriate NVC communities may be used as a proxy for this attribute. Data to support the setting of a target for this attribute will be available after the publication of the 2019 sand dune survey report. This report is expected in autumn 2020.
Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	Structure and function: surface elevation and topography	Maintain any desirable variation in elevation and / or topography across the site that supports the habitat type.	N/A	Small differences or changes in elevation and topography (eg just centimetres in elevation) may affect many marsh functions, from flooding and nutrient cycling to draining of the marsh interior. This micro-topography is critical for the development and maintenance of this habitat feature and its typical species, as are the wider sedimentary processes that influence this topography. Site-specifics: The Environment Agency (Geomatics) undertook a study of changes in elevation within the Humber Estuary between 2001 and 2010, which showed areas of erosion and accretion. The coastal and estuarine processes around the estuary are particularly dynamic in nature. There are fast-flowing currents, shifting sands and shallow waves, and the bathymetric/topographic charts of the estuary are constantly changing. (Environment Agency (EA), 2010), (Allen et al., 2003), (ABP Marine Environmental Research Ltd (ABPmer), 2011) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Fixed dunes with herbaceous vegetation ("Grey dunes")	Structure and function: topography of fixed dune	Restore a natural topography to the fixed dune feature.	N/A	Dune topography may be influenced by the operation of geomorphological processes, which should be allowed to continue in order to maintain the dune system in its naturally dynamic form. Fixed dunes occur where the dune stabilises and the organic content of the soil increases. Maintaining this zone in a natural form, and as part of the wider dune zonation, will provide optimal conditions for the full range of characteristic flora and fauna. Site-specifics: Field observations suggest that that this feature may be in decline, with possible restrictions to its natural topographic development. For this reason a precautionary approach has been adopted and a 'Restore' target has been set until appropriate management measures can be identified. A survey of the feature has been commissioned and this advice may be updated after the publication of a sand dune monitoring report, expected in autumn 2020. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Shifting dunes along the shoreline with Ammophila arenaria ("White dunes")	Structure and function: topography of shifting dune ridge	Restore a natural topography to the shifting dune feature.	N/A	Dune topography may be influenced by the operation of geomorphological processes, which should be allowed to continue in order to maintain the dune system in its naturally dynamic form. Maintaining this zone in a natural form, and as part of the wider dune zonation, will provide optimal conditions for the full range of characteristic flora and fauna. The low shifting dunes on the foreshore provide a vital structural element to any dune system: the varied natural topography provides the important means of dune-building and progradation seawards. Key dune-building plants such as Ammophila arenaria (marram grass) is sensitive to salinities over 1.5% so only persists on higher dune ridges. Site-specifics:

				Field observations suggest that this feature may be in decline. For this reason a 'Restore' target has been set as a precaution.This target may be reviewed after the publication of the 2019 sand dune survey report, expected in autumn 2020. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Shifting dunes along the shoreline with Ammophila arenaria (“White dunes”)	Structure and function: vegetation - undesirable species		N/A	Undesirable non-woody and woody vascular plant species may require active management to avert an unwanted succession to a different and less desirable state. Often, they may be indicative of a negative trend relating to another aspect of a site's structure and function. These species will vary depending on the nature of the particular feature, and in some cases these species may be natural / acceptable components, or even dominants. For this feature, two types of negative species can occur: invasive non-natives, or species indicative of poor or declining condition (eg nettle or creeping thistle). For known or likely invasives, there should be zero tolerance. Invasive non-native species may be an issue, the presence of non-natives and other undesirable species could be an indication of increased stability. Some species are potentially more invasive into areas of bare sand and will require specific management on site. Where sea buckthorn is native this species is not counted as a negative indicator. It has been widely introduced elsewhere and has proved very invasive. (Joint Nature Conservation Committee (JNCC), 2004) Site-specifics: Data to support the setting of a target for this attribute will be available after the publication of the 2019 sand dune report. This report is expected in autumn 2020.
Embryonic shifting dunes	Structure and function: vegetation - undesirable species		N/A	Two types of negative species can occur: invasive non-natives, or species indicative of poor condition (eg nettle or creeping thistle). For known or likely invasives, there should be zero tolerance. Site-specifics: Data to support the setting of a target for this attribute will be available after the publication of the 2019 sand dune report. This report is expected in autumn 2020.
Fixed dunes with herbaceous vegetation (“Grey dunes”)	Structure and function: vegetation - undesirable species	Cover of the following undesirable species are maintained within acceptable and manageable levels and are not encouraged by changes in surface condition, soils, nutrient levels or changes to hydrology: Rosa species, Cirsium arvense, Cirsium vulgare, Lolium perenne, Plantago major, Poa annua, Pteridium aquilinum, Rubus fruticosus agg., Senecio jacobaea, Urtica dioica.	N/A	Undesirable non-woody and woody vascular plant species may require active management to avert an unwanted succession to a different and less desirable state. Often, they may be indicative of a negative trend relating to another aspect of a site's structure and function. These species will vary depending on the nature of the particular feature, and in some cases these species may be natural / acceptable components, or even dominants. For this feature where sea buckthorn is native this species is not counted as a negative indicator (see H2160 table). It has been widely introduced elsewhere and has proved very invasive. Species such as Urtica dioica, Cirsium arvense and C. vulgare species are indicative of poor condition because of enrichment. Senecio jacobaea is a natural constituent of dune vegetation and should only to be included as a negative indicator where extensive dense stands of robust plants are present. (Joint Nature Conservation Committee (JNCC), 2004) Site-specifics: Detailed site specific information on this attribute will be available after the publication of the 2019 sand dune report. This report is expected in autumn 2020. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	Structure and function: vegetation - undesirable species	The frequency / cover of the following undesirable species are maintained acceptable levels and are not encouraged by changes in surface condition, soils, nutrient levels or changes to hydrology: Spartina anglica	N/A	The generic target for S. anglica is ' no recent evidence of expansion into pioneer marsh: requires better understanding of dynamics'. In some cases S. anglica stands have developed into H1330 over time. If there is an existing element of S. anglica in the system, this should be monitored to assess if it's increasing and what successional changes are occurring over time. Site-specifics: There is no evidence of serious expansion of *Spartina anglica* (SM6) into the marsh communities. As an undesirable species that outcompetes *S.maritima* , *Spartina anglica* is not a designated feature of the SAC; however, as a pioneer species it colonises areas of mudflat potentially enabling the introduction and establishment of Atlantic Salt Meadows. (Berry et al., 2009) During a 2018 survey of the Humber saltmarsh feature no *Spartina* was recorded in the inner estuary. Of the middle and outer estuary units surveyed, six are estimated to have Spartina covering less than 1% of the unit area, with 12 units estimated at between 1 and 10% cover. The majority of these units have previously mapped areas of some SM6, although newly colonised/accreting areas generally have scattered *Spartina* in the pioneer and low-mid saltmarsh zones.(Jukes and Pawley, 2019) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.

Salicornia and other annuals colonising mud and sand	Structure and function: vegetation - undesirable species	The frequency / cover of the following undesirable species are maintained acceptable levels and are not encouraged by changes in surface condition, soils, nutrient levels or changes to hydrology: Spartina anglica	N/A	The generic target for Spartina anglica is ' no recent evidence of expansion into pioneer marsh: requires better understanding of dynamics'. S.anglica can form a component of the H1310 habitat, but should not be in a monoculture. Site-specifics: There has been no evidence of expansion of *Spartina anglica* (SM6) into pioneer saltmarsh (Berry et al., 2009). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Dunes with Hippophae rhamnoides	Structure and function: vegetation - undesirable species	The frequency / cover of the following undesirable species are maintained at acceptable levels and are not encouraged by changes in surface condition, soils, nutrient levels or changes to hydrology:	N/A	Undesirable non-woody and woody vascular plants species may require active management to avert an unwanted succession to a different and less desirable state. Often, they may be indicative of a negative trend relating to another aspect of a site's structure and function. These species will vary depending on the nature of the particular feature, and in some cases these species may be natural / acceptable components, or even dominants. Site-specifics: Field observations indicate non-natives such as *Rosa rugosa* and undesirable species such as nettle (*Urtica* spp.) and creeping thistle (*Cirsium arvense*) in a number of sand dune areas. For this reason a 'Restore' target has been set as a precaution, although it is understood partner organisations are taking management steps in specific locations. This advice may be updated after the publication of the 2019 sand dune survey report, expected in autumn 2020.
Shifting dunes along the shoreline with Ammophila arenaria (“White dunes”)	Structure and function: vegetation community composition		N/A	This habitat feature will comprise a number of associated semi-natural vegetation types and their transitional zones. In the UK these have been categorised by the National Vegetation Classification (NVC). Maintaining or restoring the presence, variety and composition of these vegetation types at this site will help to conserve the typical species composition of the SAC feature at this site at appropriate levels (recognising natural fluctuations). The vegetation types equivalent to this habitat are generally NVC types SD6 and elements of SD5, but can contain elements of other communities depending on degree of surface stability. The majority falls within SD6: a dynamic vegetation type maintained only by change, which will rapidly change and disappear if stability is imposed. It can vary from stands of pure Ammophila arenaria (marram grass) to more diverse communities, reflecting a range of natural factors. SD10 Carex arenaria community may become prominent on areas of dune subject to erosion through disturbance. There is a degree of geographical variation. The species composition of shifting dunes is constrained by the harsh conditions, but the vegetation is by no means uniform. The most marked floristic variation relates to the degree of instability. Where sand accretion is extremely rapid it is possible to find vegetation that consists only of Ammophila arenaria. As rates of sand deposition decline the marram is joined by more species. There are a number of sub-communities and there will be natural fluxes in the transition between the mobile dunes and fixed dunes seaward as sand deposition changes. (Adey and McKibbin, 1970) Site-specifics: NVC data to support the setting of a target for this attribute will be available after the publication of the 2019 sand dune survey report. This report is expected in autumn 2020.
Embryonic shifting dunes	Structure and function: vegetation community composition	Ensure the component vegetation communities of the feature are referable to and characterised by the following National Vegetation Classification type (s):	N/A	This habitat feature will comprise a number of associated semi-natural vegetation types and their transitional zones, reflecting the geographical location of the site, altitude, aspect, soil conditions (especially base-status and drainage) and vegetation management. In the UK these have been categorised by the National Vegetation Classification (NVC). Maintaining or restoring these characteristic and distinctive vegetation types, and the range of types as appropriate, will be important to sustaining the overall habitat feature. This will also help to conserve their typical plant species (ie the constant and preferential species of a community), and therefore that of the SAC feature, at appropriate levels (recognising natural fluctuations). (Adey and McKibbin, 1970) Site-specifics: Data to support the setting of a target for this attribute will be available after the publication of the 2019 sand dune survey report. This report is expected in autumn 2020.
Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	Structure and function: vegetation community composition	Ensure the component vegetation communities of the feature are referable to and characterised by the following National Vegetation Classification type (s):	N/A	This habitat feature will comprise a number of associated semi-natural vegetation types and their transitional zones, reflecting the geographical location of the site, altitude, aspect, soil conditions (especially base-status and drainage) and vegetation management. In the UK these have been categorised by the National Vegetation Classification (NVC). Maintaining or restoring these characteristic and distinctive vegetation types, and the range of types as appropriate, will be important to sustaining the overall habitat feature. This will also help to conserve their typical plant species (ie the constant and preferential species of a community), and therefore that of the SAC feature, at appropriate levels (recognising natural fluctuations). The vegetation types equivalent to this Annex I habitat are NVC types SM10 to SM20 inclusive, but there will be transitions and mosaics between these and with other Annex I types and associated transitions to landward, where many of the rare species are found. Site-specifics: Vegetation community types found in the Humber Estuary SAC include: SM10 Transitional low-marsh communities SM11 and SM 12 *Aster tripolium* saltmarsh communities (sea aster) SM13 *Puccinellia maritima* saltmarsh (common saltmarsh grass) (with sub-communities 13a-c; 13f) SM14 *Halimione portulacoides* saltmarsh (sea purslane) (with sub-communities 14a and 14c) SM15 *Juncus maritimus-Triglochin maritima* saltmarsh (sea rush – sea arrowgrass) SM16 *Festuca rubra* saltmarsh (red fescue) (with sub-communities 16a and 16c)

				SM18 *Juncus maritimus* saltmarsh (sea rush) SM24 *Elymus pycnanthus* saltmarsh (sea couch grass) SM28 *Elymus repens* saltmarsh (couch grass) S4 *Phragmites australis* swamp (common reed) S21 *Bolboschoenus maritimus* swamp (sea club-rush) (Bullen Consultants, 2001), (Dargie, 2001) During the 2018 survey of the Humber saltmarsh feature it was noted that many units within the estuary do not meet the vegetation composition targets for one or more zone. However, this is generally due to one species-poor community dominating a zone e.g. only SM24 in the upper zone, with few species other than Sea Couch *Elytrigia atherica* present.(Jukes and Pawley, 2019) Vegetation zonation and NVC communities present were similar to those previously mapped in 2001, with some changes due to loss from erosion as well as expansion from colonisation of accreting areas.(Jukes and Pawley, 2019) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Dunes with Hippophae rhamnoides	Structure and function: vegetation community composition	Ensure the component vegetation communities of the feature are referable to and characterised by the following National Vegetation Classification type: SD18	N/A	This habitat feature will comprise a number of associated semi-natural vegetation types and their transitional zones, reflecting the geographical location of the site, altitude, aspect, soil conditions (especially base-status and drainage) and vegetation management. In the UK these have been categorised by the National Vegetation Classification (NVC). Maintaining or restoring these characteristic and distinctive vegetation types, and the range of types as appropriate, will be important to sustaining the overall habitat feature. This will also help to conserve their typical plant species (ie the constant and preferential species of a community), and therefore that of the SAC feature, at appropriate levels (recognising natural fluctuations). This feature can be largely described as SD18 Hippophae rhamnoides dune scrub. Site-specifics: Data to support the setting of a target for this attribute will be available after the publication of the 2019 sand dune report. This report is expected in autumn 2020.
Fixed dunes with herbaceous vegetation ("Grey dunes")	Structure and function: vegetation community composition	Ensure the component vegetation communities of the feature are referable to and characterised by the following National Vegetation Classification types:	N/A	This habitat feature will comprise a number of associated semi-natural vegetation types and their transitional zones, reflecting the geographical location of the site, altitude, aspect, soil conditions (especially base-status and drainage) and vegetation management. In the UK these have been categorised by the National Vegetation Classification (NVC). Maintaining or restoring these characteristic and distinctive vegetation types, and the range of types as appropriate, will be important to sustaining the overall habitat feature. This will also help to conserve their typical plant species (ie the constant and preferential species of a community), and therefore that of the SAC feature, at appropriate levels (recognising natural fluctuations). (Adey and McKibbin, 1970) Site-specifics: Data to support the setting of a target for this attribute will be available after the publication of the 2019 sand dune report. This report is expected in autumn 2020.
Salicornia and other annuals colonising mud and sand	Structure and function: vegetation community composition	Maintain the species composition of component vegetation communities and associated transitions, allowing for successional changes in response to natural processes.	N/A	This habitat feature will comprise a number of associated semi-natural vegetation types and their transitional zones, reflecting the geographical location of the site, altitude, aspect, soil conditions (especially base-status and drainage) and vegetation management. In the UK these have been categorised by the National Vegetation Classification (NVC). Maintaining or restoring these characteristic and distinctive vegetation types, and the range of types as appropriate, will be important to sustaining the overall habitat feature. This will also help to conserve their typical plant species (ie the constant and preferential species of a community), and therefore that of the SAC feature, at appropriate levels (recognising natural fluctuations). The vegetation types equivalent to this Annex I habitat are NVC types SM7, SM8, SM9 and SM27. There will be transitions and mosaics between these and with other Annex I types and they can occur in complex mosaics, including as colonists of bare areas within stands of H1330 (old turf-cuttings, salt pans, disturbed areas, etc). Site-specifics: The vegetation communities represented in the Humber Estuary SAC include: SM8 *Salicornia* spp., SM9 annual sea blite *Suaeda maritima* communities and common saltmarsh grass *Puccinellia maritima* (SM10) (Berry et al., 2009). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Dunes with Hippophae rhamnoides	Structure and function: vegetation community transitions	Maintain the habitat in a mosaic with other dune Annex I habitats, and manage transitional areas to retain open scrub.	N/A	Transitions / zonations between adjacent but different vegetation communities are usually related to naturally occurring changes in soil, aspect or slope. Such 'ecotones' retain characteristics of each bordering community and can add value by often containing species not found in the adjacent communities. Retaining such transitions can provide further diversity to the habitat feature, and support additional flora and fauna. Site-specifics: Detailed site specific information on this attribute will be available after the publication of the 2019 sand dune report. This report is expected in autumn 2020. The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Shifting dunes along the shoreline with Ammophila arenaria ("White dunes")	Structure and function: vegetation community transitions	Restore the full natural range of vegetation zones and the transitions between them.	N/A	Zonations are seen as indicative of good conservation of structure and function. It is essential that the relationship between this habitat and other elements of the sand dune system are recognised. As much of the dune frontage as possible should have intact zonation to the next stage in succession (generally fixed dunes). This target needs to be determined at a site level, as there may be specific factors that naturally limit continuous coverage. (Adey and McKibbin, 1970) Site-specifics:

				reason a precautionary approach has been adopted and a 'Restore' target has been set until appropriate management measures can be identified. A survey of the feature has been commissioned and this advice may be updated after the publication of a sand dune monitoring report, expected in autumn 2020.
Fixed dunes with herbaceous vegetation (“Grey dunes”)	Structure and function: vegetation community transitions (range and zones)	Restore the patterns of natural zonations / transitions, with full zonation from beach inland to fixed dune should be intact over at least 95% of coastal frontage.	N/A	Transitions / zonations between adjacent but different vegetation communities are usually related to naturally occurring changes in soil, aspect or slope. Such 'ecotones' retain characteristics of each bordering community and can add value by often containing species not found in the adjacent communities. Retaining such transitions can provide further diversity to the habitat feature, and support additional flora and fauna. Some dunes are on naturally sediment-deficit coasts: on these there is likely to be less that 95% frontage of strandline and embryo dunes. (Adey and McKibbin, 1970) Site-specifics: Field observations of the sand dune features on the Humber suggest this feature may be in decline for this attribute. For this reason a precautionary approach has been adopted and a 'Restore' target has been set until appropriate management measures can be identified. A survey of the feature has been commissioned and this advice may be updated after the publication of a sand dune monitoring report, expected in autumn 2020.
Embryonic shifting dunes	Structure and function: vegetation composition - trees and scrub	Scrub and tree cover is absent or rare, except where sea buckthorn is native (where<10% cover is ideal)	N/A	Dense cover of trees and shrubs can smother and shade out smaller and more characteristic vegetation of this habitat feature, and interrupt naturally occurring dune processes. Usually, active management is required to reduce or contain its cover across this habitat feature. Apart from sea buckthorn (where it is native), other trees and shrubs would usually indicate an artificially stabilised system. Site-specifics: Data to inform this attribute will be available after the publication of the 2019 sand dune survey report. This report is expected in autumn 2020. Sea buckthorn is native to the east coast of England and so the target of less than 10% coverage for this feature is appropriate.
Dunes with Hippophae rhamnoides	Structure and function: vegetation structure - scrub age	Maintain a diverse age structure amongst the scrub habitat found on the site.	N/A	To sustain this feature in the longer term, there should be a variety of different growth stages present. Each phase of growth associated with the sea buckthorn scrub that dominates this feature, also represents different microclimatic conditions and microhabitats that may provide shelter or food to other organisms. Therefore, it is important to maintain a mosaic of sea buckthorn in different phases of growth. Typically this age structure should comprise a variety of different ages, typically with 30% of scrub area being in colonising stage (SD18a), and 10% of scrub less than 5 years old and 20% more than 20 years old. Site-specifics: Detailed site specific information on this attribute will be available after the publication of the 2019 sand dune report. This report is expected in autumn 2020. The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Embryonic shifting dunes	Structure and function: vegetation structure - zonation of dune vegetation		N/A	The coastal sand dune ecosystem has a characteristic range of natural features, representing different stages of natural succession. The full representation of these stages should be maintained or, where appropriate, restored. On some sites there may be specific natural factors that limit continuous coverage, related to broader scale sediment budgets. Where Leymus arenarius is present, there can be a continuous floristic transition to marram-dominated mobile dunes (Shifting dunes along the shoreline with Ammophila arenaria). Site-specifics: Data to support the setting of a target for this attribute will be available after the publication of the 2019 sand dune report. This report is expected in autumn 2020.
Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	Structure and function: vegetation structure - zonation of salt marsh vegetation	Maintain the full range of zonations (low-mid, mid, mid-upper and transitional zones) between component saltmarsh communities found in H1330.	N/A	The coastal salt marsh ecosystem has a characteristic range of natural features, representing different stages of natural succession. The full representation of these stages should be maintained or, where appropriate, restored. The number of tidal inundations, degree of exposure and elevation will determine the zonation. Site-specifics: The Humber estuary supports saltmarsh on both its northern and southern banks in varying degrees of diversity. In areas such as Cherry Cobb on the north bank, and south of Cleethorpes, there is clear zonation of saltmarsh vegetation from low to mid marsh communities through to mid to upper marsh communities. Where there is a significant influence of fresh water in the upper reaches of the estuary, and where the marsh joins higher ground, transitional communities are found. Generally stable marshes are mainly dominated by middle marsh habitats with fewer upper marsh zones. The lack of clear saltmarsh zonation often apparent on the Humber may be attributable to the presence of the sea walls that are present along almost the entire length, which prevent the natural landward colonisation by saltmarsh communities as sea levels rise (Kemp et al., 2008). (Allen et al., 2003), (Bullen Consultants, 2001), (Dargie, 2001), (Kemp et al., 2008), (English Nature, 2003) During an 2018 survey of the Humber saltmarsh feature vegetation zonation and NVC communities present were similar to those previously mapped in 2001, with some changes due to loss of swamp/saltmarsh communities due to erosion, as well as expansion due to accretion and colonisation of mudflats. In the inner estuary there are new areas of reedbed and the middle estuary shows new areas of saltmarsh. Some units show changes due to sea wall realignment, with new areas of saltmarsh landward between the new and old seawalls.(Jukes and Pawley, 2019) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Salicornia and other annuals	Structure and function:	Maintain any existing	N/A	The coastal saltmarsh ecosystem has a characteristic range of natural features, representing different stages of natural succession. The full representation of these stages should be maintained or, where appropriate, restored.

and sand	structure - zonation of saltmarsh	between H1310 and other adjacent saltmarsh or intertidal communities.		Site-specifics: On the Humber this feature is usually found on the edges of the main saltmarsh, for example at Pyewipe, or in creeks, pans and standing water since they are adapted to increased saltwater exposure. (Allen et al., 2003), (Bullen Consultants, 2001), (Dargie, 2001) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Fixed dunes with herbaceous vegetation ("Grey dunes")	Structure and function: vegetation structure diversity		N/A	A varied vegetation structure and a succession of flowers and seeds through the year are important for maintaining the habitat's diversity. Targets for ratio of short to taller vegetation should be set on a site-specific basis. In addition, a proportion of the short turf area should be<5cm tall. The ratio of short to tall vegetation can be lower (but not > <30%) in semi-fixed dune grassland (SD7) where > Ammophila arenaria (Marram grass) is still abundant. Levels and timing of stock grazing should be sufficient to allow adequate seed production. (Adey and McKibbin, 1970) Site-specifics: Data to support the setting of a target for this attribute will be available after the publication of the 2019 sand dune report. This report is expected in autumn 2020.
Intertidal seagrass beds	Structure: biomass	Maintain the leaf / shoot density, length, percentage cover, and rhizome mat across the feature at natural levels (as far as possible), to ensure a healthy, resilient habitat.	N/A	Biomass is the total amount of live vegetation associated with the seagrass bed. Leaf length and density are critical structural elements of each bed. Naturally, these can vary enormously and are influenced by the site-specific natural parameters, but both can be affected by human impacts. The parameters will also be very site-specific and therefore differ between beds (Jackson et al., 2013). (Cleator, 1993), (Agustí et al., 1994) Site-specifics: There is currently no site specific evidence available on the biomass of the sea grass beds at Spurn Point. There is no biomass data available for this subfeature so the target has been set with low confidence
Estuaries	Structure: freshwater sources	Maintain the natural freshwater flow / volume into the estuary.	N/A	Gross freshwater flows are important in maintaining the salinity gradient and water circulation in an estuary (Dyer, 1997), (Environment Agency (EA), 2011), (WFD UKTAG, 2012), (Defra, 2005). Site-specifics: The Humber Estuary drains a catchment of some 24,472 km² and is the site of the largest single input of freshwater from Britain into the North Sea. Average freshwater flow into the Humber estuary from the rivers is 250 m3s-1, ranging from 60 m3s-1 in drier periods to 450 m3s-1 in wet periods. Peak flows of up to 1500 m3s-1 have been recorded during floods. The rivers Trent and Ouse, which provide the main fresh water flow into the Humber (Allen et al., 2003), (Joint Nature Conservation Committee (JNCC), 2007) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Estuaries	Structure: habitat zonation	Maintain the estuary zonation, which is affected by both changes in salinity gradient and tides in the estuary from river to sea (horizontally) and with shore height (vertically) from terrestrial to subtidal.	N/A	The distribution of habitats within an estuary is influenced by both changes in salinity gradients and tidal currents in the transition from the terrestrial to the marine environment. Retaining natural transitions from river to sea and upper to lower shore are important to a healthy estuary structure (Joint Nature Conservation Committee (JNCC), 2004), (Davies et al., 2001). Habitat zonation will be representative of the limits and range of estuarine communities with tidal movements and salinity (Joint Nature Conservation Committee (JNCC), 2004), (Davies et al., 2001), (Dyer, 1997), (Hiscock et al., 2006), (Davidson and Buck, 1997). Site-specifics: Please refer to the feature and sub-features descriptions for further information on habitat zonation and distribution. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Coastal lagoons	Structure: isolating barrier - presence, nature and integrity	Maintain the isolating barrier so that there is no change in its presence, nature and integrity during a monitoring cycle.	N/A	Lagoons have an open connection with the marine environment (silled and sluiced lagoons and lagoonal inlets) and a proportion of water is exchanged at most tides. The presence, nature and integrity of the isolating barrier is fundamental to the structure and function of a lagoon (Joint Nature Conservation Committee (JNCC), 2004). If present, it controls the quantity and dynamics of saline water in and out of the lagoon (Bamber, 2010). The isolating barrier may be a sill, channel, sluice, weir or impermeable base of a percolation route, except in the case of overtopping lagoons (isolated and some percolation lagoons). Lagoons with a regular exchange with the sea tend to support more diverse communities as recruitment opportunities are greater (Joint Nature Conservation Committee (JNCC), 2004). While this may lead to higher species diversity, it may be at the cost of lagoon specialist species. It should be noted that natural communities in lagoons tend to be characterised by a small number of rare species that are able to survive in the changeable lagoon environment. This means lagoons that are of conservation importance often have low species diversity, and high species diversity is not required for a lagoon to be of high conservation value. Site-specifics: The channel through the saltmarsh that connected Humberston Fitties to the estuary has silted up over recent years and it now persists as an isolated lagoon, its water largely acquired through overtopping of the bank during spring tides and some limited groundwater seepage. Although the channel is silted up, it is still slightly lower than the surrounding saltmarsh and so on high spring tides water will flow over it into the main lagoon. At Northcoates Lagoon seawater enters the system at high tide through two channels and flows through to the north

				and south of the system. In the late summer the lagoons occasionally dry out completely, although the channel system that provides the in-flow of seawater from the estuary is deeper and usually retains water throughout the summer. (Seaton, 2001), (English Nature, 2003) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Estuaries	Structure: morphology	Maintain the characteristic morphology of the habitat.	N/A	Morphology describes the behaviour of an estuarine system, and the interaction of the topography, sediments and physical processes, eg wave and tides (Dyer, 1997), (Environment Agency (EA), 2011), (Davidson and Buck, 1997). Morphology is an essential structural component of an estuary and dictates the distribution and composition of its substrate, and therefore its habitats and species (Dyer, 1997), (Townend, 2005), (Townend and Wright, 2005), (Environment Agency (EA), 2011). Site-specifics: The Humber Estuary is a macrotidal, coastal plain estuary. Exhibiting a classic funnel shape it is approximately 6.5km wide at its entrance (opening to 9.5km wide immediately past its entrance at Spurn Point), and 2.5km wide at its upper reaches. The estuary is a very dynamic environment, with local hydrodynamics forming and influencing a range of estuarine features. The outer estuary is subject to a variable degree of exposure to currents and waves, with moderately exposed conditions predominant on the outer areas and more sheltered conditions towards the middle estuary. However, the upper estuary is characterised by a variable degree of exposure to currents, depending on location (Allen et al., 2003), (Hemingway et al., 2008), (ABP Marine Environmental Research Ltd (ABPmer), 2011). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal seagrass beds	Structure: non-native species and pathogens (habitat)	Restrict the introduction and spread of non-native species and pathogens, and their impacts.	N/A	Non-native species may become invasive and displace native organisms by preying on them or out-competing them for resources such as food, space or both. In some cases this has led to the loss of indigenous species from certain areas (Joint Nature Conservation Committee (JNCC), 2004). A pathogen causes disease or illness to its host. Pathogens include bacteria, viruses, protozoa and fungi (Biology-Online, 2021). Site-specifics: There are no known records of non-native invasive species or pathogens affecting the mudflats and sand flats feature within the Humber Estuary SAC. However, the Humber is considered to be at risk from non-native invasive due to the high levels of shipping in the estuary and an associated risk that invasive species could establish easily in the local habitat.(Pearce et al., 2012) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal mixed sediments	Structure: non-native species and pathogens (habitat)	Restrict the introduction and spread of non-native species and pathogens, and their impacts.	N/A	Non-native species may become invasive and displace native organisms by preying on them or out-competing them for resources such as food, space or both. In some cases this has led to the loss of indigenous species from certain areas (Joint Nature Conservation Committee (JNCC), 2004). A pathogen causes disease or illness to its host. Pathogens include bacteria, viruses, protozoa and fungi (Biology-Online, 2021). Site-specifics: There are no known records of non-native invasive species or pathogens affecting the mudflats and sand flats feature within the Humber Estuary SAC. However, the Humber is considered to be at risk from non-native invasive species due to the high levels of shipping in the estuary and an associated risk that invasive species could establish easily in the local habitat(Pearce et al., 2012). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal mud	Structure: non-native species and pathogens (habitat)	Restrict the introduction and spread of non-native species and pathogens, and their impacts.	N/A	Non-native species may become invasive and displace native organisms by preying on them or out-competing them for resources such as food, space or both. In some cases this has led to the loss of indigenous species from certain areas (Joint Nature Conservation Committee (JNCC), 2004). A pathogen causes disease or illness to its host. Pathogens include bacteria, viruses, protozoa and fungi (Biology-Online, 2021). Site-specifics: There are no known records of non-native invasive species or pathogens affecting the mudflats and sand flats feature within the Humber Estuary SAC. However, the Humber is considered to be at risk from non-native invasive species due to the high levels of shipping in the estuary and an associated risk that invasive species could establish easily in the local habitat (Pearce et al., 2012). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal sand and muddy sand	Structure: non-native species and pathogens (habitat)	Restrict the introduction and spread of non-native species and pathogens, and their impacts.	N/A	Non-native species may become invasive and displace native organisms by preying on them or out-competing them for resources such as food, space or both. In some cases this has led to the loss of indigenous species from certain areas (Joint Nature Conservation Committee (JNCC), 2004). A pathogen causes disease or illness to its host. Pathogens include bacteria, viruses, protozoa and fungi (Biology-Online, 2021). Site-specifics: There are no known records of non-native invasive species or pathogens affecting the mudflats and sand flats feature within the Humber Estuary SAC. However, the Humber is considered to be at risk from non-native invasive due to the high levels of shipping in the estuary and an associated risk that invasive species could establish easily in the local habitat.

				The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal coarse sediment	Structure: non-native species and pathogens (habitat)	Restrict the introduction and spread of non-native species and pathogens, and their impacts.	N/A	Non-native species may become invasive and displace native organisms by preying on them or out-competing them for resources such as food, space or both. In some cases this has led to the loss of indigenous species from certain areas (Joint Nature Conservation Committee (JNCC), 2004). A pathogen causes disease or illness to its host. Pathogens include bacteria, viruses, protozoa and fungi (Biology-Online, 2021). Site-specifics: There are no known records of non-native invasive species or pathogens affecting the Humber Estuary SAC (Pearce et al., 2012). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal sand	Structure: non-native species and pathogens (habitat)	Restrict the introduction and spread of non-native species and pathogens, and their impacts.	N/A	Non-native species may become invasive and displace native organisms by preying on them or out-competing them for resources such as food, space or both. In some cases this has led to the loss of indigenous species from certain areas (Joint Nature Conservation Committee (JNCC), 2004). A pathogen causes disease or illness to its host. Pathogens include bacteria, viruses, protozoa and fungi (Biology-Online, 2021). Site-specifics: There are no known records of non-native invasive species or pathogens affecting the Humber Estuary SAC. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal mud	Structure: non-native species and pathogens (habitat)	Restrict the introduction and spread of non-native species and pathogens, and their impacts.	N/A	Non-native species may become invasive and displace native organisms by preying on them or out-competing them for resources such as food, space or both. In some cases this has led to the loss of indigenous species from certain areas (Joint Nature Conservation Committee (JNCC), 2004). A pathogen causes disease or illness to its host. Pathogens include bacteria, viruses, protozoa and fungi (Biology-Online, 2021). Site-specifics: There are no known records of non-native invasive species or pathogens affecting the Humber Estuary SAC. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal mixed sediments	Structure: non-native species and pathogens (habitat)	Restrict the introduction and spread of non-native species and pathogens, and their impacts.	N/A	Non-native species may become invasive and displace native organisms by preying on them or out-competing them for resources such as food, space or both. In some cases this has led to the loss of indigenous species from certain areas (Joint Nature Conservation Committee (JNCC), 2004). A pathogen causes disease or illness to its host. Pathogens include bacteria, viruses, protozoa and fungi (Biology-Online, 2021). Site-specifics: There are no known records of non-native invasive species or pathogens affecting the Humber Estuary SAC. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Sandbanks which are slightly covered by sea water all the time	Structure: non-native species and pathogens (habitat)	Restrict the introduction and spread of non-native species and pathogens, and their impacts.	N/A	Non-native species may become invasive and displace native organisms by preying on them or out-competing them for resources such as food, space or both. In some cases this has led to the loss of indigenous species from certain areas (Joint Nature Conservation Committee (JNCC), 2004). A pathogen causes disease or illness to its host. Pathogens include bacteria, viruses, protozoa and fungi (Biology-Online, 2021). Site-specifics: There are no known records of non-native invasive species or pathogens affecting the subtidal sandbanks feature within the Humber Estuary SAC. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Estuaries	Structure: non-native species and pathogens (habitat)	Restrict the introduction and spread of non-native species and pathogens, and their impacts.	N/A	Non-native species may become invasive and displace native organisms by preying on them or out-competing them for resources such as food, space or both. In some cases this has led to the loss of indigenous species from certain areas (Joint Nature Conservation Committee (JNCC), 2004). A pathogen causes disease or illness to its host. Pathogens include bacteria, viruses, protozoa and fungi (Biology-Online, 2021). (Eno et al., 1997), (Royal Yacht Association (RYA) and British Marine Federation, 2010), (Connor et al., 2004) Site-specifics: There are no known records of non-native invasive species or pathogens affecting the Humber Estuary SAC. The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Mudflats and sandflats not covered by seawater at low tide	Structure: non-native species and pathogens (habitat)	Restrict the introduction and spread of non-native	N/A	Non-native species may become invasive and displace native organisms by preying on them or out-competing them for resources such as food, space or both. In some cases this has led to the loss of indigenous species from certain areas (Joint Nature Conservation Committee (JNCC), 2004). A pathogen causes disease or illness to its host. Pathogens include bacteria, viruses, protozoa and fungi (Biology-Online, 2021).

		pathogens, and their impacts.		Site-specifics: There are no known records of non-native invasive species or pathogens affecting the mudflats and sand flats feature within the Humber Estuary SAC. However, the Humber is considered to be at risk from non-native invasive due to the high levels of shipping in the estuary and an associated risk that invasive species could establish easily in the local habitat. (Franco et al., 2015), (Pearce et al., 2012) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Coastal lagoons	Structure: non-native species and pathogens (habitat)	Restrict the introduction and spread of non-native species and pathogens, and their impacts.	N/A	Non-native species may become invasive and displace native organisms by preying on them or out-competing them for resources such as food, space or both. In some cases this has led to the loss of indigenous species from certain areas (Joint Nature Conservation Committee (JNCC), 2004). A pathogen causes disease or illness to its host. Pathogens include bacteria, viruses, protozoa and fungi (Biology-Online, 2021). Site-specifics: There are no known records of non-native invasive species or pathogens affecting the coastal lagoon feature within the Humber Estuary SAC. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Grey seal (Halichoerus grypus)	Structure: Non-native species and pathogens (species)	Restrict the introduction and spread of non-native species and pathogens, and their impacts.	N/A	Non-native species may become invasive and displace native organisms by preying on them or out-competing them for resources such as food, space or both. In some cases this has led to the loss of indigenous species from certain areas (Joint Nature Conservation Committee (JNCC), 2004). A pathogen causes disease or illness to its host. Pathogens include bacteria, viruses, protozoa and fungi (Biology-Online, 2021). Site-specifics: Seal populations along the East Coast were affected by the Phocine Distemper Virus (PDV) epidemic in 1998 and 2002.). Figures show a small decrease in the rate of pup production following the epidemic however, colonies on the east coast of England continue to be monitored by the National Trust, Lincolnshire Trust for Natural History and Natural England. Numbers of pups born at these colonies continued to increase rapidly. Colonies in the southern North Sea increased by 10.5% between 2010 and 2012. Pup production at Donna Nook and East Anglia increased by 14.4% and those at the Farne Islands by 3.4% over the same period. (Special Committee on Seals (SCOS), 2012), (Special Committee on Seals (SCOS), 2014) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal seagrass beds	Structure: rhizome structure and reproduction	Restore the extent and structure of the rhizome mats across the site, and conditions to allow for regeneration of seagrass beds.	N/A	Zostera marina has the ability to reproduce via seed dispersal. Seeds are often apparent in the UK, although successful seed colonisation is rarely documented. Survey work has linked the colonisation of seeds to increased temperature (Koch, 2001), (Jackson et al., 2013). Colonisation could increase in the UK as temperatures rise. The majority of seagrass beds in the UK reproduce through the horizontal spread of a mat of rhizomes and roots. Leaves from Zostera species die back naturally in the winter and new shoots grow in the spring. If some shoots are lost during the summer they are likely to regrow the following year but if the rhizome mat is lost, recovery relies on its regrowth first. Seagrass is constantly regrowing, and to recover this growth should be at a rate that balances loss. The rate at which the seagrass (shoots, rhizome / roots) regrows varies from site to site, and can be hindered by other parameters. Recovery may occur within a season, or take years. There have been cases where growth has not occurred quickly enough to recover losses, leading to catastrophic losses of entire seagrass beds (Jackson et al., 2013). (Cleator, 1993), (Agustí et al., 1994) Site-specifics: Seagrass surveys are conducted annually by the YWT and NEIFCA within the area protected through the Humber Estuary Fishing Byelaw. This bylaw restricts activity within and around sea grass beds on the landward side of Spurn Point. Between 2013 and 2016 there has been an increase in Zostera extent in the bylaw area. The positive effects of this legal protection should be maintained to allow for ongoing regeneration and increase of extent of sea grass beds(Yorkshire Wildlife Trust, 2014). The target has been set as the subfeature is still in recovery. Rhizome matting is essential to this recovery and so is set to 'Restore' in line with the wider targets for the subfeature.
Coastal lagoons	Structure: sediment composition and distribution	Maintain the distribution of sediment composition across the feature (and each of its subfeatures), and input of fresh sediment to maintain the lagoon regime.	N/A	Sediment character is important in determining the biological communities present. The substrate types (hard and soft) and their distribution are important to the biodiversity of this complex feature. The sedimentary bed of the lagoon is normally a combination of the original sediment present prior to lagoon closure and the input of fine silts and clays brought into the lagoon subsequently. Commonly, the substrate is sand or gravel and will become progressively, but slowly, finer with time. The most common sedimentary substratum within UK lagoons is muddy-sand (WFD UKTAG, 2012), (Joint Nature Conservation Committee (JNCC), 2004). Site-specifics: At Humberston Fitties the sediment type is fine silts and mud, with more sand along the arms and rubble (mostly fragments of house bricks) in a narrow band of sediment in the areas bordering the track and car park. The rubble has led to a decreased depth of sediment. At Northcoates Lagoon the sediment type of both lagoons is muddy sa (Seaton, 2001), (Worsfold, 2001) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Mudflats and sandflats not	Structure: sediment	Maintain the distribution of	N/A	Sediment character is important in determining the biological communities present. Intertidal sediments (ranging from highly stable mudflats and saltmarshes, to highly mobile shingle and sand beaches) are subject to a range of

seawater at low tide	and distribution	composition across the feature.		so maintaining the sediment composition supports natural succession of the habitats and communities. Where they are subject to constant (net) erosion, the natural processes will be adversely affected (Gray and Elliott, 2009). Site-specifics: The intertidal sediment survey carried out for Natural England in 2014/15 shows that there does not appear to have been any significant changes in sediment composition and distribution based on comparisons with previous surveys. There is some indication that some areas may have become slightly more or less muddy, but this is likely due to natural estuarine dynamics and extreme meteorological events (E.g. the storm surge of 2013) affecting beach elevation and sediment type. (Franco et al., 2015); (Frost et al., 2010) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Sandbanks which are slightly covered by sea water all the time	Structure: sediment composition and distribution	Maintain the distribution of sediment composition across the feature.	N/A	Sediment character is important in determining the biological communities present. The distribution of sediment types across a sandbank changes naturally. This natural fluctuation should not be inhibited (Gray and Elliott, 2009). (Klein, 2006), (Elliott et al., 1998), (Cooper et al., 2011), (Burningham and French, 2009) Site-specifics: Results from the 2010 subtidal sediment survey show that the subtidal sandbank features are generally dominated by fine sand, with varying secondary components of medium sand. This information will be updated following the analysis of the subtidal sediment data gathered during the 2016 subtidal sediment survey. (ABPmer, 2008), (Pears et al., 2010) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal seagrass beds	Structure: sediment composition and distribution	Maintain the distribution of sediment composition types across the feature / subfeature.	N/A	Zostera can colonise a wide variety of sediments, from sheltered gravel to sand or mud (Joint Nature Conservation Committee (JNCC), 2014), (Den Hartog, 1977), (Cleator, 1993), but requires a substrate soft enough for rhizomes to elongate and fasten. The presence and character of each bed is driven by a complex relationship between the levels of exposure. Sediment composition is important in determining the biological communities supported by the seagrass. There is a relationship between seagrass density and sediment composition that can vary across the seagrass bed (eg core area, or peripheral areas), increasing the diversity of communities present. Seagrass relies on sediment but the seagrass rhizomes also help to bind sediment and prevent erosion. A change to sediment composition can result in a loss or change to seagrass distribution and character. The distribution of sediment composition types should be used to characterise the site to avoid the need for long-term sediment coring, which could be destructive to this sensitive habitat. Site-specifics: Within the Humber Estuary SAC intertidal seagrass beds have been identified on the sheltered area behind Spurn peninsula where sediment composition ranges from mud in the middle to lower shore to muddy sand towards the upper shore. Small clumps have been identified at Horseshoe Point on the south bank but are no longer thought to be extant and are not considered for this target due to a lack of evidence they have ever been established there. (Yorkshire Wildlife Trust, 2014),(Franco et al., 2015), (Yorkshire Wildlife Trust, 2013) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal coarse sediment	Structure: sediment composition and distribution	Maintain the distribution of sediment composition types across the feature.	N/A	Sediment character is important in determining the biological communities present (Gray and Elliott, 2009). Varied sediment type and grain size ensure structural complexity and connectivity. Site-specifics: Sediment composition and distribution is highly variable within the Humber Estuary. Towards the mouth of the estuary, the proportion of silt drops and is generally replaced by more coarse sediments, due to the increased mobility of the sediments. Grab samples indicated that coarse sediment in the waters off Immingham and Sunk Island is composed of gravelly sand. Allen et al., 2003 ABPmer, 2008 Coddington and Leighton, 2010 ABP Marine Environmental Research Ltd (ABPmer), 2011 Enviroment Agency (EA), 2016 The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal sand	Structure: sediment composition and distribution	Maintain the distribution of sediment composition types across the feature.	N/A	Sediment character is important in determining the biological communities present (Gray and Elliott, 2009). Varied sediment type and grain size ensure structural complexity and connectivity. Site-specifics: Results from the 2010 subtidal sediment survey showed that the estuary is generally dominated by fine sand, with varying secondary components of medium sand in the outer estuary and very fine sand in the inner and middle estuary. Initial results from the 2016 subtidal sediment survey also show that subtidal sand is distributed across the whole estuary. However, this information will be updated following the analysis of the subtidal sediment data gathered during the survey (Enviroment Agency (EA), 2016)

				are occurring / have occurred on the site.
Subtidal mud	Structure: sediment composition and distribution	Maintain the distribution of sediment composition types across the feature.	N/A	Sediment character is important in determining the biological communities present (Gray and Elliott, 2009). Varied sediment type and grain size ensure structural complexity and connectivity. Site-specifics: Subtidal mud has been repeatedly sampled off Grimsby, off Hull and in the mouth of the Trent at Trent Falls since 2010. Comparisons with previous grab surveys has showed that there has been little change in the distribution of sediments at the subfeature level (Enviroment Agency (EA), 2016);(Green, 2018) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal mixed sediments	Structure: sediment composition and distribution	Maintain the distribution of sediment composition types across the feature.	N/A	Sediment character is important in determining the biological communities present (Gray and Elliott, 2009). Varied sediment type and grain size ensure structural complexity and connectivity. Site-specifics: Muddy gravelly sands have been recorded in middle estuary, where the mud fraction range from 21% to 40%, the gravel content between 7% to 47% and the sand content between 31% to 72% (Coddington and Leighton, 2010). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal sand and muddy sand	Structure: sediment composition and distribution	Maintain the distribution of sediment composition types across the feature.	N/A	Sediment character is important in determining the biological communities present. Varied sediment type and grain size ensure structural complexity and connectivity. Intertidal sediments (ranging from highly stable mudflats and saltmarshes, to highly mobile shingle and sand beaches) are subject to a range of deposition and erosion processes, which human activity can influence. Most intertidal sediments stabilise over time so maintaining the sediment composition supports natural succession of the habitats and communities. Where they are subject to constant (net) erosion, the natural processes will be adversely affected (Gray and Elliott, 2009). Site-specifics: The intertidal sediment survey carried out in 2014/15 shows that there does not appear to have been any significant changes in sediment composition and distribution based on comparisons with previous surveys. There is some indication that some areas may have become slightly more or less muddy, but this is likely be due natural estuarine dynamics and extreme meteorological events (e.g. the storm surge of 2013) affecting beach elevation and sediment type(Franco et al., 2015),(Frost et al., 2010). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal mud	Structure: sediment composition and distribution	Maintain the distribution of sediment composition types across the feature.	N/A	Sediment character is important in determining the biological communities present. Varied sediment type and grain size ensure structural complexity and connectivity. Intertidal sediments (ranging from highly stable mudflats and saltmarshes, to highly mobile shingle and sand beaches) are subject to a range of deposition and erosion processes, which human activity can influence. Most intertidal sediments stabilise over time so maintaining the sediment composition supports natural succession of the habitats and communities. Where they are subject to constant (net) erosion, the natural processes will be adversely affected (Gray and Elliott, 2009). Site-specifics: The intertidal sediment survey carried out in 2014/2015 indicates that there does not appear to have been any significant changes in sediment composition and distribution based on comparisons with previous surveys. There is some indication that some areas may have become slightly more or less muddy, but this is likely be due natural estuarine dynamics and extreme meteorological events (E.g. the storm surge of 2013) affecting beach elevation and sediment type(Franco et al., 2015)'(Frost et al., 2010). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal mixed sediments	Structure: sediment composition and distribution	Maintain the distribution of sediment composition types across the feature.	N/A	Sediment character is important in determining the biological communities present. Varied sediment type and grain size ensure structural complexity and connectivity. Intertidal sediments (ranging from highly stable mudflats and saltmarshes, to highly mobile shingle and sand beaches) are subject to a range of deposition and erosion processes, which human activity can influence. Most intertidal sediments stabilise over time so maintaining the sediment composition supports natural succession of the habitats and communities. Where they are subject to constant (net) erosion, the natural processes will be adversely affected (Gray and Elliott, 2009). Site-specifics: The intertidal sediment survey carried out in 2014/15 shows that there does not appear to have been any significant changes in sediment composition and distribution based on comparisons with previous surveys. There is some indication that some areas may have become slightly more or less muddy, but this is likely be due natural estuarine dynamics and extreme meteorological events (E.g. the storm surge of 2013) affecting beach elevation and sediment type. (Franco et al., 2015),(Frost et al., 2010). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Estuaries	Structure: sediment movement, sources and sinks	Maintain the sediment regime and budget within the estuary,	N/A	Sediment movement, sources and sinks within, and interacting with, an estuary are important to maintaining a healthy estuarine system and sediment budget. This includes sediment inputs to an estuary from rivers, coastal and marine sources, and the movement of sediment to and from the subtidal to the intertidal. If the sediment budget or sediment movement is restricted this can cause the decline and erosion, or change, of habitats. A shift in the sediment budget from morphological equilibrium would indicate a decline or an adverse negative impact (Joint

		sediment sources, sinks and movement.		(Environment Agency (EA), 2009). Site-specifics: Sediment enters the Humber Estuary from three main pathways: the North Sea; the Holderness coastline; and from fluvial sources. However, it is suspected that almost all the non-cohesive sediment entering the Humber is derived from the erosion of the Holderness cliffs and nearshore seabed (Wilson, 2010) A net southward longshore drift supplies sediment to the mouth of the estuary where it is then re-distributed within the estuarine system. Sediment supply and transport processes are an important physical characteristic of the Humber Estuary and are essential to the morphological and ecological functioning of the estuary. The estuary supports a large area of subtidal and intertidal habitats ranging from gravels and sands, to muddy sands and mud, reflecting varying degrees of exposure to waves, currents and inflowing rivers. (Allen et al., 2003), (Hemingway et al., 2008) ,(ABPmer, 2008) (Wilson, 2010), (ABP Marine Environmental Research Ltd (ABPmer), 2011) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal mud	Structure: sediment total organic carbon content	Maintain total organic carbon (TOC) content in the sediment at existing levels.	N/A	Total Organic Carbon (TOC) content can be used for measuring change in the organic input to the mudflat / sandflat. TOC content of the sediment can influence community structure and contaminant levels (Viaroli et al., 2004). Site-specifics: The organic content of the sediment ranged from 1.9% to 2.8% which can be considered low(Franco et al., 2015). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal sand and muddy sand	Structure: sediment total organic carbon content	Maintain total organic carbon (TOC) content in the sediment at existing levels.	N/A	Total Organic Carbon (TOC) content can be used for measuring change in the organic input to the mudflat / sandflat. TOC content of the sediment can influence community structure and contaminant levels (Viaroli et al., 2004). Site-specifics: The organic content of the sediment ranged from 1.9% to 2.8% which can be considered low. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal mixed sediments	Structure: sediment total organic carbon content	Maintain total organic carbon (TOC) content in the sediment at existing levels.	N/A	Total Organic Carbon (TOC) content can be used for measuring change in the organic input to the mudflat / sandflat. TOC content of the sediment can influence community structure and contaminant levels (Viaroli et al., 2004). Site-specifics: The organic content of the sediment ranged from 1.9% to 2.8% which can be considered low(Franco et al., 2015). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Mudflats and sandflats not covered by seawater at low tide	Structure: sediment total organic carbon content	Maintain total organic carbon (TOC) content in the sediment at existing levels.	N/A	Total Organic Carbon (TOC) content can be used for measuring change in the organic input to the mudflat / sandflat. TOC content of the sediment can influence community structure and contaminant levels (Viaroli et al., 2004). Site-specifics: The organic content of the sediment ranged from 1.9% to 2.8% which can be considered low. (Franco et al., 2015) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Coastal lagoons	Structure: species composition of component communities	Maintain the species composition of component communities.	N/A	Species composition of communities includes a consideration of both the overall range of species present within the community, as well as their relative abundance. Species considered need not be restricted to sessile benthic species but could include mobile species associated with the benthos. Species composition could be altered by human activities without changing the overall community type. Within each component community, species composition and population structure should be taken into consideration to avoid diminishing biodiversity and affecting ecosystem functioning within the habitat (Joint Nature Conservation Committee (JNCC), 2004). It is the presence of a small number of individual species of lagoon specialists that is important in lagoons. The change of just one species may be significant if it's a lagoon specialist. There are some unique communities in lagoons such as communities of submerged vascular plants that support the specialist species. Site-specifics: Humberston Fitties has exhibited a high diversity of brackish water species including the marsh samphire *Salicornia* species and semi-natural species including *Gammarus insensibilis, Ventrosia ventrosa, Conopeum seurati, Idotea chelipes, Corophium insidiosum, Ruppia maritima* and *Chaetomorpha linum.* The species at Northcoates Point A include *Gammarus chevreuxi* which is present at only a few lagoon sites in the UK as well as *Idotea chelipes, Ventrosia ventrosa, Hydrobia acuta* and *Ruppia cirrhosa.* The species at Northcoates Point B include *Idotea chelipes* and *Ventrosia ventrosa* (Allen et al., 2003). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.

Mudflats and sandflats not covered by seawater at low tide	Structure: species composition of component communities	Maintain the species composition of component communities.	N/A	Species composition of communities includes a consideration of both the overall range of species present within the community, as well as their relative abundance. Species considered need not be restricted to sessile benthic species but could include mobile species associated with the benthos. Species composition could be altered by human activities without changing the overall community type. Within each component community, species composition and population structure should be taken into consideration to avoid diminishing biodiversity and affecting ecosystem functioning within the habitat (Joint Nature Conservation Committee (JNCC), 2004). The sediment community composition will change when the habitat is subjected to pollutants and other forms of disturbance (Joint Nature Conservation Committee (JNCC), 2004), but will also be subject to significant natural variation annually. Benthic invertebrate communities are a good indicator of the health of the feature, if assessed over time. Site-specifics: The IQI score is 0.80 for mudflat and 0.83 for sandflat habitats, giving a WFD classification of 'High' indicating excellent condition. The 2014/15 survey noted an increase in abundance but no significant change in composition on the north bank, compared to 2009. This was due to large number of *Peringia ulvae* being present in the 2014/15 sample. This could be a result of the naturally patchy nature of benthic distribution and *P. ulvae* is not a negative indicator. Overall, the composition and abundance levels of component communities are currently at an acceptable level. (Franco et al., 2015);(Frost et al., 2010) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal seagrass beds	Structure: species composition of component communities	Maintain the species composition of component communities.	N/A	Species composition of communities includes a consideration of both the overall range of species present within the community, as well as their relative abundance. Species considered need not be restricted to sessile benthic species but could include mobile species associated with the benthos. Species composition could be altered by human activities without changing the overall community type. Within each component community, species composition and population structure should be taken into consideration to avoid diminishing biodiversity and affecting ecosystem functioning within the habitat (Joint Nature Conservation Committee (JNCC), 2004). (Joint Nature Conservation Committee (JNCC), 2004) Site-specifics: There is no survey data currently available for this subfeature. There is no species composition data available for this subfeature so the target has been set with low confidence
Intertidal mud	Structure: species composition of component communities	Maintain the species composition of component communities.	N/A	Species composition of communities includes a consideration of both the overall range of species present within the community, as well as their relative abundance. Species considered need not be restricted to sessile benthic species but could include mobile species associated with the benthos. Species composition could be altered by human activities without changing the overall community type. Within each component community, species composition and population structure should be taken into consideration to avoid diminishing biodiversity and affecting ecosystem functioning within the habitat (Joint Nature Conservation Committee (JNCC), 2004). The sediment community composition will change when the habitat is subjected to pollutants and other forms of disturbance (Joint Nature Conservation Committee (JNCC), 2004), but will also be subject to significant natural variation annually. Benthic invertebrate communities are a good indicator of the health of the feature, if assessed over time. Site-specifics: The IQI score is 0.80 for mudflat and 0.83 for sandflat habitats in the Humber, giving a WFD classification of 'High' indicating excellent condition. Overall, the composition and abundance levels of component communities of the intertidal mud subfeature are currently at an acceptable level(Environment Agency, 2014). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal sand and muddy sand	Structure: species composition of component communities	Maintain the species composition of component communities.	N/A	Species composition of communities includes a consideration of both the overall range of species present within the community, as well as their relative abundance. Species considered need not be restricted to sessile benthic species but could include mobile species associated with the benthos. Species composition could be altered by human activities without changing the overall community type. Within each component community, species composition and population structure should be taken into consideration to avoid diminishing biodiversity and affecting ecosystem functioning within the habitat (Joint Nature Conservation Committee (JNCC), 2004). The sediment community composition will change when the habitat is subjected to pollutants and other forms of disturbance (Joint Nature Conservation Committee (JNCC), 2004), but will also be subject to significant natural variation annually. Benthic invertebrate communities are a good indicator of the health of the feature, if assessed over time. Site-specifics: The IQI score is 0.80 for mudflat and 0.83 for sandflat habitats in the Humber, giving a WFD classification of 'High' indicating excellent condition. Sand and muddy sand communities on the Humber show normal species composition and abundance levels(Environment Agency, 2014). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.

sediments	species composition of component communities	species composition of component communities.		Species composition of communities includes a consideration of both the overall range of species present within the community, as well as their relative abundance. Species considered need not be restricted to sessile benthic species but could include mobile species associated with the benthos. Species composition could be altered by human activities without changing the overall community type. Within each component community, species composition and population structure should be taken into consideration to avoid diminishing biodiversity and affecting ecosystem functioning within the habitat (Joint Nature Conservation Committee (JNCC), 2004). The sediment community composition will change when the habitat is subjected to pollutants and other forms of disturbance (Joint Nature Conservation Committee (JNCC), 2004), but will also be subject to significant natural variation annually. Benthic invertebrate communities are a good indicator of the health of the feature, if assessed over time. Site-specifics: The IQI score is 0.80 for mudflat and 0.83 for sandflat habitats in the Humber, giving a WFD classification of 'High' indicating excellent condition. For the Mixed sediment subfeature the 2014 intertidal sediment survey specifically described the main area of LS.Mx as 'impoverished'. However, there are no known issues or anthropogenic impacts in this area and it could be considered that the 'impoverished' state of the habitat is a natural one(Franco et al., 2015). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Estuaries	Structure: species composition of component communities	Maintain the species composition of component communities.	N/A	Species composition of communities includes a consideration of both the overall range of species present within the community, as well as their relative abundance. Species considered need not be restricted to sessile benthic species but could include mobile species associated with the benthos. Species composition could be altered by human activities without changing the overall community type. Within each component community, species composition and population structure should be taken into consideration to avoid diminishing biodiversity and affecting ecosystem functioning within the habitat (Joint Nature Conservation Committee (JNCC), 2004). (Joint Nature Conservation Committee (JNCC), 2004), (Davies et al., 2001), (Dyer, 1997), (Hiscock et al., 2006), (Environment Agency (EA), 2011), (Davidson and Buck, 1997) Site-specifics: For further information on the component communities present within the estuary please refer to the corresponding sub-features supporting notes. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Sandbanks which are slightly covered by sea water all the time	Structure: species composition of component communities	Maintain the species composition of component communities.	N/A	Species composition of communities includes a consideration of both the overall range of species present within the community, as well as their relative abundance. Species considered need not be restricted to sessile benthic species but could include mobile species associated with the benthos. Species composition could be altered by human activities without changing the overall community type. Within each component community, species composition and population structure should be taken into consideration to avoid diminishing biodiversity and affecting ecosystem functioning within the habitat (Joint Nature Conservation Committee (JNCC), 2004). The sediment community composition will change when the habitat is subjected to pollutants and other forms of disturbance (Joint Nature Conservation Committee (JNCC), 2004), but will also be subject to significant natural variation annually. Benthic invertebrate communities are a good indicator of the health of the feature, if assessed over time. Site-specifics: The 2010 subtidal survey observed that impoverished communities were present across the sandbank features. Benthic data show that species present include nematodes *N. hombergii* and the polychaete *C. capitata*. These represent opportunistic species characteristic of high stress environments, which is likely to be a direct result of the highly mobile nature of the sandbank features (ABPmer, 2008), (Pears et al., 2010) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal mixed sediments	Structure: species composition of component communities	Maintain the species composition of component communities.	N/A	Species composition of communities includes a consideration of both the overall range of species present within the community, as well as their relative abundance. Species considered need not be restricted to sessile benthic species but could include mobile species associated with the benthos. Species composition could be altered by human activities without changing the overall community type. Within each component community, species composition and population structure should be taken into consideration to avoid diminishing biodiversity and affecting ecosystem functioning within the habitat (Joint Nature Conservation Committee (JNCC), 2004). The sediment community composition will change when the habitat is subjected to pollutants and other forms of disturbance (Joint Nature Conservation Committee (JNCC), 2004), but will also be subject to significant natural variation annually. Benthic invertebrate communities are a good indicator of the health of the feature, if assessed over time. Site-specifics: There is limited evidence on species composition of component communities for subtidal mixed sediment communities within the Humber Estuary. This attribute will be updated once evidence is available from forthcoming surveys. The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Subtidal mud	Structure: species	Maintain the species	N/A	Species composition of communities includes a consideration of both the overall range of species present within the

	composition of component communities	composition of component communities.		but could include mobile species associated with the benthos. Species composition could be altered by human activities without changing the overall community type. Within each component community, species composition and population structure should be taken into consideration to avoid diminishing biodiversity and affecting ecosystem functioning within the habitat (Joint Nature Conservation Committee (JNCC), 2004). The sediment community composition will change when the habitat is subjected to pollutants and other forms of disturbance (Joint Nature Conservation Committee (JNCC), 2004), but will also be subject to significant natural variation annually. Benthic invertebrate communities are a good indicator of the health of the feature, if assessed over time. --- Site-specifics: Humber subtidal sediments were surveyed in 2016. The following subtidal mud communities were identified: SS.SSa.CMuSa.AalbNuc - (A5.261) Abra alba and Nucula nitidosa in circalittoral muddy sand or slightly mixed sediment. SS.SMu.SMuVS.PolCvol - (A5.321) Polydora ciliata and Corophium volutator in variable salinity infralittoral firm mud or clay. Found at a single station (4) just north of Middle Bank. SS.SMu.SMuVS.AphTubi – (A.5322) Aphelochaeta marioni and Tubificoides spp. in variable salinity infralittoral mud. SS.SMu.SMuVS.NhomTubi - (A5.323) Nephtys hombergii and Tubificoides spp. in variable salinity infralittoral soft mud. SS.SMu.SMuVS.MoMu (A.5324) - Infralittoral fluid mobile mud. These are low-richness samples found in very low-energy waters between Immingham and Hull. SS.SMu.SMuVS.CapTubi - (A5.325) Capitella capitata and Tubificoides spp. in reduced salinity infralittoral muddy sediment. This is an indicator of organic enrichment, and was found at a single station (21) east of Hull. SS.SMu.SMuVS.OlVS (A5.326) Oligochaetes in variable or reduced salinity infralittoral muddy sediment. This biotope can also be an indicator of organic enrichment, and was found at a single station (25) off Immingham (Green, 2018) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal sand	Structure: species composition of component communities	Maintain the species composition of component communities.	N/A	Species composition of communities includes a consideration of both the overall range of species present within the community, as well as their relative abundance. Species considered need not be restricted to sessile benthic species but could include mobile species associated with the benthos. Species composition could be altered by human activities without changing the overall community type. Within each component community, species composition and population structure should be taken into consideration to avoid diminishing biodiversity and affecting ecosystem functioning within the habitat (Joint Nature Conservation Committee (JNCC), 2004). The sediment community composition will change when the habitat is subjected to pollutants and other forms of disturbance (Joint Nature Conservation Committee (JNCC), 2004), but will also be subject to significant natural variation annually. Benthic invertebrate communities are a good indicator of the health of the feature, if assessed over time. --- Site-specifics: Humber subtidal sediments were surveyed in 2016. The following subtidal sand communities were identified: A single biotope covered all the samples found in the upper Humber –SS.SSa.SSaVS.MoSaVS (A5.211, Infralittoral mobile sand in variable salinity (estuaries)), characterised by a very high abundance of salinity-tolerant copepods and juvenile gammarid amphipods in fluid sand. The middle Humber was also characterised by this biotope at 18 of the 25 stations sampled. The remaining 7 stations were characterised as the brackish SS.SSa.SSaVS.NintGam (A5.213, Neomysis integer and Gammarus spp. in fluctuating low salinity infralittoral mobile sand), containing brackish/freshwater species such as the amphipod Neomysis and the duckweed Lemna. Only two species-poor biotopes, indicative of high physical disturbance, were found in samples collected from the two subtidal sandbank areas: SS.SSa.IFiSa.IMoSa (A5.231) - Infralittoral mobile clean sand with sparse fauna. SS.SSa.IFiSa.NcirBat (A5.233) - Nephtys cirrosa and Bathyporeia spp. in infralittoral sand. (Green, 2018) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal coarse sediment	Structure: species composition of component communities	Maintain the species composition of component communities.	N/A	Species composition of communities includes a consideration of both the overall range of species present within the community, as well as their relative abundance. Species considered need not be restricted to sessile benthic species but could include mobile species associated with the benthos. Species composition could be altered by human activities without changing the overall community type. Within each component community, species composition and population structure should be taken into consideration to avoid diminishing biodiversity and affecting ecosystem functioning within the habitat (Joint Nature Conservation Committee (JNCC), 2004). The sediment community composition will change when the habitat is subjected to pollutants and other forms of disturbance (Joint Nature Conservation Committee (JNCC), 2004), but will also be subject to significant natural variation annually. Benthic invertebrate communities are a good indicator of the health of the feature, if assessed over time. --- Site-specifics: Subtidal coarse sediment has only been recorded in single samples in the Humber SAC and was not recorded in the latest grab survey. For this reason meaningful community composition data is not currently available for this subfeature (Green, 2018) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.

Coastal lagoons	Structure: structure and integrity of lagoon banks	Maintain the presence and structure of the banks of the lagoon so that they maintain the extent and integrity of the lagoon.	N/A	The surrounding banks of the lagoon need to be maintained in a natural and functional state. Reduction / disintegration of the lagoon bank would result in a loss of water, and the supported and structural subtidal habitat, or reduced isolation / division from adjacent freshwater sources. Site-specifics: At Humberston Fitties the lagoon banks are robust enough to ensure that the lagoon itself can persist as an isolated lagoon with only spring tides being high enough to overtop the sand dune banks that are found on the north-east side. Northcoates Lagoon is almost entirely surrounded by saltmarsh apart from the channel system into which seawater enters at high tide, the morphology of which is likely to be influenced by the sea wall to the south. (Seaton, 2001), (Worsfold, 2001) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Estuaries	Structure: substrate composition and distribution	Maintain the distribution, composition and character of substrate across the feature (and each of its subfeatures).	N/A	The substrate types (hard and soft) and their distribution are important to the biodiversity of this complex feature. Substrate character is instrumental in determining the biological communities present within the estuary. Some estuaries also include geological or geomorphological features of interests and so substrates associated with these should also be considered (Joint Nature Conservation Committee (JNCC), 2004), (Davies et al., 2001), (Dyer, 1997), (Hiscock et al., 2006), (Environment Agency (EA), 2011), (Defra, 2005). The existing distribution should be used where no historical data is available to provide a baseline (ie in an assessment, a survey would have to be undertaken first to establish the existing composition and distribution). Site-specifics: Within the Humber Estuary coarser sediments are found at the mouth and channel beds. In the inner estuary the sediments are usually finer, along with the banks in the slower parts of the channels. A survey of the intertidal sediments was conducted in 2014 and mapped the habitat distribution within the site (Franco et al., 2015). An assessment of particle size analysis with the Humber estuary showed the majority of samples within the site had a high proportion of sand (Pears et al., 2010),(Enviroment Agency (EA), 2016). For more information on the distribution, composition and character of substrate across the feature please see the identified sub-features of estuaries (Allen et al., 2003), (Pears et al., 2010), (Franco et al., 2015), (ABP Marine Environmental Research Ltd (ABPmer), 2011), (Enviroment Agency (EA), 2016). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Estuaries	Structure: tidal regime	Maintain the tidal range, currents and circulation patterns across the feature (and each of its subfeatures).	N/A	Tidal regime is considered an essential structural component of estuaries. Changes in tidal energy can result in changes to habitat composition / distribution. Tidal range is the vertical height difference between high and low water (Joint Nature Conservation Committee (JNCC), 2004), (Davies et al., 2001), (Hiscock et al., 2006), (Environment Agency (EA), 2011). Site-specifics: The Humber Estuary is macro-tidal, with a mean spring tidal range of 5.7m at Spurn, increasing to 7.4m at Saltend and then decreasing to 6.9m at Hessle (45km inland), near the Humber Bridge. Tides are semi-diurnal and tidal amplification occurs as far as Blacktoft on spring tides and Brough on neaps, with a variation of 2.5m between neap and spring high water levels (Allen et al., 2003), (Hemingway et al., 2008), (ABP Marine Environmental Research Ltd (ABPmer), 2011) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Estuaries	Structure: topography	Maintain the characteristic physical form (eg coastal plain, bar built, ria, complex), topographic features of the estuary and the overall topography on which the morphology relies.	N/A	Topography is considered an essential structural component of estuaries. Changes in topography, eg altering the slope of the shore, will change the exposure / extent of habitats (lower intertidal may become shallow subtidal). Some estuaries have been chosen for designation because they are representative of particular types of estuaries within Europe. Altering an estuary's topography will alter its behaviour and morphology (Joint Nature Conservation Committee (JNCC), 2004), (Davies et al., 2001), (Hiscock et al., 2006), (Environment Agency (EA), 2011), (Defra, 2005), (Manning, 2012), (Davidson and Buck, 1997), (Townend, 2005), (Townend and Wright, 2005). (Environment Agency (EA), 2009), (Channel Coastal Observatory (CCO), 2013) Site-specifics: The Environment Agency (Geomatics) undertook a study of changes in elevation within the Humber Estuary between 2001 and 2010, which showed areas of erosion and accretion (Environment Agency (EA), 2010). The coastal and estuarine processes around the estuary are particularly dynamic in nature. There are fast-flowing currents, shifting sands and shallow waves, and the bathymetric/topographic charts of the estuary are constantly changing (Environment Agency (EA), 2010), (Allen et al., 2003), (ABP Marine Environmental Research Ltd (ABPmer), 2011). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Mudflats and sandflats not covered by seawater at low tide	Structure: topography	Maintain the presence of topographic features, while allowing for natural responses to hydrodynamic regime, by	N/A	Topography is considered an essential structural component for this feature. Alterations in topography can cause changes in the slope angle of the foreshore or result in increases or decreases in surface elevation. Topographic changes can alter the way the sediment drains and holds water, and can also alter the tidal exposure, meaning areas can be covered by the tide for longer or shorter periods. This can influence the animal and plant communities supported (Gray and Elliott, 2009) and reduce the areas available to coastal birds for feeding. Such changes could occur through direct interaction, such as sand extraction, or indirect impacts, such as changes in wave height or tidal flow regime, which cause erosion or deposition (Elliott et al., 1998). Site-specifics:

		erosion or deposition through human-induced activity.		The Environment Agency (Geomatics) undertook a study of changes in elevation within the Humber Estuary between 2001 and 2010, which showed areas of erosion and accretion. The intertidal sediment survey carried out in 2009 and 2014/15 also noted that some transects showed signs of sediment accretion, for example on the north bank of the middle estuary off Cherry Cobb This was confirmed by the encroaching saltmarsh vegetation. Other transects showed signs of erosion. The coastal and estuarine processes around the estuary are particularly dynamic in nature. There are fast-flowing currents, shifting sands and shallow waves, and the bathymetric charts of the estuary are constantly changing. (Franco et al., 2015);(Frost et al., 2010);(ABPMer, 2008);(Franco et al., 2015);(Frost et al., 2010) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Sandbanks which are slightly covered by sea water all the time	Structure: topography	Maintain the presence of topographic features, while allowing for natural responses to hydrodynamic regime, by preventing erosion or deposition through human-induced activity.	N/A	Topography is considered an essential structural component for this feature. Sandbanks often have distinctive topographic characteristics such as bank crests, slopes and troughs. The shape, appearance and dimensions of these vary from sandbank to sandbank and reflect the processes that both created and maintain them in the present day (Dyer and Huntley, 1999). Topographic structures such as sandbank crests, troughs and mega-ripples, support different sediment types and associated communities (Elliott et al., 1998). Site-specifics: The Humber Estuary has a macro-tidal range, fast flows and a high background sediment content, which means the bed of the estuary, is very dynamic in its morphology. This dynamism means that the sandbank features are not stable and their profiles vary in height and extent by many metres on an annual basis. (ABPmer, 2008) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal mud	Structure: topography	Maintain the presence of topographic features, while allowing for natural responses to hydrodynamic regime, by preventing erosion or deposition through human-induced activity.	N/A	Topography is considered an essential structural component for this feature. Alterations in topography can cause changes in the slope angle of the foreshore or result in increases or decreases in surface elevation. Topographic changes can alter the way the sediment drains and holds water, and can also alter the tidal exposure, meaning areas can be covered by the tide for longer or shorter periods. This can influence the animal and plant communities supported (Gray and Elliott, 2009) and reduce the areas available to coastal birds for feeding. Such changes could occur through direct interaction, such as sand extraction, or indirect impacts, such as changes in wave height or tidal flow regime, which cause erosion or deposition (Elliott et al., 1998). Site-specifics: The Environment Agency (Geomatics) undertook a study of changes in elevation within the Humber Estuary between 2001 and 2010, which showed areas of erosion and accretion. The intertidal sediment survey carried out in 2009 and 2014 also noted that some transects showed signs of sediment accretion, for example on the North Bank of the Middle Estuary off Cherry Cobb This was confirmed by the encroaching saltmarsh vegetation. Other transects showed signs of erosion(ABPMer, 2008). The coastal and estuarine processes around the estuary are particularly dynamic in nature. There are fast-flowing currents, shifting sands and shallow waves, and the bathymetric charts of the estuary are constantly changing. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal sand and muddy sand	Structure: topography	Maintain the presence of topographic features, while allowing for natural responses to hydrodynamic regime, by preventing erosion or deposition through human-induced activity.	N/A	Topography is considered an essential structural component for this feature. Alterations in topography can cause changes in the slope angle of the foreshore or result in increases or decreases in surface elevation. Topographic changes can alter the way the sediment drains and holds water, and can also alter the tidal exposure, meaning areas can be covered by the tide for longer or shorter periods. This can influence the animal and plant communities supported (Gray and Elliott, 2009) and reduce the areas available to coastal birds for feeding. Such changes could occur through direct interaction, such as sand extraction, or indirect impacts, such as changes in wave height or tidal flow regime, which cause erosion or deposition (Elliott et al., 1998). Site-specifics: The Environment Agency (Geomatics) undertook a study of changes in elevation within the Humber Estuary between 2001 and 2010, which showed areas of erosion and accretion. The intertidal sediment survey carried out in 2009 and 2014/15 also noted at some transects showed signs of sediment accretion, for example on the north bank of the middle estuary off Cherry Cobb. This was confirmed by the encroaching saltmarsh vegetation. Other transects showed signs of erosion(ABPMer, 2008),(Franco et al., 2015),(Frost et al., 2010) The coastal and estuarine processes around the estuary are particularly dynamic in nature. There are fast-flowing currents, shifting sands and shallow wares, and the bathymetric charts of the estuary are constantly changing. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal mixed sediments	Structure: topography	Maintain the presence of topographic features, while allowing for natural responses to hydrodynamic regime, by preventing	N/A	Topography is considered an essential structural component for this feature. Alterations in topography can cause changes in the slope angle of the foreshore or result in increases or decreases in surface elevation. Topographic changes can alter the way the sediment drains and holds water, and can also alter the tidal exposure, meaning areas are covered by the tide for longer or shorter periods. This can influence the animal and plant communities supported (Gray and Elliott, 2009) and reduce the areas available to coastal birds for feeding. Such changes could occur through direct interaction, such as sand extraction, or indirect impacts, such as changes in wave height or tidal flow regime, which cause erosion or deposition (Elliott et al., 1998). Site-specifics:

		deposition through human-induced activity.		2001 and 2010, which showed areas of erosion and accretion. The intertidal sediment survey carried out in 2009 and 2014 also noted at some transects showed signs of sediment accretion, for example on the North Bank of the Middle Estuary off Cherry Cobb This was confirmed by the encroaching saltmarsh vegetation. Other transects showed signs of erosion. The coastal and estuarine processes around the estuary are particularly dynamic in nature. There are fast-flowing currents, shifting sands and shallow waves, and the bathymetric charts of the estuary are constantly changing. (ABPMer, 2008);(Franco et al., 2015);(Frost et al., 2010) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Sandbanks which are slightly covered by sea water all the time	Structure: volume	Maintain the existing (where no previous evidence exists) or best-known (where some evidence exists) volume of sediment in the sandbank, allowing for natural change.	N/A	Sandbanks can strongly influence the behaviour of tidal currents and wave conditions in the surrounding environment. A significant reduction in the volume of a sandbank would indicate large-scale structural or morphological changes. Such changes in the sandbank would affect how it influences wave and tidal conditions in the surrounding environment, which in turn could affect physical and biological conditions such as grain size distribution and exposure levels. (Klein, 2006), (Elliott et al., 1998), (Cooper et al., 2011), (Burningham and French, 2009), (Dyer and Huntley, 1999) Site-specifics: The Humber Estuary has a macro-tidal range, fast flows and a high background sediment content, which means the bed of the estuary is very dynamic in its morphology. This dynamism means that the sandbank features are not stable and their profiles vary in height and extent by many metres on an annual basis. (ABPmer, 2008) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Estuaries	Structure: water density	Maintain the natural water density or gradient across the feature (and each of its subfeatures).	N/A	Water density is influenced by temperature and salinity and is an essential structural component of an estuary and its water column. Density gradients are important in determining the stratification and character of an estuary (Joint Nature Conservation Committee (JNCC), 2004), (Davies et al., 2001), (Dyer, 1997), (Hiscock et al., 2006), (Environment Agency (EA), 2011), (Knauss, 1997). Site-specifics: The Humber is a well-mixed estuary due to high tidal flow speeds which cause almost total mixing of the saline water moving into the estuary with freshwater from the Rivers Ouse, Derwent and Trent. There is a strong longitudinal salinity gradient up the estuary with an average salinity of 30 at Spurn, reducing to a salinity of 5 at Trent Falls. The Environment Agency hold more detailed data on physico-chemi properties (Allen et al., 2003), (Hemingway et al., 2008), (ABP Marine Environmental Research Ltd (ABPmer), 2011) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Coastal lagoons	Structure: water depth	Maintain the natural shallow water depth to enable photosynthesis, which allows lagoon specialist species to survive.	N/A	Water depth will vary from the middle to the edges of a lagoon as well as temporally. Water depth in a lagoon needs to be shallow enough to allow photosynthesis to take place but also deep enough to submerge plants and provide optimal habitat for lagoon animals (Joint Nature Conservation Committee (JNCC), 2004). Changes in water depth may be due to natural processes (ie sedimentation). One metre is suggested as the minimum depth. Site-specifics: The water depth at both Humberston Fitties and Northcoates Lagoon decreases throughout the summer. At Humberston Fitties the RSPB Tetney Marshes Reserve records indicate a peak depth of around 50cm. At Northcoates Lagoon the lagoons occasionally dry out completely in the late summer, although the channel system that provides the in-flow of seawater from the estuary is deeper and usually retains water throughout the summer.(Seaton, 2001), (Worsfold, 2001), (English Nature, 2003), (Royal Society for the Proctection of Birds (RSPB), 2017) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Grey seal (Halichoerus grypus)	Supporting habitat: extent and distribution	Maintain the extent and spatial distribution of the following supporting habitats: haulout sites.	N/A	The extent of supporting habitats captures the presence and area of the habitats that the species relies on. The distribution of supporting habitat will partially govern the distribution of the species, and maintaining or recovering the distribution of supporting habitats will help ensure the stability of this species. Supporting habitats may not be limited to those described in the target. Seals feed in the water column over a variety of habitats, including sediments and rock. They may use different foraging areas at different times of the year to target seasonal prey. Seals may have a number of preferred haulout areas for pupping, nursing or resting, which helps reduce competition for space. (Joint Nature Conservation Committee (JNCC), 2005) Site-specifics: Within the Humber SAC there is only one haul out site which is located at Donna Nook. It is used throughout the year as a haulout site and breeding occurs here once a year for winter breeding. Lincolnshire Wildlife Trust have produced a site specific pup distribution map. This shows the three main pupping areas known as “Range” ,”Dunes” and “Skidbrook Ridge”. The dynamic nature of the estuary is constrained by coastal squeeze along almost its entire length, restricting the natural development of intertidal mudflats and sand flats. The EA monitor coastal squeeze on the Humber. At this point the intertidal area is monitored but not split in to the subfeatures presented in the rest of this advice. The Humber Flood Risk Management Strate(FRMS) HRA predicts a total loss of habitat across the estuary of 286ha by 2056, a large percentage of this is likely to be mudflat and sand flats. This was modelled in 2008 and will be reviewed as part of the comprehensive review of the Humber FRMS, scheduled for completion in 2020 (Berry et al.

				2009) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
River lamprey (Lampetra fluviatilis)	Supporting habitat: extent and distribution	Maintain the extent and spatial distribution of the following supporting habitats: water column.	N/A	The extent of supporting habitats captures the presence and area of the habitats that the species relies on. The distribution of supporting habitat will partially govern the distribution of the species, and maintaining or recovering the distribution of supporting habitats will help ensure the stability of this species. Supporting habitats may not be limited to those described in the target. Lamprey use estuaries as part of their migration. A reduction in the amount or quality of habitat within the estuary could reduce the diversity and viability of fish populations upon which both lamprey species feed. Site-specifics: The supporting habitats for river lamprey include the Humber Estuary itself, which is used as a migratory corridor for both upstream and downstream migration, and can also be used as a feeding ground for adult river lamprey. Other supporting habitats, and potentially more important areas for key lifecycle stages, lie outside of the Humber Estuary in the freshwaters rivers including the Ouse, Nidd, Wharfe, Swale, Derwent, Trent and Ure. These rivers, and potentially others in the catchment, provide suitable habitats for spawning and larval development. In order for river lamprey to successfully migrate between freshwater and the estuary, the extent of the water column should be maintained. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Sea lamprey (Petromyzon marinus)	Supporting habitat: extent and distribution	Maintain the extent and spatial distribution of the following supporting habitats: water column.	N/A	The extent of supporting habitats captures the presence and area of the habitats that the species relies on. The distribution of supporting habitat will partially govern the distribution of the species, and maintaining or recovering the distribution of supporting habitats will help ensure the stability of this species. Supporting habitats may not be limited to those described in the target. Lamprey use estuaries as part of their migration. A reduction in the amount or quality of habitat within the estuary could reduce the diversity and viability of fish populations upon which both lamprey species feed. Site-specifics: It is difficult and expensive to monitor the presence and spatial distribution of sea lamprey in the Humber Estuary itself and therefore targets are set using evidence gathered from freshwater spawning habitats. Sea lamprey spawning sites are widely distributed across the Ouse catchment with lamprey redds recorded on major river tributaries including the river Ure, Swale, Wharfe and Nidd. The availability of spawning habitat depends on biological influences including water levels, flows and sediment rates. Sea lamprey presence is very low compared to river lamprey. A spawning survey carried out in 2011 recorded only 1 sea lamprey on the river Ure with no sightings or redds identified on any of the other major rivers. A sea lamprey tagging survey carried out in 2015 caught 45 sea lamprey downstream of Naburn weir on the River Ure, although none were recorded upstream at the spawning sites. The lack of data for sea lamprey presence and spatial distribution makes it difficult to conclude with an accurate target. A 'Maintain' target has been used due to ongoing sea lamprey work which is being undertaken in collaboration with key partners and stakeholders. A 5-year spawning study commissioned by the Environment Agency will report in early 2017, alongside another tagging survey. Once the data from these surveys have been assessed the target may be updated and amended if necessary. (The Bellflask Ecological Survey Team, 2011), (Bubb, 2015) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Sea lamprey (Petromyzon marinus)	Supporting habitat: food availability (species)	Maintain the abundance of preferred food items required by the species.	N/A	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival, and the overall sustainability of the population. Inappropriate management and direct or indirect impacts that affect the distribution, abundance and availability of food items may adversely affect the population. Sea lampreys feed semi-parasitically by attaching to the body of a fish from which they suck blood. Sea lamprey feed on large fish including sharks, adult shad and salmon. It seems likely that the abundance of sea lamprey in British waters may be linked to the abundance of suitable prey, in particular shad and salmon (Henderson, 2003). The re-establishment of large migratory populations of these species in the rivers of a region will almost certainly aid the re-establishment of large sea lamprey populations (Henderson, 2003). Lampreys seem to feed on a wide variety of marine and migratory fishes, including sturgeon, herring, salmon, cod and haddock. Salmon and sea trout entering rivers often bear fresh scars attributable to attacks by lampreys (Maitland, 2003). Site-specifics: Whilst in the ammocoete stage, lamprey feed on microorganisms found in the silt. The food source includes diatoms, algae, protozoans and detritus. After metamorphosis, and the downstream migration to the sea, the adults feed on a wide variety of marine and anadramous fish. These include sturgeon (*Acipenser sturio*), herring (*Clupea harengus*), salmon (*Salmo salar*), cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*). (The Bellflask Ecological Survey Team, 2012), (Maitland, 2003) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
River lamprey (Lampetra fluviatilis)	Supporting habitat: food availability (species)	Maintain the abundance of preferred food items required by the species.	N/A	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival, and the overall sustainability of the population. Inappropriate management and direct or indirect impacts that affect the distribution, abundance and availability of food items may adversely affect the population. River lampreys feed in estuaries and coastal waters for 1-2 year before migrating upstream into fresh water to spawn, whereas sea lampreys will venture out into the open sea (Henderson, 2003). (Maitland, 2003). Adults feed semi-parasitically during

				plaice, dab, flounder, salmon and sea trout. The available evidence suggests that river lamprey are highly adaptable in their feeding and behaviour, and will live and feed in estuaries for extended periods (Henderson, 2003). The prey of lamprey is likely to vary seasonally with availability. An analysis of the size of scales in the intestines of lampreys of various body lengths indicates that there is a relationship between the size of host and predator (Maitland, 2003). The presence of adequate fish stocks within the estuary is essential for maintaining lamprey population levels. Site-specifics: Whilst in the ammocoete stage, lamprey feed on micro-organisms found in the silt. The food source includes diatoms, algae, protozoans and detritus. After metamorphosis, young river lampreys feed on fish in estuaries and the sea. They feed on a variety of fish species, but particularly herring (*Clupea harengus*), sprat (*Sprattus sprattus*) and flounder (*Platichthys flesus*). (The Bellflask Ecological Survey Team, 2012), (Maitland, 2003) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Grey seal (Halichoerus grypus)	Supporting habitat: food availability (species)	Maintain the cover / abundance of preferred food items required by the species.	N/A	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. Inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of food items may adversely affect the population. Removal of target and non-target prey species has the potential to impact seal populations and their distribution and damage habitats essential to prey species. Preferred prey species need to be considered, as feeding on sub-optimal prey species may impact fitness and abundance (Joint Nature Conservation Committee (JNCC), 2005). Site-specifics: Foraging grounds are usually characterised by gravel/sand seabed sediment which is the preferred habitat of their sandeel prey. Grey seals are predominantly fish feeders and take a variety of species including sandeels *Anguilla Anguilla*, gadoids, salmonids, and flatfish (order Pleuronectiformes), although cephalopod and crustacean invertebrates are occasionally consumed. Dietary composition varies seasonally and is linked to the availability of prey species. The subtidal area also provides an important breeding, sheltering and nursery area for fish species. It is a major spawning area for the Dover sole *Solea solea* and is also used as a nursery area for fish such as plaice. Food requirements depend on the size of the seal and fat content (oiliness) of the prey, but an average consumption estimate is 4 to 7 kg per seal per day depending on the prey species (Allen et al., 2003), (Special Committee on Seals (SCOS), 2013) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Embryonic shifting dunes	Supporting processes: adaptation and resilience (habitat)	Restore the feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either within or external to the site.	N/A	This attribute and target has been included to recognise the increasing likelihood of natural habitat features to absorb or adapt to wider environmental changes. Resilience may be described as the ability of an ecological system to cope with, and adapt to environmental stress and change while retaining the same basic structure and ways of functioning. Such environmental changes may include changes in sea levels, precipitation and temperature, which are likely to affect the extent, distribution, composition and functioning of a feature within a site. The vulnerability and response of features to such changes will vary. Using best available information, any necessary or likely adaptation or adjustment by the feature and its management in response to actual or expected climatic change should be allowed for, as far as practicable, in order to ensure the feature's long-term viability. (Natural England and RSPB, 2014), (European Commission, 2013), (Natural England, 2009) The overall vulnerability of this particular site to climate change has been assessed by Natural England, taking into account the sensitivity, fragmentation, topography and management of its habitats/supporting habitats (Natural England (NE), 2015). This means that action to address specific issues is likely, such as reducing habitat fragmentation, creating more habitat to buffer the site, expanding the habitat into more varied landscapes and/or addressing particular management and condition issues. Individual species may be more or less vulnerable than their habitat itself. In many cases, change will be inevitable so further site assessment and appropriate monitoring may be needed. Site-specifics: Field observations of the sand dune features on the Humber suggest that that this feature may be in decline, restricting its ability to adapt to change. For this reason a precautionary approach has been adopted and a 'Restore' target has been set until appropriate management measures can be identified. A survey of the feature has been commissioned and this advice may be updated after the publication of a sand dune monitoring report, expected in autumn 2020. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Shifting dunes along the shoreline with Ammophila arenaria (“White dunes”)	Supporting processes: adaptation and resilience (habitat)	Restore the feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either within or external to the site.	N/A	This attribute and target has been included to recognise the increasing likelihood of natural habitat features to absorb or adapt to wider environmental changes. Resilience may be described as the ability of an ecological system to cope with, and adapt to environmental stress and change while retaining the same basic structure and ways of functioning. Such environmental changes may include changes in sea levels, precipitation and temperature, which are likely to affect the extent, distribution, composition and functioning of a feature within a site. The vulnerability and response of features to such changes will vary. Using best available information, any necessary or likely adaptation or adjustment by the feature and its management in response to actual or expected climatic change should be allowed for, as far as practicable, in order to ensure the feature's long-term viability. (Natural England and RSPB, 2014), (European Commission, 2013), (Natural England, 2009) The overall vulnerability of this particular site to climate change has been assessed by Natural England, taking into account the sensitivity, fragmentation, topography and management of its habitats/supporting habitats (Natural England (NE), 2015). This means that action to address specific issues is likely, such as reducing habitat fragmentation, creating more habitat to buffer the site, expanding the habitat into more varied landscapes and/or addressing particular management and condition issues. Individual species may be more or less vulnerable than their habitat itself. In many cases, change will be inevitable so further site assessment and appropriate monitoring may be needed. Site-specifics:

				Field observations of the sand dune features on the Humber suggest that that this feature may be in decline, restricting its ability to adapt to change. For this reason a precautionary approach has been adopted and a 'Restore' target has been set until appropriate management measures can be identified. A survey of the feature has been commissioned and this advice may be updated after the publication of a sand dune monitoring report, expected in autumn 2020.
Fixed dunes with herbaceous vegetation ("Grey dunes")	Supporting processes: adaptation and resilience (habitat)	Restore the feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either within or external to the site.	N/A	This attribute and target has been included to recognise the increasing likelihood of natural habitat features to absorb or adapt to wider environmental changes. Resilience may be described as the ability of an ecological system to cope with, and adapt to, environmental stress and change while retaining the same basic structure and ways of functioning. Such environmental changes may include changes in sea levels, precipitation and temperature, which are likely to affect the extent, distribution, composition and functioning of a feature within a site. The vulnerability and response of features to such changes will vary. Using best available information, any necessary or likely adaptation or adjustment by the feature and its management, in response to actual or expected climatic change, should be allowed for, as far as practicable, in order to ensure the feature's long-term viability. (Natural England and RSPB, 2014), (European Commission, 2013), (Natural England, 2009) The overall vulnerability of this particular site to climate change has been assessed by Natural England, taking into account the sensitivity, fragmentation, topography and management of its habitats/supporting habitats (Natural England (NE), 2015). This means that action to address specific issues is likely, such as reducing habitat fragmentation, creating more habitat to buffer the site, expanding the habitat into more varied landscapes and/or addressing particular management and condition issues. Individual species may be more or less vulnerable than their habitat itself. In many cases, change will be inevitable so further site assessment and appropriate monitoring may be needed. Site-specifics: Field observations of the sand dune features on the Humber suggest that that this feature may be in decline, restricting its ability to adapt to change. For this reason a precautionary approach has been adopted and a 'Restore' target has been set until appropriate management measures can be identified. A survey of the feature has been commissioned and this advice may be updated after the publication of a sand dune monitoring report, expected in autumn 2020. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	Supporting processes: adaptation and resilience (habitat)	Restore the feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either within or external to the site.	N/A	This attribute and target has been included to recognise the increasing likelihood of natural habitat features to absorb or adapt to wider environmental changes. Resilience may be described as the ability of an ecological system to cope with, and adapt to, environmental stress and change while retaining the same basic structure and ways of functioning. Such environmental changes may include changes in sea levels, precipitation and temperature, which are likely to affect the extent, distribution, composition and functioning of a feature within a site. The vulnerability and response of features to such changes will vary. Using best available information, any necessary or likely adaptation or adjustment by the feature and its management in response to actual or expected climatic change should be allowed for, as far as practicable, in order to ensure the feature's long-term viability.(European Commission, 2013),(Natural England, 2009) The overall vulnerability of this particular site to climate change has been assessed by Natural England, taking into account the sensitivity, fragmentation, topography and management of its habitats/supporting habitats (Natural England (NE), 2015). This means that action to address specific issues is likely, such as reducing habitat fragmentation, creating more habitat to buffer the site, expanding the habitat into more varied landscapes and/or addressing particular management and condition issues. Individual species may be more or less vulnerable than their habitat itself. In many cases, change will be inevitable so further site assessment and appropriate monitoring may be needed. Site-specifics: Saltmarsh within the Humber estuary is at a risk to loss of extent due to coastal squeeze, whereby intertidal habitats are trapped by artificial structures e.g. sea defences and rising sea levels. The EA monitor coastal squeeze on the Humber.The Humber Flood Risk Management Strate(HFRMS) HRA predicts that approximately 300ha of intertidal habitat will be lost to coastal squeeze by 2056 and a percentage of this will likely be saltmarsh. This was modelled in 2008; the HFRMS is currently being reviewed, with conclusions expected by 2021, after which time the advice is likely to change. The EA have a number of existing and planned managed realignments sites on the Humber to compensate the loss of intertidal habitat and allow for the natural migration of intertidal habitats.Examples of these are at Alkborough, Paull Holme Strays and Donna Nook, with more sites planned in future. (English Nature, 2003), (Enviroment Agency (EA), 2011) The target has been set as restore based on the loss of habitat due to coastal flood defences and commercial developments.
Salicornia and other annuals colonising mud and sand	Supporting processes: adaptation and resilience (habitat)	Restore the feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either within or external to the site.	N/A	This attribute and target has been included to recognise the increasing likelihood of natural habitat features to absorb or adapt to wider environmental changes. Resilience may be described as the ability of an ecological system to cope with, and adapt to environmental stress and change while retaining the same basic structure and ways of functioning. Such environmental changes may include changes in sea levels, precipitation and temperature, which are likely to affect the extent, distribution, composition and functioning of a feature within a site. The vulnerability and response of features to such changes will vary. Using best available information, any necessary or likely adaptation or adjustment by the feature and its management in response to actual or expected climatic change should be allowed for, as far as practicable, in order to ensure the feature's long-term viability. (Natural England and RSPB, 2014), (European Commission, 2013), (Natural England, 2009) The overall vulnerability of this particular site to climate change has been assessed by Natural England, taking into account the sensitivity, fragmentation, topography and management of its habitats/supporting habitats (Natural England (NE), 2015). This means that action to address specific issues is likely, such as reducing habitat fragmentation, creating more habitat to buffer the site, expanding the habitat into more varied landscapes and/or addressing particular management and condition issues. Individual species may be more or less vulnerable than their habitat itself. In many cases, change will be inevitable so further site assessment and appropriate monitoring may be needed. Site-specifics: Intertidal habitat within the Humber estuary is at a high exposure to loss of extent due to coastal squeeze, whereby intertidal habitats are trapped by artificial structures i.e. sea defences and rising sea levels. The EA monitor coastal squeeze on the Humber and the current understanding is that loss of intertidal habitat due to coastal squeeze is

				The Humber Flood Risk Management Strategy HRA predicts that approximately 300ha of intertidal habitat will be lost to coastal squeeze by 2056; this was modelled in 2008 and will be reviewed in 2017. This could have an impact on the colonisation of annual species. The EA have a number of existing and planned managed realignments sites on the Humber to offset the loss of intertidal habitat and allow for the natural migration of intertidal habitats. (Enviroment Agency (EA), 2011) The target has been set as restore due to the loss of habitat to coastal flood defences and commercial developments.
Shifting dunes along the shoreline with Ammophila arenaria (“White dunes”)	Supporting processes: aeolian (wind-blown) processes	Maintain the ability of wind-blow processes to transport sand from the beach plain to the foredune.	N/A	Allowing natural wind-blow (or 'aeolian') processes to shape the topography of this habitat feature is important to its long-term conservation. The beach plain needs to be dry to allow sand to be transported into the dune system. Site-specifics: Field observations of the sand dune features on the Humber suggest that this feature, where it exists,is not restricted by barrier to wind blown processes. For this reason a 'Maintain' target has been set for this attribute. A survey of the feature has been commissioned and this advice may be updated after the publication of a sand dune monitoring report, expected in autumn 2020. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Fixed dunes with herbaceous vegetation (“Grey dunes”)	Supporting processes: aeolian (wind-blown) processes	Maintain the ability of wind-blow processes to transport sand from the beach plain to the foredune.	N/A	Allowing natural wind-blow (or 'aeolian') processes to shape the topography of this habitat feature is important to its long-term conservation. The beach plain needs to be dry to allow sand to be transported into the dune system. Site-specifics: Field observations of the sand dune features on the Humber suggest that this feature, where it exists, does not suffer from restricted wind-blown processes. For this reason a 'Maintain' target has been set for this attribute. A survey of the feature has been commissioned and this advice may be updated after the publication of a sand dune monitoring report, expected in autumn 2020. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Dunes with Hippophae rhamnoides	Supporting processes: aeolian (wind-blown) processes	Maintain the natural movement of sand within the site, resulting from wind blow-outs and blow-throughs.	N/A	Allowing natural wind-blow (or 'aeolian') processes to operate and to allow active movement of dry sand is important. Too much stabilised sand will encourage development of the scrub habitat at the expense of open dune habitat. Site-specifics: Detailed site specific information on this attribute will be available after the publication of the 2019 sand dune report. This report is expected in autumn 2020. The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Embryonic shifting dunes	Supporting processes: aeolian (wind-blown) processes	Maintain the natural movement of sand within the site, resulting from wind blow-outs and blow-throughs.	N/A	Allowing natural wind-blow (or 'aeolian') processes to operate and to allow active movement of dry sand is important. Blow-throughs are a natural element of the dynamics of this zone. However, excessive recreational pressure can inhibit vegetation growth in sand-building phases. Site-specifics: Field observations of the sand dune features on the Humber suggest that this feature, where it exists,is not restricted by barriers to wind-blown processes. For this reason a 'Maintain' target has been set for this attribute. A survey of the feature has been commissioned and this advice may be updated after the publication of a sand dune monitoring report, expected in autumn 2020. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Salicornia and other annuals colonising mud and sand	Supporting processes: air quality (habitat)	Maintain concentrations and deposition of air pollutants at below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System	N/A	This target has been included because this habitat type is considered sensitive to changes in air quality. Exceedance of these critical values for air pollutants may modify the chemical status of its substrate, accelerating or damaging plant growth, altering its vegetation structure and composition and causing the loss of sensitive typical species associated with it. Critical Loads and Levels are recognised thresholds below which such harmful effects on sensitive UK habitats will not occur to a significant level, according to current levels of scientific understanding. There are critical levels for ammonia (NH_3), oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as halogens, heavy metals, persistent organic pollutants (POPs), volatile organic compounds (VOCs) or dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. More information about site-relevant Critical Loads and Levels for this site is available by using the ‘search by site’ tool on the Air Pollution Information System (Centre for Ecology & Hydrology (CEH), 2014). It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. Site-specifics: Average nitrogen levels has been recorded at 15.62 kg N/ha/yr which is under the maximum critical load level for this feature, hence the target to maintain air pollution at current levels. However, maximum nitrogen deposition levels has been recorded 25.1 kg N/ha/yr which is within the critical load level for this site (20-30 kg N/ha/yr) indicating that the feature is already at risk of being affected by increases in N levels.

				'search by site' tool on the Air Pollution Information System (www.apis.ac.uk). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	Supporting processes: air quality (habitat)	Maintain concentrations and deposition of air pollutants to below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System	N/A	This target has been included because this habitat type is considered sensitive to changes in air quality. Exceedance of these critical values for air pollutants may modify the chemical status of its substrate, accelerating or damaging plant growth, altering its vegetation structure and composition and causing the loss of sensitive typical species associated with it. Critical Loads and Levels are recognised thresholds below which such harmful effects on sensitive UK habitats will not occur to a significant level, according to current levels of scientific understanding. There are critical levels for ammonia (NH_3), oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as halogens, heavy metals, persistent organic pollutants (POPs), volatile organic compounds (VOCs) or dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant, but flux-based critical levels for the protection of semi-natural habitats are still under development. > More information about site-relevant Critical Loads and Levels for this site is available by using the 'search by site' tool on the Air Pollution Information System (Centre for Ecology & Hydrology (CEH), 2014). It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. Site-specifics: Average nitrogen levels have been recorded at 15.62 kg N/ha/yr which is under the maximum critical load level for this feature, hence the target to maintain air pollution at current levels. However, maximum nitrogen deposition level has been recorded 25.1 kg N/ha/yr which is within the critical load level for this site (20-30 kgN/ha/yr), indicating that the feature is already at risk of being affected by increases in N levels. More information about site-relevant Critical Loads and Levels for the Humber Estuary SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Shifting dunes along the shoreline with Ammophila arenaria ("White dunes")	Supporting processes: air quality (habitat)	Restore concentrations and deposition of air pollutants to below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System	N/A	This target has been included because this habitat type is considered sensitive to changes in air quality. Exceedance of these critical values for air pollutants may modify the chemical status of its substrate, accelerating or damaging plant growth, altering its vegetation structure and composition and causing the loss of sensitive typical species associated with it. Critical Loads and Levels are recognised thresholds below which such harmful effects on sensitive UK habitats will not occur to a significant level, according to current levels of scientific understanding. There are critical levels for ammonia (NH_3), oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as halogens, heavy metals, persistent organic pollutants (POPs), volatile organic compounds (VOCs) or dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. > More information about site-relevant Critical Loads and Levels for this site is available by using the 'search by site' tool on the Air Pollution Information System (Centre for Ecology & Hydrology (CEH), 2014). It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. (UK Research on Eutrophication and Acidification of Terrestrial Ecosystems (UKREATE), 2008), (Jones et al., 2002), (Jones et al., 2002), (Emmett et al., 2011), (Bobbink and Hettelingh, 2011), (UR and Natura 2000 Programme Directorate of Ministry of Economic Affairs, 2012), (Whitfield and McIntosh, 2014), (Jones et al., 2004), (Jones et al., 2009) Site-specifics: The target is set as 'Restore' based on current information on the Air Pollution Information System (APIS - accessed 24/06/19) which indicates that nitrogen deposition levels are beyond the critical load range for this habitat. Please refer to the website (APIS) for further information and details. Data provided by APIS indicated that the Humber SAC area is well in excess of the critical load levels for this feature.
Dunes with Hippophae rhamnoides	Supporting processes: air quality (habitat)	Restore concentrations and deposition of air pollutants to below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System	N/A	This target has been included because this habitat type is considered sensitive to changes in air quality. Exceedance of these critical values for air pollutants may modify the chemical status of its substrate, accelerating or damaging plant growth, altering its vegetation structure and composition, and causing the loss of sensitive typical species associated with it. Critical Loads and Levels are recognised thresholds below which such harmful effects on sensitive UK habitats will not occur to a significant level, according to current levels of scientific understanding. There are critical levels for ammonia (NH_3), oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as halogens, heavy metals, persistent organic pollutants (POPs), volatile organic compounds (VOCs) or dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. More information about site-relevant Critical Loads and Levels for this site is available by using the 'search by site' tool on the Air Pollution Information System (Centre for Ecology & Hydrology (CEH), 2014). It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. Site-specifics: The target is set as 'Restore' based on current information on the Air Pollution Information System (APIS - accessed 24/06/19) which indicates that nitrogen deposition levels are beyond the critical load range for this habitat. Please refer to the website (APIS) for further information and details.
Fixed dunes with herbaceous vegetation ("Grey dunes")	Supporting processes: air quality (habitat)	Restore concentrations and deposition of air pollutants to below the site-	N/A	This target has been included because this habitat type is considered sensitive to changes in air quality. Exceedance of these critical values for air pollutants may modify the chemical status of its substrate, accelerating or damaging plant growth, altering its vegetation structure and composition, and causing the loss of sensitive typical species associated with it. Critical Loads and Levels are recognised thresholds below which such harmful effects on sensitive UK habitats will not occur to a significant level, according to current levels of scientific understanding. There are critical levels for ammonia (NH_3), oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), and critical loads for nutrient

		Load or Level values given for this feature of the site on the Air Pollution Information System.		halogens, heavy metals, persistent organic pollutants (POPs), volatile organic compounds (VOCs) or dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. More information about site-relevant Critical Loads and Levels for this site is available by using the 'search by site' tool on the Air Pollution Information System (Centre for Ecology & Hydrology (CEH), 2014). It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. Site-specifics: The target is set as 'Restore' based on current information on the Air Pollution Information System (APIS - accessed 24/06/19) which indicates that nitrogen deposition levels are beyond the critical load range for this habitat. Please refer to the website (APIS) for further information and details. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Embryonic shifting dunes	Supporting processes: air quality (habitat)	Restore concentrations and deposition of air pollutants to below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System.	N/A	This target has been included because this habitat type is considered sensitive to changes in air quality. Exceedance of these critical values for air pollutants may modify the chemical status of its substrate, accelerating or damaging plant growth, altering its vegetation structure and composition and causing the loss of sensitive typical species associated with it. Critical Loads and Levels are recognised thresholds below which such harmful effects on sensitive UK habitats will not occur to a significant level, according to current levels of scientific understanding. There are critical levels for ammonia (NH_3), oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as halogens, heavy metals, persistent organic pollutants (POPs), volatile organic compounds (VOCs) or dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. > More information about site-relevant Critical Loads and Levels for this site is available by using the 'search by site' tool on the Air Pollution Information System (Centre for Ecology & Hydrology (CEH), 2014). It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. (Plassmann, 2009), (UK Research on Eutrophication and Acidification of Terrestrial Ecosystems (UKREATE), 2008), (Jones et al., 2002), (Jones et al., 2002), (Emmett et al., 2011), (Bobbink and Hettelingh, 2011), (UR and Natura 2000 Programme Directorate of Ministry of Economic Affairs, 2012), (Whitfield and McIntosh, 2014), (Jones et al., 2004) Site-specifics: The target is set as 'Restore' based on current information on the Air Pollution Information System (APIS - accessed 24/06/19) which indicates that nitrogen deposition levels are beyond the critical load range for this habitat. Please refer to the website (APIS) for further information and details.
Embryonic shifting dunes	Supporting processes: conservation measures (habitat)		N/A	This target has been included because active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and / or management agreements. For this feature, direct habitat and species management is not expected to take place in this zone. However, excessive recreational activity can be damaging and may well need to be managed. Site-specifics: Detailed site specific information on this attribute will be available after the publication of the 2019 sand dune report. This report is expected in autumn 2020.
Fixed dunes with herbaceous vegetation ("Grey dunes")	Supporting processes: conservation measures (habitat)	At a site, unit and / or catchment level (as necessary, maintain natural hydrological processes to provide the conditions necessary to sustain the feature within the site.	N/A	This target has been included because active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and / or management agreements. For this feature: Reduce nutrient levels to maintain high numbers of species through the management activities of grazing, burning, mowing, sod-cutting and scrub cutting. The reworking of sand through cultivation or sand-drift may help to conserve the dynamic habitat. Management of succession is a critical aspect of management for this habitat, by a combination of active processes and grazing / cutting. A range of invertebrates and plants require bare sand where it is not too frequently disturbed by vehicles or feet. Where damage initiates a blow-out, this can be a +ve outcome in over-stabilised dunes, where sea defence concerns or critical infrastructure are not compromised. Site-specifics: Detailed site specific information on this attribute will be available after the publication of the 2019 sand dune report. This report is expected in autumn 2020. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Dunes with Hippophae rhamnoides	Supporting processes: conservation measures (habitat)	Maintain the management measures (either within and / or outside the site boundary as appropriate) that are necessary to maintain the	N/A	This target has been included because active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and / or management agreements. Site-specifics: This feature is managed in some areas of the SAC by various conservation organisations. An example of this is the RSPB management of *Rosa rugosa* at Tetney Marshes.

		functions and supporting processes associated with the feature.		The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	Supporting processes: conservation measures (habitat)	Maintain the management measures (either within and / or outside the site boundary as appropriate) that are necessary to maintain / restore the structure, functions and supporting processes associated with the feature.	N/A	This target has been included because active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and / or management agreements. Site-specifics: There are a range of saltmarsh conservation measures ongoing at sites across the Humber estuary. These include targeted grazing, vegetation management, access restriction/management , infrastructure management, among others, and may vary in location as well as seasonally. Please consult a Natural England Area Adviser for the latest information on conservation measures taking place. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Salicornia and other annuals colonising mud and sand	Supporting processes: conservation measures (habitat)	Maintain the management measures (either within and / or outside the site boundary as appropriate) that are necessary to maintain the structure, functions and supporting processes associated with the feature.	N/A	This target has been included because active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and / or management agreements. Site-specifics: There are a range of conservation measures ongoing at sites across the Humber estuary. These include grazing, vegetation management, access restriction/management , infrastructure management, among others, and may vary in location as well as seasonally. Please consult a Natural England Area Adviser for the latest information on conservation measures taking place. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Shifting dunes along the shoreline with Ammophila arenaria (“White dunes”)	Supporting processes: conservation measures (habitat)	Maintain the management measures within the site boundary that are necessary to restore the feature.	N/A	This target has been included because active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and / or management agreements. Management should consider the structures on and functions of the site as a whole. Management measures specifically aimed at maintaining and enhancing the features for which they are designated, and to address some of the pressures and future threats. Site-specifics: Detailed site specific information on this attribute will be available after the publication of the 2019 sand dune report. This report is expected in autumn 2020. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Mudflats and sandflats not covered by seawater at low tide	Supporting processes: energy / exposure	Maintain the natural physical energy resulting from waves, tides and other water flows, so that the exposure does not cause alteration to the biotopes and stability, across the habitat.	N/A	The amount of energy received across the site significantly affects the communities present. Physical energy can be received through wave energy and / or tidal flow, and can be altered through human activity. Any such alterations to energy should be avoided (Hiscock et al., 2006). Ambient energy levels related to wave and tidal action influence the amount of physical disturbance experienced by seabed sediments. Physically stable or immobile sediments often support different animal and plant communities when compared with mobile or disturbed sediments (Gray and Elliott, 2009). Therefore, understanding the site's baseline conditions is very importance. However, due to the complexity of measuring the energy and disturbance levels of an area, it's unlikely that a quantifiable objective could be determined. Site-specifics: The Humber Estuary is a dynamic environment, with local hydrodynamics forming and influencing a range of estuarine features. The outer estuary is subject to a variable degree of exposure to currents and waves, with moderately exposed conditions predominant on the outer areas and more sheltered conditions towards the middle estuary. The inner estuary is characterised by a variable degree of exposure to currents, depending on location.(Allen et al., 2003) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Sandbanks which are slightly covered by sea water all the time	Supporting processes: energy / exposure	Maintain the natural physical energy resulting from waves, tides and other water flows, so that the exposure does not cause alteration to the biotopes	N/A	The amount of energy received across the site significantly affects the communities present. Physical energy can be received through wave energy and / or tidal flow, and can be altered through human activity. Any such alterations to energy should be avoided (Hiscock et al., 2006). Energy levels are a major controlling factor in sandbank habitats. Thus determining baselines, developing tolerance levels and quantifiable objectives are very important. However, there is some uncertainty over how this objective could be developed and is an area of continuing research. It's likely that energy levels and exposure will be indicated by the biotope and community compositions of the site. The energy levels required to support the feature will vary depending on the type of sandbank. (Klein, 2006), (Elliott et al., 1998), (Cooper et al., 2011), (Burningham and French, 2009), (Kenyon and Cooper, 2005), (Gray and Elliott, 2009) Site-specifics: The Humber Estuary is a dynamic environment, with local hydrodynamics forming and influencing a range of

		across the habitat.		estuarine features. The effect of wave energy on the estuarine system is largely restricted to the outer estuary, both in terms of offshore propagation, and those locally generated. However, Spurn peninsula, the long sand and shingle spit that extends out across the mouth of the estuary, provides some shelter from waves from the north-east. As you move towards the middle of the estuary wave action generally reduces due to the meandering of the tidal channels, waves refracting and energy losses due to shallow water effects. The Humber estuary is also characterised by strong tidal currents. The ebb velocities in the outer estuary are *circa* 20% higher than those on the flood. Morphological measures of the tidal asymmetry suggest the estuary has become more flood dominant particularly up estuary of the Humber Bridge over the last 150 years. (Allen et al., 2003), (Wilson, 2010), (ABP Marine Environmental Research Ltd (ABPmer), 2011) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal mixed sediments	Supporting processes: energy / exposure	Maintain the natural physical energy resulting from waves, tides and other water flows, so that the exposure does not cause alteration to the biotopes and stability, across the habitat.	N/A	The amount of energy received across the site significantly affects the communities present. Physical energy can be received through wave energy and / or tidal flow, and can be altered through human activity. Any such alterations to energy should be avoided (Hiscock et al., 2006). Ambient energy levels related to wave and tidal action influence the amount of physical disturbance experienced by seabed sediments. Physically stable or immobile sediments often support different animal and plant communities when compared with mobile or disturbed sediments (Gray and Elliott, 2009). Therefore, understanding the site's baseline conditions is very importance. However, due to the complexity of measuring the energy and disturbance levels of an area, it's unlikely that a quantifiable objective could be determined. Site-specifics: The Humber Estuary is a dynamic environment, with local hydrodynamics forming and influencing a range of estuarine features. The effect of wave energy on the estuarine system is largely restricted to the outer estuary, both in terms of offshore propagation, and those locally generated. However, Spurn peninsula, the long sand and shingle spit that extends out across the mouth of the estuary, provides some shelter from waves from the north-east. Towards the middle of the estuary wave action generally reduces due to the meandering of the tidal channels, waves refracting and energy losses due to shallow water effects. The Humber estuary is also characterised by strong tidal currents. The ebb velocities in the outer estuary are *circa* 20% higher than those on the flood. Morphological measures of the tidal asymmetry suggest the estuary has become more flood dominant particularly up estuary of the Humber Bridge over the last 150 years . The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal sand	Supporting processes: energy / exposure	Maintain the natural physical energy resulting from waves, tides and other water flows, so that the exposure does not cause alteration to the biotopes and stability, across the habitat.	N/A	The amount of energy received across the site significantly affects the communities present. Physical energy can be received through wave energy and / or tidal flow, and can be altered through human activity. Any such alterations to energy should be avoided (Hiscock et al., 2006). Ambient energy levels related to wave and tidal action influence the amount of physical disturbance experienced by seabed sediments. Physically stable or immobile sediments often support different animal and plant communities when compared with mobile or disturbed sediments (Gray and Elliott, 2009). Therefore, understanding the site's baseline conditions is very importance. However, due to the complexity of measuring the energy and disturbance levels of an area, it's unlikely that a quantifiable objective could be determined. Site-specifics: The Humber Estuary is a dynamic environment, with local hydrodynamics forming and influencing a range of estuarine features. The effect of wave energy on the estuarine system is largely restricted to the outer estuary, both in terms of offshore propagation, and those locally generated. However, Spurn peninsula, the long sand and shingle spit that extends out across the mouth of the estuary, provides some shelter from waves from the north-east. As you move towards the middle of the estuary wave action generally reduces due to the meandering of the tidal channels, waves refracting and energy losses due to shallow water effects. The Humber estuary is also characterised by strong tidal currents. The ebb velocities in the outer estuary are *circa* 20% higher than those on the flood. Morphological measures of the tidal asymmetry suggest the estuary has become more flood dominant particularly up estuary of the Humber Bridge over the last 150 years. (Allen et al., 2003);(Wilson, 2010); (ABP Marine Environmental Research Ltd (ABPmer), 2011) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal mud	Supporting processes: energy / exposure	Maintain the natural physical energy resulting from waves, tides and other water flows, so that the exposure does not cause alteration to the biotopes and stability, across the habitat.	N/A	The amount of energy received across the site significantly affects the communities present. Physical energy can be received through wave energy and / or tidal flow, and can be altered through human activity. Any such alterations to energy should be avoided (Hiscock et al., 2006). Ambient energy levels related to wave and tidal action influence the amount of physical disturbance experienced by seabed sediments. Physically stable or immobile sediments often support different animal and plant communities when compared with mobile or disturbed sediments (Gray and Elliott, 2009). Therefore, understanding the site's baseline conditions is very importance. However, due to the complexity of measuring the energy and disturbance levels of an area, it's unlikely that a quantifiable objective could be determined. Site-specifics: The Humber Estuary is a dynamic environment, with local hydrodynamics forming and influencing a range of estuarine features. The effect of wave energy on the estuarine system is largely restricted to the outer estuary, both in terms of offshore propagation, and those locally generated. However, Spurn peninsula, the long sand and shingle spit that extends out across the mouth of the estuary, provides some shelter from waves from the north-east. As you move towards the middle of the estuary wave action generally reduces due to the meandering of the tidal channels, waves refracting

				The Humber estuary is also characterised by strong tidal currents. The ebb velocities in the outer estuary are *circa* 20% higher than those on the flood. Morphological measures of the tidal asymmetry suggest the estuary has become more flood dominant particularly up estuary of the Humber Bridge over the last 150 years . The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal mixed sediments	Supporting processes: energy / exposure	Maintain the natural physical energy resulting from waves, tides and other water flows, so that the exposure does not cause alteration to the biotopes and stability, across the habitat.	N/A	The amount of energy received across the site significantly affects the communities present. Physical energy can be received through wave energy and / or tidal flow, and can be altered through human activity. Any such alterations to energy should be avoided (Hiscock et al., 2006). Ambient energy levels related to wave and tidal action influence the amount of physical disturbance experienced by seabed sediments. Physically stable or immobile sediments often support different animal and plant communities when compared with mobile or disturbed sediments (Gray and Elliott, 2009). Therefore, understanding the site's baseline conditions is very importance. However, due to the complexity of measuring the energy and disturbance levels of an area, it's unlikely that a quantifiable objective could be determined. Site-specifics: The Humber Estuary is a dynamic environment, with local hydrodynamics forming and influencing a range of estuarine features. The outer estuary is subject to a variable degree of exposure to currents and waves, with moderately exposed conditions predominantly on the outer areas and more sheltered conditions towards the middle estuary. The upper estuary is characterised by a variable degree of exposure to currents, depending on location(Allen et al., 2003). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal coarse sediment	Supporting processes: energy / exposure	Maintain the natural physical energy resulting from waves, tides and other water flows, so that the exposure does not cause alteration to the biotopes and stability, across the habitat.	N/A	The amount of energy received across the site significantly affects the communities present. Physical energy can be received through wave energy and / or tidal flow, and can be altered through human activity. Any such alterations to energy should be avoided (Hiscock et al., 2006). Ambient energy levels related to wave and tidal action influence the amount of physical disturbance experienced by seabed sediments. Physically stable or immobile sediments often support different animal and plant communities when compared with mobile or disturbed sediments (Gray and Elliott, 2009). Therefore, understanding the site's baseline conditions is very importance. However, due to the complexity of measuring the energy and disturbance levels of an area, it's unlikely that a quantifiable objective could be determined. Site-specifics: The Humber Estuary is a dynamic environment, with local hydrodynamics forming and influencing a range of estuarine features. The effect of wave energy on the estuarine system is largely restricted to the outer estuary, both in terms of offshore propagation, and those locally generated. However, Spurn peninsula, the long sand and shingle spit that extends out across the mouth of the estuary, provides some shelter from waves from the north-east. As you move towards the middle of the estuary wave action generally reduces due to the meandering of the tidal channels, waves refracting and energy losses due to shallow water effects. The Humber estuary is also characterised by strong tidal currents. The ebb velocities in the outer estuary are *circa* 20% higher than those on the flood. Morphological measures of the tidal asymmetry suggest the estuary has become more flood dominant particularly up estuary of the Humber Bridge over the last 150 years. (Allen et al., 2003);(Wilson, 2010); (ABP Marine Environmental Research Ltd (ABPmer), 2011) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal seagrass beds	Supporting processes: energy / exposure	Maintain the natural physical energy resulting from waves, tides and other water flows, so that the exposure does not cause alteration to the biotopes and stability, across the habitat.	N/A	The amount of energy received across the site significantly affects the communities present. Physical energy can be received through wave energy and / or tidal flow, and can be altered through human activity. Any such alterations to energy should be avoided (Hiscock et al., 2006). There is a complex relationship between hydrology and seagrass beds. Waves at the shoreline create high velocity environments that mobilise sediments and drive lower bed limits (for intertidal seagrass beds). Wave exposure and currents also influence the sediment grain size. Areas of high wave exposure have coarser sediments with lower nutrient concentrations, but are less anoxic (Jackson et al., 2013). Exposure to tides and waves can create patchiness making more exposed areas of the bed more vulnerable (Jackson et al., 2013). However, seagrass beds need current to survive. The lower limit of current velocities (ie the slowest) that seagrass can tolerate is determined by the physiology of the plant species, whereas the upper limit is purely mechanical (Jackson et al., 2013). Site-specifics: The Humber Estuary is a dynamic environment, with local hydrodynamics forming and influencing a range of estuarine features. The outer estuary is subject to a variable degree of exposure to currents and waves, with moderately exposed conditions predominantly on the outer areas and more sheltered conditions towards the middle estuary. The upper estuary is characterised by a variable degree of exposure to currents, depending on location. Intertidal seagrass has recently been identified in the area behind Spurn peninsula, which is a sheltered area (ABP Marine Environmental Research Ltd (ABPmer), 2011);(Franco et al., 2015);(Hemingway et al., 2008). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal sand and muddy sand	Supporting processes: energy / exposure	Maintain the natural physical energy resulting from waves, tides and other water flows, so	N/A	The amount of energy received across the site significantly affects the communities present. Physical energy can be received through wave energy and / or tidal flow, and can be altered through human activity. Any such alterations to energy should be avoided (Hiscock et al., 2006). Ambient energy levels related to wave and tidal action influence the amount of physical disturbance experienced by seabed sediments. Physically stable or immobile sediments often support different animal and plant communities when compared with mobile or disturbed sediments (Gray and Elliott, 2009). Therefore, understanding the site's baseline conditions is very importance. However, due to the complexity of measuring the energy and disturbance levels of an area, it's unlikely that a quantifiable objective could

		exposure does not cause alteration to the biotopes and stability, across the habitat.		Site-specifics: The Humber Estuary is a dynamic environment, with local hydrodynamics forming and influencing a range of estuarine features. The outer estuary is subject to a variable degree of exposure to currents and waves, with moderately exposed conditions predominantly on the outer areas and more sheltered conditions towards the middle estuary. The upper estuary is characterised by a variable degree of exposure to currents, depending on location (Allen et al., 2003). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal mud	Supporting processes: energy / exposure	Maintain the natural physical energy resulting from waves, tides and other water flows, so that the exposure does not cause alteration to the biotopes and stability, across the habitat.	N/A	The amount of energy received across the site significantly affects the communities present. Physical energy can be received through wave energy and / or tidal flow, and can be altered through human activity. Any such alterations to energy should be avoided (Hiscock et al., 2006). Ambient energy levels related to wave and tidal action influence the amount of physical disturbance experienced by seabed sediments. Physically stable or immobile sediments often support different animal and plant communities when compared with mobile or disturbed sediments (Gray and Elliott, 2009). Therefore, understanding the site's baseline conditions is very importance. However, due to the complexity of measuring the energy and disturbance levels of an area, it's unlikely that a quantifiable objective could be determined. Site-specifics: The Humber Estuary is a dynamic environment, with local hydrodynamics forming and influencing a range of estuarine features. The outer estuary is subject to a variable degree of exposure to currents and waves, with moderately exposed conditions predominantly on the outer areas and more sheltered conditions towards the middle estuary. The upper estuary is characterised by a variable degree of exposure to currents, depending on location (Allen et al., 2003). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Estuaries	Supporting processes: energy / exposure	Maintain the natural physical energy resulting from waves, tides and other water flows, so that the exposure does not cause alteration to the biotopes, natural disturbance levels and stability, across the feature.	N/A	This feature is characterised by energy. The amount of energy received across the site significantly affects the communities present. Physical energy can be received through wave energy and tidal flow, and can be altered through human activity. Any such alterations to energy should be avoided (Hiscock et al., 2006). The exposure of an estuary to wave and tidal energy dictates its physical structure, substrate character and habitat distribution. Increasing energy can result in increased erosion, the steepening of the shoreline or increases in the particle size of the sediment. Reductions in energy can increase sedimentation (Hiscock et al., 2006), (Channel Coastal Observatory (CCO), 2013), (Environment Agency (EA), 2011), (Davidson and Buck, 1997). Site-specifics: The Humber Estuary is a dynamic environment, with local hydrodynamics forming and influencing a range of estuarine features. The effect of wave energy on the estuarine system is largely restricted to the outer estuary, both in terms of offshore propagation and those locally generated, with only the Spurn Bight area producing a significant fetch from the prevailing wind direction. Spurn peninsula, the long sand and shingle spit that extends out across the mouth of the estuary, provides some shelter from waves from the north-east to the frontages of Cleethorpes and Grimsby on the south bank of the Estuary. Further upstream towards the middle of the estuary wave action generally reduces due to the meandering of the tidal channels, waves refracting and energy losses due to shallow water effects. The Humber estuary is also characterised by strong tidal currents. The ebb velocities in the outer estuary are approximately 20% higher than those on the flood. Morphological measures of the tidal asymmetry suggest the estuary has become more flood dominant particularly up-estuary of the Humber Bridge over the last 150 years (ABP Marine Environmental Research Ltd (ABPmer), 2011),(Royal Society for the Protection of Birds (RSPB), 2013), (ABP Marine Environmental Research Ltd (ABPmer), 2011), (Wilson, 2010) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Coastal lagoons	Supporting processes: eutrophication of sediments	Maintain dissolved organic nitrogen levels and phytoplankton community structure / abundance at a level that is not having an adverse impact on the species and communities of a specific lagoon and does not detract from its ability	N/A	Coastal lagoons act as sinks for organic matter. This is due to the input being greater than the output, because of the nature of the lagoon hydrodynamics and further organic material being generated within the lagoon. As a result, lagoonal sediments commonly have an organic content of 10-15% by weight, compared with 3-8% in coastal muddy-sands. This organic loading encourages the seasonal growth of annual algae and phytoplankton. Some lagoons may be regarded as naturally eutrophic with communities adapted to low oxygen conditions (WFD UKTAG, 2012). Site-specifics: No site specific information is currently available for this attribute. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Embryonic shifting dunes	Supporting processes: functional connectivity with wider coastal sedimentary system	Maintain adequate movement of sediment from all key sediment sources (directly from	N/A	This Annex 1 habitat is an integral element of the 'coastal foredune' (the beach-dune sand-sharing system). However, it is also important that sediment transport, which feeds the beach from offshore, is not interrupted. In some cases sand may come from marram-dominated dunes landward (shifting dunes along the shore with Ammophila arenaria). (Psuty, 2004), (Rogers et al., 2010) Site-specifics:

		the beach, indirectly from offshore, eroding cliffs, etc).		The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Salicornia and other annuals colonising mud and sand	Supporting processes: functional connectivity with wider coastal sedimentary system	Maintain adequate inputs of sediment in the water column from the sediment sources (offshore / eroding cliffs, etc).	N/A	This attribute and target has been included to recognise the potential need at this site to maintain or restore the connectivity of the site to its wider sedimentary system, in order to meet the conservation objectives. These connections may include features outside of the designated site boundary that are important for the migration, dispersal and genetic exchange of those typical species closely associated with the qualifying Annex I habitat features of the site. These features may also be important to the operation of the supporting ecological processes on which the designated site and its features may rely. In most cases increasing actual and functional connectivity would be beneficial. Where there is a lack of detailed knowledge of the connectivity requirements of the qualifying feature, Natural England will advise as to whether these are applicable on a case-by-case basis. (HR Wallingford et al., 2002) Site-specifics: Sediment enters the Humber Estuary from three main pathways: the North Sea; the Holderness coastline; and from fluvial sources. A net southward longshore drift supplies sediment to the mouth of the estuary where it is then re-distributed within the estuarine system. Sediment supply and transport processes are an important physical characteristic of the Humber Estuary and are essential to the morphological and ecological functioning of the estuary. (Allen et al., 2003); (Hemingway et al., 2008); (ABP Marine Environmental Research Ltd (ABPmer), 2011) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	Supporting processes: functional connectivity with wider coastal sedimentary system	Maintain adequate inputs of sediment in the water column from the sediment sources (offshore / eroding cliffs, etc).	N/A	This attribute and target has been included to recognise the potential need at this site to maintain or restore the connectivity of the site to its wider sedimentary system, in order to meet the conservation objectives. These connections may include features outside of the designated site boundary that are important for the migration, dispersal and genetic exchange of those typical species closely associated with the qualifying Annex I habitat features of the site. These features may also be important to the operation of the supporting ecological processes on which the designated site and its features may rely. In most cases increasing actual and functional connectivity would be beneficial. Where there is a lack of detailed knowledge of the connectivity requirements of the qualifying feature, Natural England will advise as to whether these are applicable on a case-by-case basis. (HR Wallingford et al., 2002) Site-specifics: Sediment enters the Humber Estuary from three main pathways: the North Sea; the Holderness coastline; and from fluvial sources. A net southward longshore drift supplies sediment to the mouth of the estuary where it is then re-distributed within the estuarine system. Sediment supply and transport processes are an important physical characteristic of the Humber Estuary and are essential to the morphological and ecological functioning of the estuary. (Allen et al., 2003), (Hemingway et al., 2008), (ABP Marine Environmental Research Ltd (ABPmer), 2011) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Shifting dunes along the shoreline with Ammophila arenaria (“White dunes”)	Supporting processes: hydrology (habitat)	At a site, unit and / or catchment level (as necessary), maintain the natural hydrological regime to provide the conditions necessary to sustain the feature within the site.	N/A	This target is included as defining and maintaining the appropriate hydrological regime, and is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature. Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and / or the likelihood of impacts. (Davy et al., 2006), (Davy et al., 2010), (Stratford et al., 2014) Site-specifics: The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Fixed dunes with herbaceous vegetation (“Grey dunes”)	Supporting processes: hydrology (habitat)	At a site, unit and / or catchment level (as necessary, maintain natural hydrological processes to provide the conditions necessary to sustain the feature within the site.	N/A	This target is included because defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature. Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and / or the likelihood of impacts. For this feature, hydrology can be influenced by dune topography, vegetation, substrate and flow regimes. (Davy et al., 2006), (Davy et al., 2010), (Stratford et al., 2014) Site-specifics: Detailed site specific information on this attribute will be available after the publication of the 2019 sand dune report. This report is expected in autumn 2020. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Embryonic shifting dunes	Supporting processes: hydrology (habitat)	At a site, unit and / or catchment level as necessary, maintain natural hydrological processes to	N/A	This target is included because defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature. Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and / or the likelihood of impacts. On a few sites, the development of new Embryonic shifting dunes can lead to new primary dune slacks forming. (Davy et al., 2006), (Davy et al., 2010), (Stratford et al., 2014)

		conditions necessary to sustain the feature within the site.		Site-specifics: The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Intertidal seagrass beds	Supporting processes: light levels (habitat)	Maintain the natural light availability to the seagrass bed.	N/A	Light availability is important as photosynthesis is essential to seagrasses. Low light availability reduces respiration and productivity by the roots and rhizomes, lowering nutrient uptake. If light availability, and therefore carbon uptake (Agustí et al., 1994), is reduced by physical, biological or chemical parameters (eg epiphyte cover, storm events, poor water quality) lower depth limits are likely to be shallower and the extent limits of the seagrass beds reduced. Seagrass has light requirements an order of magnitude higher than other marine macrophytes, ranging from 2-37% of in-water surface irradiance (SI) (Oleson and Sand-Jensen, 1993), (Erftemeijer and Lewis III, 2006), (Jackson et al., 2013). The high light requirements are a result of inefficient carbon uptake in seagrass (Agustí et al., 1994), (Jackson et al., 2013). The critical thresholds for light availability for Zostera marina range from 11-37% of SI, but for Z. noltii it's only 2% SI. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	Supporting processes: morphological setting	Maintain the morphological setting of the habitat within the wider estuarine and coastal system.	N/A	Changes to the form, shape or structure of the estuary or coastal zone in which the site is located, and changes to the exposure of the site, could affect the sediment transfer and depositional processes on which this habitat feature relies. Site-specifics: The Humber Estuary is a macro-tidal, coastal plain estuary. Exhibiting a classic funnel shape it is approximately 6.5km wide at its entrance (opening to 9.5km wide immediately past its entrance at Spurn Point), and 2.5km wide at its upper reaches. The estuary is a very dynamic environment, with local hydrodynamics forming and influencing a range of estuarine features. The outer estuary is subject to a variable degree of exposure to currents and waves, with moderately exposed conditions predominant on the outer areas and more sheltered conditions towards the middle estuary. The inner estuary is characterised by a variable degree of exposure to currents, depending on location. Some morphological changes may have a positive impact on the functioning of the estuary, for example the construction of managed realignment sites creates space for more intertidal habitat. (Allen et al., 2003), (Hemingway et al., 2008),(ABP Marine Environmental Research Ltd (ABPmer), 2011) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Salicornia and other annuals colonising mud and sand	Supporting processes: morphological setting	Maintain the morphological setting of the habitat within the wider estuarine and coastal system.	N/A	Changes to the form, shape or structure of the estuary or coastal zone in which the site is located, and changes to the exposure of the site, could affect the sediment transfer and depositional processes on which this habitat feature relies. Site-specifics: The Humber Estuary is a macro-tidal, coastal plain estuary. Exhibiting a classic funnel shape it is approximately 6.5km wide at its entrance (opening to 9.5km wide immediately past its entrance at Spurn Point), and 2.5km wide at its upper reaches. The estuary is a very dynamic environment, with local hydrodynamics forming and influencing a range of estuarine features. The outer estuary is subject to a variable degree of exposure to currents and waves, with moderately exposed conditions predominant on the outer areas and more sheltered conditions towards the middle estuary. The inner estuary is characterised by a variable degree of exposure to currents, depending on location. (Allen et al., 2003), (Hemingway et al., 2008), (ABP Marine Environmental Research Ltd (ABPmer), 2011) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal seagrass beds	Supporting processes: morphology	Maintain the natural physical form and coastal processes that shape the seagrass bed.	N/A	The coastal geomorphology will have overriding influences on all processes so should be maintained to support all the processes required. Site-specifics: The Humber Estuary is a macro-tidal, coastal plain estuary. Exhibiting a classic funnel shape it is approximately 6.5km wide at its entrance (opening to 9.5km wide immediately past its entrance at Spurn Point), and 2.5km wide at its upper reaches. The estuary is highly dynamic in its morphology. This dynamism is displayed in cyclical variations in the positions of channels and banks throughout the estuary (ABP Marine Environmental Research Ltd (ABPmer), 2011),(Allen et al., 2003),(Hemingway et al., 2008). The dominant influences on morphological change in the estuary are tides, waves, freshwater flows, tidal surges and biological activity. These influences produce changes in suspended sediment concentrations, deposition rates, bed composition and ultimately channel/bank configurations. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal seagrass beds	Supporting processes: physico-	Maintain the natural physico-	N/A	The physico-chemical properties that influence habitats include salinity, pH and temperature. They can act alone or in combination to affect habitats and their communities in different ways, depending on species-specific tolerances. In coastal habitats they can vary widely and can influence the abundance, distribution and composition of communities

	properties (habitat)	properties of the water.		the communities they support. Although seagrass species in England demonstrate an ability to exist in a wide range of salinities, the relationship between salinity, colonisation and seed success are not known. Fresh water influence may determine seagrass distribution in the UK (Jackson et al., 2013). It's recommended that the existing salinity levels at a site are maintained or restored to natural conditions, as far as possible. Many biological processes are temperature-dependent in seagrass beds (eg flowering and germination). At high temperatures photosynthesis and respiration increase, and if the temperature gets too high this causes a negative energy balance. At low temperatures growth reduces. Tolerances vary for each species and there are likely to be site-specific and seasonal requirements that are not well understood, so any changes to the natural temperature should be avoided (Jackson et al., 2013). Site-specifics: The Humber is a well-mixed estuary due to high tidal flow speeds within the estuary which causes almost total mixing of the saline water moving into the estuary with freshwater from the Rivers Ouse, Derwent and Trent. There is strong longitudinal salinity gradient up the estuary with an average salinity of 30 at Spurn, reducing to a salinity of 5 at Trent Falls (Allen et al., 2003), (Environment Agency, 2014). The Environment Agency holds data on physico-chemical properties. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal coarse sediment	Supporting processes: physico-chemical properties (habitat)	Maintain the natural physico-chemical properties of the water.	N/A	The physico-chemical properties that influence habitats include salinity, pH and temperature. They can act alone or in combination to affect habitats and their communities in different ways, depending on species-specific tolerances. In coastal habitats they can vary widely and can influence the abundance, distribution and composition of communities at relatively local scales. Changes in any of these properties, as a result of human activities, may impact habitats and the communities they support (Elliott et al., 1998), (Gray and Elliott, 2009), (Little, 2000). Site-specifics: The Humber is a well-mixed estuary due to high tidal flow speeds which cause almost total mixing of the saline water moving into the estuary with freshwater from the Rivers Ouse, Derwent and Trent. There is a strong longitudinal salinity gradient up the estuary with an average salinity of 30 at Spurn, reducing to a salinity of 5 at Trent Falls. The Environment Agency hold more detailed data on physico-chemical properties. Allen et al., 2003 Hemingway et al., 2008 ABP Marine Environmental Research Ltd (ABPmer), 2011 Environment Agency, 2014 The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal mixed sediments	Supporting processes: physico-chemical properties (habitat)	Maintain the natural physico-chemical properties of the water.	N/A	The physico-chemical properties that influence habitats include salinity, pH and temperature. They can act alone or in combination to affect habitats and their communities in different ways, depending on species-specific tolerances. In coastal habitats they can vary widely and can influence the abundance, distribution and composition of communities at relatively local scales. Changes in any of these properties, as a result of human activities, may impact habitats and the communities they support (Elliott et al., 1998), (Gray and Elliott, 2009), (Little, 2000). Site-specifics: The Humber is a well-mixed estuary due to high tidal flow speeds within the estuary which causes almost total mixing of the saline water moving into the estuary with freshwater from the Rivers Ouse, Derwent and Trent. There is strong longitudinal salinity gradient up the estuary with an average salinity of 30 at Spurn, reducing to a salinity of 5 at Trent Falls(Allen et al., 2003). The Environment Agency holds data on physico-chemical properties. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal mud	Supporting processes: physico-chemical properties (habitat)	Maintain the natural physico-chemical properties of the water.	N/A	The physico-chemical properties that influence habitats include salinity, pH and temperature. They can act alone or in combination to affect habitats and their communities in different ways, depending on species-specific tolerances. In coastal habitats they can vary widely and can influence the abundance, distribution and composition of communities at relatively local scales. Changes in any of these properties, as a result of human activities, may impact habitats and the communities they support (Elliott et al., 1998), (Gray and Elliott, 2009), (Little, 2000). Site-specifics: The Humber is a well-mixed estuary due to high tidal flow speeds within the estuary which causes almost total mixing of the saline water moving into the estuary with freshwater from the Rivers Ouse, Derwent and Trent. There is strong longitudinal salinity gradient up the estuary with an average salinity of 30 at Spurn, reducing to a salinity of 5 at Trent Falls. (Allen et al., 2003) The Environment Agency holds data on physico-chemical properties. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal sand and muddy sand	Supporting processes: physico-chemical properties (habitat)	Maintain the natural physico-chemical properties of the water.	N/A	The physico-chemical properties that influence habitats include salinity, pH and temperature. They can act alone or in combination to affect habitats and their communities in different ways, depending on species-specific tolerances. In coastal habitats they can vary widely and can influence the abundance, distribution and composition of communities at relatively local scales. Changes in any of these properties, as a result of human activities, may impact habitats and the communities they support (Elliott et al., 1998), (Gray and Elliott, 2009), (Little, 2000).

				Site-specifics: The Humber is a well-mixed estuary due to high tidal flow speeds within the estuary which causes almost total mixing of the saline water moving into the estuary with freshwater from the Rivers Ouse, Derwent and Trent. There is strong longitudinal salinity gradient up the estuary with an average salinity of 30 at Spurn, reducing to a salinity of 5 at Trent Falls(Allen et al., 2003). The Environment Agency holds data on physico-chemical properties(Environment Agency, 2014). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal mud	Supporting processes: physico-chemical properties (habitat)	Maintain the natural physico-chemical properties of the water.	N/A	The physico-chemical properties that influence habitats include salinity, pH and temperature. They can act alone or in combination to affect habitats and their communities in different ways, depending on species-specific tolerances. In coastal habitats they can vary widely and can influence the abundance, distribution and composition of communities at relatively local scales. Changes in any of these properties, as a result of human activities, may impact habitats and the communities they support (Elliott et al., 1998), (Gray and Elliott, 2009), (Little, 2000). Site-specifics: The Humber is a well-mixed estuary due to high tidal flow speeds which cause almost total mixing of the saline water moving into the estuary with freshwater from the Rivers Ouse, Derwent and Trent. There is a strong longitudinal salinity gradient up the estuary with an average salinity of 30 at Spurn, reducing to a salinity of 5 at Trent Falls. The Environment Agency hold more detailed data on physico-chemical properties. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal sand	Supporting processes: physico-chemical properties (habitat)	Maintain the natural physico-chemical properties of the water.	N/A	The physico-chemical properties that influence habitats include salinity, pH and temperature. They can act alone or in combination to affect habitats and their communities in different ways, depending on species-specific tolerances. In coastal habitats they can vary widely and can influence the abundance, distribution and composition of communities at relatively local scales. Changes in any of these properties, as a result of human activities, may impact habitats and the communities they support (Elliott et al., 1998), (Gray and Elliott, 2009), (Little, 2000). Site-specifics: The Humber is a well-mixed estuary due to high tidal flow speeds which cause almost total mixing of the saline water moving into the estuary with freshwater from the Rivers Ouse, Derwent and Trent (Allen et al., 2003),(Hemingway et al., 2008), (ABP Marine Environmental Research Ltd (ABPmer), 2011) There is a strong longitudinal salinity gradient up the estuary with an average salinity of 30 at Spurn, reducing to a salinity of 5 at Trent Falls. The Environment Agency hold more detailed data on physico-chemical properties (Environment Agency, 2014). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal mixed sediments	Supporting processes: physico-chemical properties (habitat)	Maintain the natural physico-chemical properties of the water.	N/A	The physico-chemical properties that influence habitats include salinity, pH and temperature. They can act alone or in combination to affect habitats and their communities in different ways, depending on species-specific tolerances. In coastal habitats they can vary widely and can influence the abundance, distribution and composition of communities at relatively local scales. Changes in any of these properties, as a result of human activities, may impact habitats and the communities they support (Elliott et al., 1998), (Gray and Elliott, 2009), (Little, 2000). Site-specifics: The Humber is a well-mixed estuary due to high tidal flow speeds which cause almost total mixing of the saline water moving into the estuary with freshwater from the Rivers Ouse, Derwent and Trent. There is a strong longitudinal salinity gradient up the estuary with an average salinity of 30 at Spurn, reducing to a salinity of 5 at Trent Falls. The Environment Agency hold more detailed data on physico-chemical properties. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Sandbanks which are slightly covered by sea water all the time	Supporting processes: physico-chemical properties (habitat)	Maintain the natural physico-chemical properties of the water.	N/A	The physico-chemical properties that influence habitats include salinity, pH and temperature. They can act alone or in combination to affect habitats and their communities in different ways, depending on species-specific tolerances. In coastal habitats they can vary widely and can influence the abundance, distribution and composition of communities at relatively local scales. Changes in any of these properties, as a result of human activities, may impact habitats and the communities they support (Elliott et al., 1998), (Gray and Elliott, 2009), (Little, 2000). Site-specifics: The Humber is a well-mixed estuary due to high tidal flow speeds which cause almost total mixing of the saline water moving into the estuary with freshwater from the Rivers Ouse, Derwent and Trent. There is a strong longitudinal salinity gradient up the estuary with an average salinity of 30 at Spurn, reducing to a salinity of 5 at Trent Falls. The Environment Agency hold more detailed data on physico-chemical properties. (Allen et al., 2003), (Hemingway et al., 2008), (ABP Marine Environmental Research Ltd (ABPmer), 2011), (Environment Agency, 2014)

				The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Mudflats and sandflats not covered by seawater at low tide	Supporting processes: physico-chemical properties (habitat)	Maintain the natural physico-chemical properties of the water.	N/A	The physico-chemical properties that influence habitats include salinity, pH and temperature. They can act alone or in combination to affect habitats and their communities in different ways, depending on species-specific tolerances. In coastal habitats they can vary widely and can influence the abundance, distribution and composition of communities at relatively local scales. Changes in any of these properties, as a result of human activities, may impact habitats and the communities they support (Elliott et al., 1998), (Gray and Elliott, 2009), (Little, 2000). Site-specifics: The Humber is a well-mixed estuary due to high tidal flow speeds within the estuary which causes almost total mixing of the saline water moving into the estuary with freshwater from the Rivers Ouse, Derwent and Trent. There is a strong longitudinal salinity gradient up the estuary with an average salinity of 30 at Spurn, reducing to a salinity of 5 at Trent Falls. (Allen et al., 2003) The Environment Agency holds more detailed data on physico-chemical properties. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Coastal lagoons	Supporting processes: physico-chemical properties (habitat)	Maintain the salinity regime between 15 and 40 and pH and temperature at natural levels.	N/A	The physico-chemical properties that influence habitats include salinity, pH and temperature with the former being of utmost importance for lagoons. Physico-chemical properties may act alone or in combination to affect habitats and their communities in different ways, depending on species-specific tolerances. In coastal habitats they can vary widely and can influence the abundance, distribution and composition of communities at relatively local scales. Changes in any of these properties, as a result of human activities, may impact habitats and the communities they support. Salinity levels are critically important to both the structure and function of a lagoon. Coastal lagoons vary in salinity from brackish, due to the dilution of seawater by freshwater, to hypersaline caused by evaporation (Devlin et al., 2007). Average salinity for a lagoon is expected to be between 15 and 40; this incorporates the optimal salinity ranges for the majority of lagoon specialist species (Joint Nature Conservation Committee (JNCC), 2004). Lagoons receive saline water from the adjacent sea or estuary, or from groundwater (Bamber, 2010), and also receive freshwater via rivers and run-off. The communities found in lagoons depend on the salinity, and changes in salinity may affect the presence and distribution of species, influencing recruitment and spawning (Joint Nature Conservation Committee (JNCC), 2004). The influence of temperature and pH in lagoons is less important than salinity. Because lagoons show a high level of inherent environmental variability in both space and time (Bamber, 2010), so water temperature and pH are highly variable; much more so than in the sea (normal sea water pH is in the range 7.8-8.4). The value of pH ranges from 7-9 in lagoons and is influenced by variability in salinity and the presence of algal blooms. Photosynthesis from algal blooms reduces the amount of carbon dioxide in the water, leading to an increase in pH, often above 9 (Bamber, 2010). Temperature also shows considerable fluctuation over time in lagoons, depending on the weather and the time of the year; as water depth decreases in hot weather so the temperature will rise. (WFD UKTAG, 2012) Site-specifics: Humberston Fitties has a salinity of 15-22.5 which fluctuates over the year in an expected natural pattern. Apart from rain and surface runoff, there is no freshwater input into Humberston Fitties. Northcoates Point A has a salinity of 33-40 and Northcoates Point B has a salinity of 29. The Environment Agency hold more detailed data on physico-chemical properties within the Humber Estuary.(Allen et al., 2003), (Seaton, 2001), (Royal Society for the Proctection of Birds (RSPB), 2017) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Sea lamprey (Petromyzon marinus)	Supporting processes: physico-chemical properties (species)	Maintain the natural physico-chemical properties of the water.	N/A	The physico-chemical properties that influence the species include salinity, pH and temperature. These abiotic factors can affect the species in different ways depending on species-specific tolerances. Temperature and salinity are closely linked and can act either alone or in combination, and can ultimately determine the success of a population, most notably in coastal habitats. Changes in any of these properties, as a result of human activity, may also impact the supporting habitats and the food favoured by the species. Changes in the temperature of a water body can change the behaviour of fish, causing them to enter or leave it at different times of the year. Water temperature strongly influences water chemistry and biological processes, such as reproduction and metabolism. Temperature and flow appear to be the main triggers influencing timing of upstream migration in sea lampreys and may affect the timing, duration and consistency of spawning runs (Docker, 2014), (Abou-Seedo and Potter, 1979), (Maitland, 2003). Peak migration usually coincides with temperatures that remain above 10 oC, and continues until temperatures reach 18 oC (Maitland, 2003). Runs are erratic and of shorter duration in small runoff streams where water temperatures may be quite unstable (Maitland, 2003). Water temperatures of 11–25 oC appear essential for successful spawning (Maitland, 2003). Temperature-dependant migratory activity may be an adaptation to ensure the arrival at spawning grounds when the temperature is optimal for reproduction (Binder and McDonald, 2008). Any warming of transitional waters might be expected to affect the timing of these migrations (Turnpenny and Liney, 2006). Changes in the timing of spawning migrations could have positive or negative effects on the population, depending on any critical matching of the timing with other factors (Turnpenny and Liney, 2006). Extreme temperatures may cause barriers to migration, however this is unlikely in the UK at present (Turnpenny and Liney, 2006). Entry of migratory fish into freshwater appears to be affected when high temperatures are combined with low dissolved oxygen (DO) concentrations. The main natural physical factors affecting the concentration of oxygen in the marine environment are temperature and salinity: DO solubility decreases with increasing temperature and salinity (Best et al., 2007), and this can create stressful conditions for fish. Therefore, standards for the upper allowable temperatures should also take account of mean summer DO levels. In poor status waters, temperature may be a critical factor when considering the survival of fish during events such as combined sewer overflow (CSO) discharges, due in part to knock-on effects to DO concentrations. Site-specifics: The Humber is a well-mixed estuary due to high tidal flow speeds which cause almost total mixing of the saline water

				moving into the estuary with freshwater from the Rivers Ouse, Derwent and Trent. There is a strong longitudinal salinity gradient up the estuary with an average salinity of 30 at Spurn, reducing to a salinity of 5 at Trent Falls. The Environment Agency hold more detailed data on physic-chemical properties. Prior to the significant improvements in the tidal Yorkshire Ouse, water quality was deemed as the principal factor which limited lamprey populations in the catchment. There have been vast improvements in water quality over the last two decades however sea lamprey numbers still remain low. There is still the possibility that poor quality inputs from other rivers and sources may pose a barrier to sea lamprey migration, especially during low flow conditions. (Allen et al., 2003), (Hemingway et al., 2008), (ABP Marine Environmental Research Ltd (ABPmer), 2011) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Grey seal (Halichoerus grypus)	Supporting processes: physico-chemical properties (species)	Maintain the natural physico-chemical properties of the water.	N/A	The physico-chemical properties that influence the species include salinity, pH and temperature. These abiotic factors can affect the species in different ways depending on species-specific tolerances. Temperature and salinity are closely linked and can act either alone or in combination and can ultimately determine the success of a population, most notably in coastal habitats. Changes in any of these properties, as a result of human activity, may also impact the supporting habitats and the food favoured by the species. Site-specifics: The Humber is a well-mixed estuary due to high tidal flow speeds which cause almost total mixing of the saline water moving into the estuary with freshwater from the Rivers Ouse, Derwent and Trent. There is a strong longitudinal salinity gradient up the estuary with an average salinity of 30 at Spurn, reducing to a salinity of 5 at Trent Falls(Allen et al., 2003),(Hemingway et al., 2008). The Environment Agency hold more detailed data on physico-chemical properties (Allen et al., 2003),(Hemingway et al., 2008) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
River lamprey (Lampetra fluviatilis)	Supporting processes: physico-chemical properties (species)	Maintain the natural physico-chemical properties of the water.	N/A	The physico-chemical properties that influence the species include salinity, pH and temperature. These abiotic factors can affect the species in different ways depending on species-specific tolerances. Temperature and salinity are closely linked and can act either alone or in combination, and can ultimately determine the success of a population, most notably in coastal habitats. Changes in any of these properties, as a result of human activity, may also impact the supporting habitats and the food favoured by the species. Changes in the temperature of a water body can change the behaviour of fish, causing them to enter or leave it at different times of the year. Water temperature strongly influences water chemistry and biological processes, such as reproduction and metabolism. Temperature and flow appear to be the main triggers influencing the timing of upstream migration in river lampreys (Docker, 2014), (Abou-Seedo and Potter, 1979). The first conspicuous influx of river lampreys into estuaries generally occurs when the temperature is 12–16 °C (Abou-Seedo and Potter, 1979). The upper limit for temperature, when migration into rivers normally occurs, is probably 8–12 °C (Lucas et al., 2009). Lamprey migration has also been found to increase with increasing water temperature (Masters et al., 2006), (Russon et al., 2011). Temperature-dependant migratory activity may be an adaptation to ensure the arrival at spawning grounds when the temperature is optimal for reproduction (Binder and McDonald, 2008). Any warming of transitional waters might be expected to affect the timing of these migrations (Turnpenny and Liney, 2006). Changes in the timing of spawning migrations could have positive or negative effects on the population, depending on any critical matching of the timing with other factors (Turnpenny and Liney, 2006). Extreme temperatures may cause barriers to migration however this is unlikely in the UK at present (Turnpenny and Liney, 2006). Entry of migratory fish into freshwater appears to be affected when high temperatures are combined with low dissolved oxygen (DO) concentrations. The main natural physical factors affecting the concentration of oxygen in the marine environment are temperature and salinity: DO solubility decreases with increasing temperature and salinity (Best et al., 2007) and this can create stressful conditions for fish. Therefore, standards for the upper allowable temperatures should also take account of mean summer DO levels. In poor status waters, temperature may be a critical factor when considering the survival of fish during events such as combined sewer overflow (CSO) discharges, due in part to knock-on effects to DO concentrations. Site-specifics: The Humber is a well-mixed estuary due to high tidal flow speeds which cause almost total mixing of the saline water moving into the estuary with freshwater from the Rivers Ouse, Derwent and Trent. There is a strong longitudinal salinity gradient up the estuary with an average salinity of 30 at Spurn, reducing to a salinity of 5 at Trent Falls. The Environment Agency hold more detailed data on physico-chemical properties. Prior to the significant improvements in the tidal Yorkshire Ouse, water quality was deemed as the principal factor which limited lamprey populations in the catchment. Improvements in water quality over the last two decades have allowed lamprey populations to recover and the Ouse is now believed to support one of the most important river lamprey populations in the UK. Although the water quality improvements have contributed towards recovering lamprey populations, there is still the possibility that poor quality inputs from other rivers and sources may pose a barrier to lamprey migration, especially during low flow conditions. (Allen et al., 2003), (Hemingway et al., 2008), (ABP Marine Environmental Research Ltd (ABPmer), 2011), (Nunn et al., 2008), (Jang and Lucas, 2005), (Nunn et al., 2008) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Salicornia and other annuals colonising mud	Supporting processes: pre-marsh	Maintain the pre-marsh biological	N/A	The ability for a surface film of diatoms or microalgal organisms to develop is increasingly recognised as an essential pre-cursor for saltmarsh colonisation.

		aid the stabilisation of intertidal sediment surfaces and support successful seedling establishment.		No site specific information is currently available for this attribute. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Coastal lagoons	Supporting processes: sediment contaminants	Restrict surface sediment contaminant levels to concentrations where they are not adversely impacting the infauna of the feature.	N/A	Various different contaminants are known to affect the species that live in or on the surface of sediments. These include heavy metals (mercury, arsenics, zinc, nickel, cadmium, etc), poly-aromatic hydrocarbons (PAHs), poly-chlorinated biphenyls (PCBs), organotins (TBT) and pesticides such as hexachlorobenzene. These can impact species sensitive to particular contaminants, degrading the community structure (eg heavy metals) and bioaccumulating within organisms, entering the marine food chain (eg PCBs) (OSPAR Commission, 2012). Both the water and sediments in lagoons are likely to be severely affected by agricultural run-off and the percolation of pollutants from nearby existing developments. Site-specifics: The Humber Estuary's Baseline Maintenance Dredging Protocol Document contains further information on contaminant levels in the Humber. The Environment Agency also hold more detailed data on sediment contaminan(Franco et al., 2015),(Allen et al., 2003) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Estuaries	Supporting processes: sediment contaminants	Restrict surface sediment contaminant levels to concentrations where they are not adversely impacting the infauna of the feature.	N/A	Various different contaminants are known to affect the species that live in or on the surface of subtidal sediments. These include heavy metals (mercury, arsenics, zinc, nickel, cadmium, etc), poly-aromatic hydrocarbons (PAHs), poly-chlorinated biphenyls (PCBs), organotins (TBT) and pesticides such as hexachlorobenzene. These can impact species sensitive to particular contaminants, degrading the community structure (eg heavy metals) and bioaccumulating within organisms, entering the marine food chain (eg PCBs) (OSPAR Commission, 2012). Site-specifics: The Humber Estuary's Baseline Maintenance Dredging Protocol Document contains further information on contaminant levels in the Humber. The Environment Agency also holds more detailed data on sediment contaminants (Environment Agency, 2014), (ABP Marine Environmental Research Ltd (ABPmer), 2011) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Sandbanks which are slightly covered by sea water all the time	Supporting processes: sediment contaminants	Restrict surface sediment contaminant levels to concentrations where they are not adversely impacting the infauna of the feature.	N/A	Various different contaminants are known to affect the species that live in or on the surface of sediments. These include heavy metals (Hg, As, Zn, Ni, Ch, Cd, etc), poly-aromatic hydrocarbons (PAHs), poly-chlorinated biphenyls (PCBs), organotins (TBT) and pesticides such as hexachlorobenzene. These can impact species sensitive to particular contaminants, degrading the community structure (eg heavy metals) and bioaccumulating within organisms, entering the marine food chain (eg PCBs) (OSPAR Commission, 2012). (OSPAR Commission, 2009), (OSPAR Commission, 2010) Site-specifics: The Humber Estuary's Baseline Maintenance Dredging Protocol Document contains further information on contaminant levels in the Humber. The Environment Agency also holds more detailed data on sediment contaminants. (Beririo and Goodall, 2007), (Environment Agency, 2014) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal sand	Supporting processes: sediment contaminants	Restrict surface sediment contaminant levels to concentrations where they are not adversely impacting the infauna of the feature.	N/A	Various different contaminants are known to affect the species that live in or on the surface of sediments. These include heavy metals (Hg, As, Zn, Ni, Ch, Cd, etc), poly-aromatic hydrocarbons (PAHs), poly-chlorinated biphenyls (PCBs), organotins (TBT) and pesticides such as hexachlorobenzene. These can impact species sensitive to particular contaminants, degrading the community structure (eg heavy metals) and bioaccumulating within organisms, entering the marine food chain (eg PCBs) (OSPAR Commission, 2012). Site-specifics: The Humber Estuary's Baseline Maintenance Dredging Protocol Document contains further information on contaminant levels in the Humber (ABP Marine Environmental Research Ltd (ABPmer), 2011); (Enviroment Agency (EA), 2016). The Environment Agency also holds more detailed data on sediment contaminants (Environment Agency, 2014). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal mud	Supporting processes: sediment contaminants	Restrict surface sediment contaminant levels to concentrations where they are not adversely impacting the infauna of the feature.	N/A	Various different contaminants are known to affect the species that live in or on the surface of sediments. These include heavy metals (Hg, As, Zn, Ni, Ch, Cd, etc), poly-aromatic hydrocarbons (PAHs), poly-chlorinated biphenyls (PCBs), organotins (TBT) and pesticides such as hexachlorobenzene. These can impact species sensitive to particular contaminants, degrading the community structure (eg heavy metals) and bioaccumulating within organisms, entering the marine food chain (eg PCBs) (OSPAR Commission, 2012). Site-specifics: The Humber Estuary's Baseline Maintenance Dredging Protocol Document contains further information on contaminant levels in the Humber.

				The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal coarse sediment	Supporting processes: sediment contaminants	Restrict surface sediment contaminant levels to concentrations where they are not adversely impacting the infauna of the feature.	N/A	Various different contaminants are known to affect the species that live in or on the surface of sediments. These include heavy metals (Hg, As, Zn, Ni, Ch, Cd, etc), poly-aromatic hydrocarbons (PAHs), poly-chlorinated biphenyls (PCBs), organotins (TBT) and pesticides such as hexachlorobenzene. These can impact species sensitive to particular contaminants, degrading the community structure (eg heavy metals) and bioaccumulating within organisms, entering the marine food chain (eg PCBs) (OSPAR Commission, 2012). --- Site-specifics: The Humber Estuary's Baseline Maintenance Dredging Protocol Document contains further information on contaminant levels in the Humber (ABP Marine Environmental Research Ltd (ABPmer), 2011). The Environment Agency also hold more detailed data on sediment contaminants (Environment Agency, 2014). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal mixed sediments	Supporting processes: sediment contaminants	Restrict surface sediment contaminant levels to concentrations where they are not adversely impacting the infauna of the habitat.	N/A	Various different contaminants are known to affect the species that live in or on the surface of sediments. These include heavy metals (Hg, As, Zn, Ni, Ch, Cd, etc), poly-aromatic hydrocarbons (PAHs), poly-chlorinated biphenyls (PCBs), organotins (TBT) and pesticides such as hexachlorobenzene. These can impact species sensitive to particular contaminants, degrading the community structure (eg heavy metals) and bioaccumulating within organisms, entering the marine food chain (eg PCBs) (OSPAR Commission, 2012). --- Site-specifics: The Humber Estuary's Baseline Maintenance Dredging Protocol Document contains further information on contaminant levels in the Humber. The Environment Agency also hold more detailed data on sediment contaminants. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal seagrass beds	Supporting processes: sediment contaminants	Restrict surface sediment contaminant levels to concentrations where they are not adversely impacting the infauna of the subfeature.	N/A	Various different contaminants are known to affect the species that live in or on the surface of sediments. These include heavy metals (mercury, arsenics, zinc, nickel, cadmium, etc), poly-aromatic hydrocarbons (PAHs), poly-chlorinated biphenyls (PCBs), organotins (TBT) and pesticides such as hexachlorobenzene. These can impact species sensitive to particular contaminants, degrading the community structure (eg heavy metals) and bioaccumulating within organisms, entering the marine food chain (eg PCBs) (OSPAR Commission, 2012). (Collins et al., 2010) --- Site-specifics: The Humber Estuary's Baseline Maintenance Dredging Protocol Document contains further information on contaminant levels in the Humber(ABP Marine Environmental Research Ltd (ABPmer), 2011). The Environment Agency also holds more detailed data on sediment contaminants(Environment Agency, 2014). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal mixed sediments	Supporting processes: sediment contaminants	Restrict surface sediment contaminants (<1cm from the surface) to below the OSPAR Environment Assessment Criteria (EAC) or Effects Range Low (ERL)	N/A	Various different contaminants are known to affect the species that live in, or on the surface of, sediments. These include heavy metals (Hg, As, Zn, Ni, Ch, Cd, etc), poly-aromatic hydrocarbons (PAHs), poly-chlorinated biphenyls (PCBs), organotins (TBT) and pesticides such as hexachlorobenzene. These can impact species sensitive to particular contaminants, degrading the community structure (eg heavy metals) and bioaccumulating within organisms, entering the marine food chain (eg PCBs) (OSPAR Commission, 2012). --- Site-specifics: The Humber Estuary's Baseline Maintenance Dredging Protocol Document contains further information on contaminant levels in the Humber(ABP Marine Environmental Research Ltd (ABPmer), 2011). The Environment Agency also holds more detailed data on sediment contaminants(Environment Agency, 2014). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal sand and muddy sand	Supporting processes: sediment contaminants	Restrict surface sediment contaminants (<1cm from the surface) to below the OSPAR Environment Assessment Criteria (EAC) or Effects Range Low (ERL)	N/A	Various different contaminants are known to affect the species that live in or on the surface of sediments. These include heavy metals (Hg, As, Zn, Ni, Ch, Cd, etc), poly-aromatic hydrocarbons (PAHs), poly-chlorinated biphenyls (PCBs), organotins (TBT) and pesticides such as hexachlorobenzene. These can impact species sensitive to particular contaminants, degrading the community structure (eg heavy metals) and bioaccumulating within organisms, entering the marine food chain (eg PCBs) (OSPAR Commission, 2012). --- Site-specifics: The Humber Estuary's Baseline Maintenance Dredging Protocol Document contains further information on contaminant levels in the Humber(ABP Marine Environmental Research Ltd (ABPmer), 2011). The Environment Agency also holds more detailed data on sediment contaminants(Environment Agency, 2014). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.

	processes: sediment contaminants	sediment contaminants (<1cm from the surface) to below the OSPAR Environment Assessment Criteria (EAC) or Effects Range Low (ERL)		include heavy metals (Hg, As, Zn, Ni, Ch, Cd, etc), poly-aromatic hydrocarbons (PAHs), poly-chlorinated biphenyls (PCBs), organotins (TBT) and pesticides such as hexachlorobenzene. These can impact species sensitive to particular contaminants, degrading the community structure (eg heavy metals) and bioaccumulating within organisms, entering the marine food chain (eg PCBs) (OSPAR Commission, 2012). Site-specifics: The Humber Estuary's Baseline Maintenance Dredging Protocol Document contains further information on contaminant levels in the Humber(ABP Marine Environmental Research Ltd (ABPmer), 2011). The Environment Agency also holds more detailed data on sediment contaminants(Environment Agency, 2014). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Mudflats and sandflats not covered by seawater at low tide	Supporting processes: sediment contaminants	Restrict surface sediment contaminants (<1cm from the surface) to below the OSPAR Environment Assessment Criteria (EAC) or Effects Range Low (ERL)	N/A	Various different contaminants are known to affect the species that live in or on the surface of sediments. These include heavy metals (Hg, As, Zn, Ni, Ch, Cd, etc), poly-aromatic hydrocarbons (PAHs), poly-chlorinated biphenyls (PCBs), organotins (TBT) and pesticides such as hexachlorobenzene. These can impact species sensitive to particular contaminants, degrading the community structure (eg heavy metals) and bioaccumulating within organisms, entering the marine food chain (eg PCBs) (OSPAR Commission, 2012). Site-specifics: The Humber Estuary's Baseline Maintenance Dredging Protocol Document contains further information on contaminant levels in the Humber. The Environment Agency also holds more detailed data on sediment contaminants. (ABP Marine Environmental Research Ltd (ABPmer), 2011) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal coarse sediment	Supporting processes: sediment movement and hydrodynamic regime (habitat)	Maintain all hydrodynamic and physical conditions such that natural water flow and sediment movement are not significantly altered or prevented from responding to changes in environmental conditions.	N/A	Sedimentary habitats are often influenced by tide and wave-driven water flow that drives the movement or stability of sediment on and in areas surrounding the feature. These flow regimes can control both the shape and size of the feature, in addition to its sedimentary characteristics and biological composition. It's important that these hydrodynamic and sedimentary processes persist and are allowed to change in response to environmental conditions without hindrance. Hydrodynamic conditions include the speed and direction of wave and tidal currents, seabed shear stress and wave exposure (Little, 2000), (Elliott et al., 1998). Site-specifics: Sediment enters the Humber Estuary from three main pathways: the North Sea; the Holderness coastline; and from fluvial sources. However, it is suspected that almost all the non-cohesive sediment entering the Humber is derived from the erosion of the Holderness cliffs and near-shore seabed. A net southward longshore drift supplies sediment to the mouth of the estuary where it is then re-distributed within the estuarine system. Sediment supply and transport processes are an important physical characteristic of the Humber Estuary and are essential to the morphological and ecological functioning of the estuary. (Allen et al., 2003); (Hemingway et al., 2008);(ABPmer, 2008); (Wilson, 2010) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal mixed sediments	Supporting processes: sediment movement and hydrodynamic regime (habitat)	Maintain all hydrodynamic and physical conditions such that natural water flow and sediment movement are not significantly altered or prevented from responding to changes in environmental conditions.	N/A	Sedimentary habitats are often influenced by tide and wave-driven water flow that drives the movement or stability of sediment on and in areas surrounding the feature. These flow regimes can control both the shape and size of the feature, in addition to its sedimentary characteristics and biological composition. It's important that these hydrodynamic and sedimentary processes persist and are allowed to change in response to environmental conditions without hindrance. Hydrodynamic conditions include the speed and direction of wave and tidal currents, seabed shear stress and wave exposure (Little, 2000), (Elliott et al., 1998). Site-specifics: The Humber Estuary's Baseline Maintenance Dredging Protocol Document contains further information on contaminant levels in the Humber. The Environment Agency also hold more detailed data on sediment contaminants. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Sandbanks which are slightly covered by sea water all the time	Supporting processes: sediment movement and hydrodynamic regime (habitat)	Maintain all hydrodynamic and physical conditions such that natural water flow and sediment movement are not significantly altered or prevented from responding to changes in environmental	N/A	Sedimentary habitats are often influenced by tide and wave-driven water flow that drives the movement of sediment on and in areas surrounding the feature. These flow regimes can control both the shape and size of the feature, in addition to its sedimentary characteristics and biological composition. It's important that these hydrodynamic and sedimentary processes persist and are allowed to change in response to environmental conditions without hindrance. Hydrodynamic conditions include the speed and direction of wave and tidal currents, seabed shear stress and wave exposure (Little, 2000), (Elliott et al., 1998). Site-specifics: Sediment enters the Humber Estuary from three main pathways: the North Sea; the Holderness coastline; and from fluvial sources. However, it is suspected that almost all the non-cohesive sediment entering the Humber is derived from the erosion of the Holderness cliffs and near-shore seabed. A net southward longshore drift supplies sediment to the mouth of the estuary where it is then re-distributed within the estuarine system.

				Sediment supply and transport processes are an important physical characteristic of the Humber Estuary and are essential to the morphological and ecological functioning of the estuary. (Allen et al., 2003), (Hemingway et al., 2008), (ABPmer, 2008), (Wilson, 2010) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal mud	Supporting processes: sediment movement and hydrodynamic regime (habitat)	Maintain all hydrodynamic and physical conditions such that natural water flow and sediment movement are not significantly altered or prevented from responding to changes in environmental conditions.	N/A	Sedimentary habitats are often influenced by tide and wave-driven water flow that drives the movement or stability of sediment on and in areas surrounding the feature. These flow regimes can control both the shape and size of the feature, in addition to its sedimentary characteristics and biological composition. It's important that these hydrodynamic and sedimentary processes persist and are allowed to change in response to environmental conditions without hindrance. Hydrodynamic conditions include the speed and direction of wave and tidal currents, seabed shear stress and wave exposure (Little, 2000), (Elliott et al., 1998). Site-specifics: Sediment enters the Humber Estuary from three main pathways: the North Sea; the Holderness coastline; and from fluvial sources. However, it is suspected that almost all the non-cohesive sediment entering the Humber is derived from the erosion of the Holderness cliffs and nearshore seabed. A net southward longshore drift supplies sediment to the mouth of the estuary where it is then re-distributed within the estuarine system. Sediment supply and transport processes are an important physical characteristic of the Humber Estuary and are essential to the morphological and ecological functioning of the estuary. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal sand	Supporting processes: sediment movement and hydrodynamic regime (habitat)	Maintain all hydrodynamic and physical conditions such that natural water flow and sediment movement are not significantly altered or prevented from responding to changes in environmental conditions.	N/A	Sedimentary habitats are often influenced by tide and wave-driven water flow that drives the movement or stability of sediment on and in areas surrounding the feature. These flow regimes can control both the shape and size of the feature, in addition to its sedimentary characteristics and biological composition. It's important that these hydrodynamic and sedimentary processes persist and are allowed to change in response to environmental conditions without hindrance. Hydrodynamic conditions include the speed and direction of wave and tidal currents, seabed shear stress and wave exposure (Little, 2000), (Elliott et al., 1998). Site-specifics: Sediment enters the Humber Estuary from three main pathways: the North Sea; the Holderness coastline; and from fluvial sources. However, it is suspected that almost all the non-cohesive sediment entering the Humber is derived from the erosion of the Holderness cliffs and near-shore seabed. A net southward longshore drift supplies sediment to the mouth of the estuary where it is then re-distributed within the estuarine system. Sediment supply and transport processes are an important physical characteristic of the Humber Estuary and are essential to the morphological and ecological functioning of the estuary. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal mud	Supporting processes: sediment movement and hydrodynamic regime (habitat)	Maintain sediment transport pathways to and from the feature to ensure replenishment of habitats that rely on the sediment supply.	N/A	Sedimentary habitats are often influenced by tide and wave-driven water flow that drives the movement or stability of sediment on and in areas surrounding the feature. These flow regimes can control both the shape and size of the feature, in addition to its sedimentary characteristics and biological composition. It's important that these hydrodynamic and sedimentary processes persist and are allowed to change in response to environmental conditions without hindrance. Hydrodynamic conditions include the speed and direction of wave and tidal currents, seabed shear stress and wave exposure (Little, 2000), (Elliott et al., 1998). Site-specifics: Sediment enters the estuarine system from three main pathways: the North Sea; the Holderness coastline; and from fluvial sources. Sediment supply and transport processes are an important physical characteristic of the Humber Estuary and are essential to the morphological and ecological functioning of the estuary (Allen et al., 2003). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Mudflats and sandflats not covered by seawater at low tide	Supporting processes: sediment movement and hydrodynamic regime (habitat)	Maintain sediment transport pathways to and from the feature to ensure replenishment of the feature, and / or replenishment of habitats that rely on the sediment supply from the feature.	N/A	Sedimentary habitats are often influenced by tide and wave-driven water flow that drives the movement of sediment on and in areas surrounding the feature. These flow regimes can control both the shape and size of the feature, in addition to its sedimentary characteristics and biological composition. It's important that these hydrodynamic and sedimentary processes persist and are allowed to change in response to environmental conditions without hindrance. Hydrodynamic conditions include the speed and direction of wave and tidal currents, seabed shear stress and wave exposure (Little, 2000), (Elliott et al., 1998). Site-specifics: Sediment enters the estuarine system from three main pathways: the North Sea; the Holderness coastline; and from fluvial sources. Sediment supply and transport processes are an important physical characteristic of the Humber Estuary and are essential to the morphological and ecological functioning of the estuary. (Allen et al., 2003) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.

Intertidal mixed sediments	Supporting processes: sediment movement and hydrodynamic regime (habitat)	Maintain sediment transport pathways to and from the feature to ensure the replenishment of habitats that are reliant on the sediment supply.	N/A	Sedimentary habitats are often influenced by tide and wave-driven water flow that drives the movement or stability of sediment on and in areas surrounding the feature. These flow regimes can control both the shape and size of the feature, in addition to its sedimentary characteristics and biological composition. It's important that these hydrodynamic and sedimentary processes persist and are allowed to change in response to environmental conditions without hindrance. Hydrodynamic conditions include the speed and direction of wave and tidal currents, seabed shear stress and wave exposure (Little, 2000), (Elliott et al., 1998). Site-specifics: Sediment enters the estuarine system from three main pathways: the North Sea; the Holderness coastline; and from fluvial sources. Sediment supply and transport processes are an important physical characteristic of the Humber Estuary and are essential to the morphological and ecological functioning of the estuary(ABP Marine Environmental Research Ltd (ABPmer), 2011),(Environment Agency, 2014). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal sand and muddy sand	Supporting processes: sediment movement and hydrodynamic regime (habitat)	Maintain sediment transport pathways to and from the feature to ensure the replenishment of habitats that rely on the sediment supply.	N/A	Sedimentary habitats are often influenced by tide and wave-driven water flow that drives the movement or stability of sediment on and in areas surrounding the feature. These flow regimes can control both the shape and size of the feature, in addition to its sedimentary characteristics and biological composition. It's important that these hydrodynamic and sedimentary processes persist and are allowed to change in response to environmental conditions without hindrance. Hydrodynamic conditions include the speed and direction of wave and tidal currents, seabed shear stress and wave exposure (Little, 2000), (Elliott et al., 1998). Site-specifics: Sediment enters the estuarine system from three main pathways: the North Sea; the Holderness coastline; and from fluvial sources. Sediment supply and transport processes are an important physical characteristic of the Humber Estuary and are essential to the morphological and ecological functioning of the estuary(Allen et al., 2003). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Grey seal (Halichoerus grypus)	Supporting processes: sediment movement and hydrodynamic regime (species)	Maintain all hydrodynamic and physical conditions such that natural water flow and sediment movement is not significantly altered or constrained.	N/A	Sediment movement is influenced by tide and wave-driven water flow. Natural movement of water and sediment should not be hindered. Hydrodynamic conditions include the speed and direction of wave and tidal currents, seabed shear stress and wave exposure. Alterations to these processes could affect species presences and distribution. Site-specifics: Sediment enters the estuarine system from three main pathways: the North Sea; the Holderness coastline; and from fluvial sources. Sediment supply and transport processes are an important physical characteristic of the Humber Estuary and are essential to the morphological and ecological functioning of the estuary. The Estuary intertidal and subtidal areas also act as both sources and sinks for sediment (Allen et al., 2003) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
River lamprey (Lampetra fluviatilis)	Supporting processes: sediment movement and hydrodynamic regime (species)	Maintain all hydrodynamic and physical conditions such that natural water flow is not significantly altered or constrained.	N/A	Natural movement of water should not be hindered. Hydrodynamic conditions include the speed and direction of wave and tidal currents, seabed shear stress and wave exposure. Alterations to these processes could affect the presence and distribution of species. Gross freshwater flows are important in maintaining the salinity gradient and water circulation in an estuary. As with the sea lamprey, little data is available concerning actual water quantity requirements for river lamprey, particularly with reference to flows needed for migration upstream (Maitland, 2003). Examination of the numbers of lampreys caught at different times indicate that an increase in freshwater discharge is the predominant environmental factor responsible for initiating the movement from the sea into the estuary, although temperature may also be a contributory factor. This initial migratory phase may show a tidal influence, with most upstream progression on flood tides (Bubb and Lucas, 2006). Very low flows can also be detrimental, preventing the passage of upstream migrants over very shallow areas and making the effects of poor water quality worse in estuaries affected by pollution. Site-specifics: Very low flows may be detrimental to river lamprey populations as it could prevent upstream migrating adults from passing obstacles and barriers in low flows, as well as exacerbating any poor water quality impacts that may occur in rivers. High flows during spates are also likely to be detrimental to river lamprey populations as these conditions make it difficult for the migrating adults to access spawning grounds. Furthermore, these conditions after spawning could lower recruitment through eggs and larvae being swept downstream to unsuitable habitats. Any significant alteration or management of channels that removes resting cover or creates stretches of fast flow (>2 m s-1) should be avoided along the migratory route of river lamprey. In particular, suitable spawning habitats should retain areas of suitable gravel with interstitial currents that attract nest building. (Maitland, 2003) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Sea lamprey (Petromyzon marinus)	Supporting processes: sediment movement and	Maintain all hydrodynamic and physical conditions such that natural	N/A	Natural movement of water should not be hindered. Hydrodynamic conditions include the speed and direction of wave and tidal currents, seabed shear stress and wave exposure. Alterations to these processes could affect the presence and distribution of species. Gross freshwater flows are important in maintaining the salinity gradient and water circulation in an estuary. As with shad and other migratory species, the spawning migration of sea lampreys is likely to be influenced by tides and river flows (Maitland, 2003). As with the river lamprey, little data is available

	hydrodynamic regime (species)	water flow is not significantly altered or constrained.		concerning actual water quantity requirements for sea lamprey, particularly with reference to flows needed for migration upstream (Maitland, 2003). Examination of the numbers of lampreys caught at different times indicate that an increase in freshwater discharge is the predominant environmental factor responsible for initiating the movement from the sea into the estuary, although temperature may also be a contributory factor. This initial migratory phase may show a tidal influence, with most upstream progression on flood tides (Bubb and Lucas, 2006). Very low flows can also be detrimental, preventing the passage of upstream migrants over very shallow areas and making the effects of poor water quality worse in estuaries affected by pollution. Site-specifics: Very low flows may be detrimental to sea lamprey populations as it could prevent upstream migrating adults from passing obstacles and barriers in low flows, as well as exacerbating any poor water quality impacts that may occur in rivers. High flows during spates are also likely to be detrimental to sea lamprey populations as these conditions make it difficult for the migrating adults to access spawning grounds. Furthermore, these conditions after spawning could lower recruitment through eggs and larvae being swept downstream to unsuitable habitats. Any significant alteration or management of channels that removes resting cover or creates stretches of fast flow (>2 m s-1) must be avoided along the migratory route of river lamprey. In particular, suitable spawning habitats should retain areas of suitable gravel with interstitial currents that attract nest building. (Maitland, 2003) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Salicornia and other annuals colonising mud and sand	Supporting processes: sediment nutrient status and nutrient cycling	Maintain both the sediment nutrient status to within typical values for the habitat and the processes that sustain effective nutrient cycling by the saltmarsh feature.	N/A	Changes to the nutrient status of the underlying saltmarsh sediment away from typical natural values, and / or the processes that allow the effective cycling of nutrients by the feature, may affect the vegetation communities associated with this feature. Communities may be dynamic in their distribution and are linked to the physical processes operating at the site. The species composition and type of saltmarsh will vary regionally and also from site to site. Site-specifics: No site specific information is currently available for this attribute. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	Supporting processes: sediment nutrient status and nutrient cycling	Maintain both the sediment nutrient status to within typical values for the habitat and the processes that sustain effective nutrient cycling by the saltmarsh feature.	N/A	Changes to the nutrient status of the underlying saltmarsh sediment away from typical natural values, and / or the processes that allow the effective cycling of nutrients by the feature, may affect the vegetation communities associated with this feature. Communities may be dynamic in their distribution and are linked to the physical processes operating at the site. The species composition and type of saltmarsh will vary regionally and also from site to site. Site-specifics: No site specific information is currently available for this attribute. The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	Supporting processes: sedimentary processes	Maintain the sedimentary processes (suspended sediment, sediment transfer, etc) that sustain the elevation and topography of the marsh surface.	N/A	Small differences or changes in elevation and topography (e.g. Just centimetres in elevation) may affect many marsh functions, from flooding and nutrient cycling to draining of the marsh interior. This micro-topography is critical for the development and maintenance of this habitat feature and its typical species, as are the wider sedimentary processes that influence this topography. Site-specifics: Sediment enters the estuarine system from three main pathways: the North Sea; the Holderness coastline; and from fluvial sources. A net southward longshore drift supplies sediment to the mouth of the estuary where it is then re-distributed within the estuarine system. Sediment supply and transport processes are an important physical characteristic of the Humber Estuary and are essential to the morphological and ecological functioning of the estuary. (Allen et al., 2003), (Hemingway et al., 2008),(ABP Marine Environmental Research Ltd (ABPmer), 2011) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Salicornia and other annuals colonising mud and sand	Supporting processes: sedimentary processes	Maintain the sedimentary processes (suspended sediment, sediment transfer, etc) that sustain the elevation and topography of the marsh surface.	N/A	Small differences or changes in elevation and topography (e.g. Just centimetres in elevation) may affect many marsh functions, from flooding and nutrient cycling to draining of the marsh interior. This micro-topography is critical for the development and maintenance of this habitat feature and its typical species, as are the wider sedimentary processes that influence this topography. Site-specifics: Sediment enters the estuarine system from three main pathways: the North Sea; the Holderness coastline; and from fluvial sources. A net southward longshore drift supplies sediment to the mouth of the estuary where it is then re-distributed within the estuarine system. Sediment supply and transport processes are an important physical characteristic of the Humber Estuary and are essential to the morphological and ecological functioning of the estuary. The Environment Agency (Geomatics) undertook a study of changes in elevation within the Humber Estuary between

				(Hemingway et al., 2008), (Environment Agency (EA), 2010),(ABP Marine Environmental Research Ltd (ABPmer), 2011) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal seagrass beds	Supporting processes: sedimentation rate	Maintain the natural rate of sediment deposition.	N/A	The rate of sediment deposition is known to influence the status of habitats and / or their associated communities. Sedimentation can influence community composition, alter species growth rates and potentially impact reproductive success by affecting larval recruitment. The presence and character of seagrass beds are determined by a complex relationship between the exposure, sediment type and other parameters such as suspended sediment (Jackson et al., 2013). Seagrasses rely on the presence of suitable sediment in order to colonise. Beds are usually in more sheltered areas where suspended sediments tend to settle, providing suitable conditions for colonisation. If suspended sediment is artificially high due to human activity, this may smother seagrass beds. A change in suspended sediment character can cause a direct loss of seagrass; it's also likely to change the bed shape and the communities it supports (Jackson et al., 2013). Site-specifics: The Humber Estuary is highly dynamic in its morphology. This dynamism is displayed in cyclical variations in the positions of channels and banks throughout the estuary. The dominant influences on morphological change in the estuary are tides, waves, freshwater flows, tidal surges and biological activity. These influences produce changes in suspended sediment concentrations, deposition rates, bed composition and ultimately channel/bank configurations (ABP Marine Environmental Research Ltd (ABPmer), 2011) . The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	Supporting processes: tidal processes	Maintain the degree of tidal immersion and emersion that supports the function of the habitat type.	N/A	The location, character, and dynamic behaviour of salt marshes are governed by a number of physical factors, which include tidal regime and the movement of relative sea level. One essential element necessary for the development and growth of a saltmarsh is a relatively stable area of sediment that is covered by the tide for a shorter period than it is exposed. Site-specifics: The Humber Estuary is macro-tidal, with a mean spring tidal range of 5.7m at Spurn, increasing to 7.4m at Saltend and then decreasing to 6.9m at Hessle (45km inland), near the Humber Bridge. Tides are semi-diurnal and tidal amplification occurs as far as Blacktoft on spring tides and Brough on neaps, with a variation of 2.5m between neap and spring high water levels. (Allen et al., 2003),(Hemingway et al., 2008),(ABP Marine Environmental Research Ltd (ABPmer), 2011) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Salicornia and other annuals colonising mud and sand	Supporting processes: tidal processes	Maintain the degree of tidal immersion, emersion and flows that support the function of the habitat type.	N/A	The location, character, and dynamic behaviour of saltmarsh is governed by a number of physical factors that include tidal regime and the movement of relative sea level. One essential element necessary for the development and growth of a saltmarsh is a relatively stable area of sediment that is covered by the tide for a shorter period than the time it is exposed. This type of habitat can cope with a higher degree of tidal immersion than upper saltmarsh types, but still requires a minimum period of exposure for plants to establish adequate root systems that can resist being washed away (2-3 days minimum). Site-specifics: The Humber Estuary is macro-tidal, with a mean spring tidal range of 5.7m at Spurn, increasing to 7.4m at Saltend and then decreasing to 6.9m at Hessle (45km inland), near the Humber Bridge. Tides are semi-diurnal and tidal amplification occurs as far as Blacktoft on spring tides and Brough on neaps, with a variation of 2.5m between neap and spring high water levels. (Allen et al., 2003);(Hemingway et al., 2008); (ABP Marine Environmental Research Ltd (ABPmer), 2011) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal sand	Supporting processes: water quality - contaminants (habitat)	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	N/A	Contaminants may impact the ecology of the Marine Protected Area by having a range of biological effects on different species within the habitat, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). Site-specifics: The Environment Agency undertakes routine water quality monitoring within the Humber Estuary (Environment Agency, 2014). No contaminant issues were identified in 2015 (Franco et al., 2015). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal mud	Supporting processes: water quality - contaminants (habitat)	Restrict aqueous contaminants to levels equating to High Status	N/A	Contaminants may impact the ecology of the Marine Protected Area by having a range of biological effects on different species within the habitat, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014).

		Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.		The Environment Agency undertakes routine water quality monitoring within the Humber Estuary (Environment Agency, 2014). No contaminant issues were identified in 2015 (Franco et al., 2015). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Sandbanks which are slightly covered by sea water all the time	Supporting processes: water quality - contaminants (habitat)	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	N/A	Contaminants may impact the ecology of the Marine Protected Area by having a range of biological effects on different species within the habitat, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). Site-specifics: The Environment Agency undertakes routine water quality monitoring within the Humber Estuary (Environment Agency, 2014). No contaminant issues were identified in 2015 (Franco et al., 2015). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal mixed sediments	Supporting processes: water quality - contaminants (habitat)	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	N/A	Contaminants may impact the ecology of the Marine Protected Area by having a range of biological effects on different species within the habitat, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). Site-specifics: The Environment Agency undertakes routine water quality monitoring within the Humber Estuary (Environment Agency, 2014). No contaminant issues were identified in 2015 (Franco et al., 2015). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal seagrass beds	Supporting processes: water quality - contaminants (habitat)	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	N/A	Contaminants may impact the ecology of the Marine Protected Area by having a range of biological effects on different species within the habitat, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). Site-specifics: The Environment Agency undertakes routine water quality monitoring within the Humber Estuary (Environment Agency, 2014). No contaminant issues were identified in 2015 (Franco et al., 2015). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal coarse sediment	Supporting processes: water quality - contaminants (habitat)	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	N/A	Contaminants may impact the ecology of the Marine Protected Area by having a range of biological effects on different species within the habitat, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). Site-specifics: The Environment Agency undertakes routine water quality monitoring within the Humber Estuary (Environment Agency, 2014). No contaminant issues were identified in 2015 (Franco et al., 2015). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal mixed sediments	Supporting processes: water quality - contaminants (habitat)	Restrict aqueous contaminants to levels equating to High Status according to	N/A	Contaminants may impact the ecology of the Marine Protected Area by having a range of biological effects on different species within the habitat, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). Site-specifics:

		Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.		Agency, 2014). No contaminant issues were identified in 2015 (Franco et al., 2015). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal sand and muddy sand	Supporting processes: water quality - contaminants (habitat)	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	N/A	Contaminants may impact the ecology of the Marine Protected Area by having a range of biological effects on different species within the habitat, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). Site-specifics: The Environment Agency undertakes routine water quality monitoring within the Humber Estuary (Environment Agency, 2014). No contaminant issues were identified in 2015 (Franco et al., 2015). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal mud	Supporting processes: water quality - contaminants (habitat)	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	N/A	Contaminants may impact the ecology of the Marine Protected Area by having a range of biological effects on different species within the habitat, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). Site-specifics: The Environment Agency undertakes routine water quality monitoring within the Humber Estuary (Environment Agency, 2014). No contaminant issues were identified in 2015 (Franco et al., 2015). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Coastal lagoons	Supporting processes: water quality - contaminants (habitat)	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	N/A	Contaminants may impact the ecology of the Marine Protected Area by having a range of biological effects on different species within the habitat, depending on the nature of the contaminant (Everett, 1993), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). Lagoons act as sinks for contaminants from surrounding areas and restricted water exchange means that lagoons are very sensitive to impacts from toxic contamination. Even small quantities of pollutants resulting from the dumping of waste in lagoons can have significant impacts due to the closed nature of lagoonal systems (Everett, 1993). The degree of sensitivity of lagoons to changes in water quality is influenced by the type of communities and species present and by the type of lagoon (ie the nature of the exchange with the sea and the size of the lagoon). Site-specifics: The Environment Agency undertakes routine water quality monitoring within the Humber Estuary (Environment Agency, 2014). No contaminant issues were identified in 2015 (Franco et al., 2015). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Mudflats and sandflats not covered by seawater at low tide	Supporting processes: water quality - contaminants (habitat)	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	N/A	Contaminants may impact the ecology of the Marine Protected Area by having a range of biological effects on different species within the habitat, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). Site-specifics: The Environment Agency undertakes routine water quality monitoring within the Humber Estuary (Environment Agency, 2014). No contaminant issues were identified in 2015 (Franco et al., 2015). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Estuaries	Supporting processes: water quality - contaminants (habitat)	Restrict aqueous contaminants to levels equating to High Status	N/A	Contaminants may impact the ecology of the Marine Protected Area by having a range of biological effects on different species within the habitat, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). Estuaries are vulnerable to toxic and non-biological contaminants, particularly in coastal areas associated with industry and past industrial activities (Joint Nature Conservation Committee (JNCC), 2004), (Hiscock et al., 2006), (Environment Agency (EA), 2011), (WFD UKTAG, 2012), (OSPAR Commission, 2010), (Defra,

		Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.		Site-specifics: The Environment Agency undertakes routine water quality monitoring within the Humber Estuary (Environment Agency, 2014). No contaminant issues were identified in 2015 (Franco et al., 2015). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Sea lamprey (Petromyzon marinus)	Supporting processes: water quality - contaminants (species)	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	N/A	Contaminants may have a range of biological effects on the species, depending on the nature of the contaminant. Lamprey species are sensitive to a range of contaminants and may be affected by both episodic and chronic pollution events. Episodic pollution causes direct mortalities and has resulted in lamprey being lost from river systems, and can also result in habitat fragmentation, which may have major effects on lamprey populations (Maitland, 2003). Pollution and water quality barriers can have major effects on lamprey populations, preventing upstream migration and killing downstream migrants (Maitland, 2003). The industrial and agricultural pollution of estuaries and rivers is often highlighted as one of the probable causes of the decline of estuarine fishes in Europe. Chemical and physical irritants on fish gills can cause tissue damage and can affect respiratory and ion-balance functions (Mallatt, 1985). There is evidence that fish numbers decline with increasing heavy metal concentrations, even within compliant levels (Delpech et al., 2010). Most effects are probably linked to chronic exposure to relatively low levels of pollutants, or cocktails of different chemicals. Environmental Quality Standards (EQS) are therefore not considered appropriate, as contaminants may still cause sub-lethal and chronic effects. Site-specifics: The Environment Agency undertake routine water quality monitoring within the Humber Estuary.No contaminant issues were identified in 2015. (Environment Agency, 2014) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
River lamprey (Lampetra fluviatilis)	Supporting processes: water quality - contaminants (species)	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	N/A	Contaminants may have a range of biological effects on the species, depending on the nature of the contaminant. Lamprey species are sensitive to a range of contaminants and may be affected by both episodic and chronic pollution events. Episodic pollution causes direct mortalities and has resulted in lamprey being lost from river systems, and can also result in habitat fragmentation, which may have major effects on lamprey populations (Maitland, 2003). Pollution and water quality barriers can have major effects on lamprey populations, preventing upstream migration and killing downstream migrants (Maitland, 2003). The industrial and agricultural pollution of estuaries and rivers is often highlighted as one of the probable causes of the decline of estuarine fishes in Europe. Chemical and physical irritants on fish gills can cause tissue damage and can affect respiratory and ion-balance functions (Mallatt, 1985). There is evidence that fish numbers decline with increasing heavy metal concentrations, even within compliant levels (Delpech et al., 2010). Most effects are probably linked to chronic exposure to relatively low levels of pollutants, or cocktails of different chemicals. Environmental Quality Standards (EQS) are therefore not considered appropriate, as contaminants may still cause sub-lethal and chronic effects. Site-specifics: The Environment Agency undertakes routine water quality monitoring within the Humber Estuary.No contaminant issues were identified in 2015. (Environment Agency, 2014) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Grey seal (Halichoerus grypus)	Supporting processes: water quality - contaminants (species)	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	N/A	Contaminants may have a range of biological effects on the species, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). Site-specifics: The Environment Agency undertake routine water quality monitoring within the Humber Estuary. No contaminant issues were identified in 2015 (Environment Agency, 2014) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal mud	Supporting processes: water quality - dissolved oxygen (habitat)	Maintain the dissolved oxygen (DO) concentration at levels equating to [Good] Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year), avoiding deterioration from existing levels.	N/A	Dissolved Oxygen (DO) levels affect the condition and health of features. Excessive nutrients and / or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007). However, there's a significant amount of natural variation that needs to be considered (Environment Agency Marine Monitoring Service, 2014). Site-specifics: The Humber Estuary SAC sits within four WFD water bodies: Humber Lower, Humber Middle, Humber Upper and Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the SAC have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body fails for WFD due to a drop in DO levels(Environment Agency, 2014) There is currently no evidence that the DO sag in the Upper Humber impacts the mudflats and sand flats feature. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that

				are occurring / have occurred on the site.
Intertidal sand and muddy sand	Supporting processes: water quality - dissolved oxygen (habitat)	Maintain the dissolved oxygen (DO) concentration at levels equating to [Good] Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year), avoiding deterioration from existing levels.	N/A	Dissolved Oxygen (DO) levels affect the condition and health of features. Excessive nutrients and / or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007). However, there's a significant amount of natural variation that needs to be considered (Environment Agency Marine Monitoring Service, 2014). Site-specifics: The Humber Estuary SAC sits within four WFD water bodies: Humber Lower, Humber Middle, Humber Upper and Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the SAC have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body fails for WFD due to a drop in DO levels. There is currently no evidence that the DO sag in the Upper Humber impacts the mudflats and sand flats feature(Environment Agency, 2014). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal mixed sediments	Supporting processes: water quality - dissolved oxygen (habitat)	Maintain the dissolved oxygen (DO) concentration at levels equating to Good Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year), avoiding deterioration from existing levels.	N/A	Dissolved Oxygen (DO) levels affect the condition and health of features. Excessive nutrients and / or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007). However, there's a significant amount of natural variation that needs to be considered (Environment Agency Marine Monitoring Service, 2014). Site-specifics: The Humber Estuary SAC sits within four WFD water bodies: Humber Lower, Humber Middle, Humber Upper and Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the SAC have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body fails for WFD due to a drop in DO levels. There is currently no evidence that the DO sag in the Upper Humber impacts the mudflats and sand flats feature. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal coarse sediment	Supporting processes: water quality - dissolved oxygen (habitat)	Maintain the dissolved oxygen (DO) concentration at levels equating to Good Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year), avoiding deterioration from existing levels.	N/A	Dissolved Oxygen (DO) levels affect the condition and health of features. Excessive nutrients and / or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007). However, there's a significant amount of natural variation that needs to be considered (Environment Agency Marine Monitoring Service, 2014). Site-specifics: The Humber Estuary SAC sits within four WFD water bodies: Humber Upper, Humber Middle, Humber Lower and, Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the SAC have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body fails for WFD due to a drop in DO levels. However, this does not affect the subtidal coarse sediments sub-feature of the Humber Estuary (Environment Agency, 2014). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal seagrass beds	Supporting processes: water quality - dissolved oxygen (habitat)	Maintain the dissolved oxygen (DO) concentration at levels equating to Good Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year), avoiding deterioration from existing levels.	N/A	Dissolved Oxygen (DO) levels affect the condition and health of features. Excessive nutrients and / or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007). However, there's a significant amount of natural variation that needs to be considered (Environment Agency Marine Monitoring Service, 2014). Seagrasses require a constant supply of oxygen to sustain aerobic metabolism in the roots and the leaves of the plant. Coastal sediments tend to be anoxic due to high levels of organic matter. Seagrasses have adapted to these conditions by using systems to diffuse oxygen from the water column. These systems of diffusion can be hindered by an increase in the speed and direction of water currents, or epiphyte coverage on the leaf blade (Jackson et al., 2013). Site-specifics: The Humber Estuary SAC sits within four WFD water bodies: Humber Lower, Humber Middle, Humber Upper and Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the SAC have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body fails for WFD due to a drop in DO levels. There is currently no evidence that the DO sag in the Upper Humber impacts the mudflats and sand flats feature. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal mixed sediments	Supporting processes: water quality - dissolved oxygen (habitat)	Maintain the dissolved oxygen (DO) concentration at levels equating to Good Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the	N/A	Dissolved Oxygen (DO) levels affect the condition and health of features. Excessive nutrients and / or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007). However, there's a significant amount of natural variation that needs to be considered (Environment Agency Marine Monitoring Service, 2014). Site-specifics: The Humber Estuary SAC sits within four WFD water bodies: Humber Lower, Humber Middle, Humber Upperand Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the SAC have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body fails for WFD due to a drop in DO levels. However, this does not affect the subtidal mixed sediment sub-feature of the Estuary.

		year), avoiding deterioration from existing levels.		The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Sandbanks which are slightly covered by sea water all the time	Supporting processes: water quality - dissolved oxygen (habitat)	Maintain the dissolved oxygen (DO) concentration at levels equating to Good Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year), avoiding deterioration from existing levels.	N/A	Dissolved Oxygen (DO) levels affect the condition and health of features. Excessive nutrients and / or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007). However, there's a significant amount of natural variation that needs to be considered (Environment Agency Marine Monitoring Service, 2014). Site-specifics: The Environment Agency undertakes routine water quality monitoring within the Humber Estuary. No contaminant issues were identified in 2015. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal mud	Supporting processes: water quality - dissolved oxygen (habitat)	Maintain the dissolved oxygen (DO) concentration at levels equating to Good Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year), avoiding deterioration from existing levels.	N/A	Dissolved Oxygen (DO) levels affect the condition and health of features. Excessive nutrients and / or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007). However, there's a significant amount of natural variation that needs to be considered (Environment Agency Marine Monitoring Service, 2014). Site-specifics: The Humber Estuary SAC sits within four WFD water bodies: Humber Lower, Humber Middle, Humber Upper, Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the SAC have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body fails for WFD due to a drop in DO levels. However, this does not affect the subtidal mud sub-feature of the Estuary. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal sand	Supporting processes: water quality - dissolved oxygen (habitat)	Maintain the dissolved oxygen (DO) concentration at levels equating to Good Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year), avoiding deterioration from existing levels.	N/A	Dissolved Oxygen (DO) levels affect the condition and health of features. Excessive nutrients and / or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007). However, there's a significant amount of natural variation that needs to be considered (Environment Agency Marine Monitoring Service, 2014). Site-specifics: The Humber Estuary SAC sits within four WFD water bodies: Humber Upper, Humber Middle, Humber Lower, Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the SAC have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body fails for WFD due to a drop in DO levels. However, this does not affect the subtidal sand sub-feature of the Humber Estuary. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Mudflats and sandflats not covered by seawater at low tide	Supporting processes: water quality - dissolved oxygen (habitat)	Maintain the dissolved oxygen (DO) concentration at levels equating to Good Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year), avoiding deterioration from existing levels.	N/A	Dissolved Oxygen (DO) levels affect the condition and health of features. Excessive nutrients and / or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007). However, there's a significant amount of natural variation that needs to be considered (Environment Agency Marine Monitoring Service, 2014). Site-specifics: The Humber Estuary SAC sits within four WFD water bodies: Humber Lower, Humber Middle, Humber Upper, and Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the SAC have been classified as achieving Good Ecological Potential. In 2013 and 2014 the Humber Upper water body fails for WFD due to a drop in DO levels. However, this does not affect the mudflat and sand flat features (Environment Agency, 2014) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Estuaries	Supporting processes: water quality - dissolved oxygen (habitat)	Restore the dissolved oxygen (DO) concentration at levels equating to Good Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year), avoiding	N/A	Dissolved Oxygen (DO) levels affect the condition and health of features. Excessive nutrients and / or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007). However, there's a significant amount of natural variation that needs to be considered (Royal Society for the Protection of Birds (RSPB), 2014), (Joint Nature Conservation Committee (JNCC), 2004), (Hiscock et al., 2006), (Environment Agency (EA), 2011), (OSPAR Commission, 2010), (Defra, 2010), (Environment Agency Marine Monitoring Service, 2014). Site-specifics: From 2009 to 2012 the dissolved oxygen levels within the Humber Estuary SAC have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body fails WFD chemical criteria due to a drop in DO levels. There is a dissolved oxygen (DO) sag that occurs annually in the tidal Ouse during the summer months. The key

		deterioration from existing levels.		potential for the DO sag to cause a barrier to the upstream migrating sea lamprey. This indicates that estuarine processes are being affected by DO water quality. The target has been set to restore as the Upper Humber WFD water body fails due to a drop in DO levels.
River lamprey (Lampetra fluviatilis)	Supporting processes: water quality - dissolved oxygen (species)	Maintain the dissolved oxygen (DO) concentration at levels equating to Good Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year), avoiding deterioration from existing levels.	N/A	Dissolved Oxygen (DO) affects the condition and health of species. Excessive nutrients and / or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish, infaunal and epifaunal communities. However, there's a significant amount of natural variation that needs to be considered. Barriers to migration can be created as a result of poor water quality, in particular low levels of dissolved oxygen (DO), and can lead to species that migrate from the sea to spawn in freshwater (anadromous) being excluded from important habitat. There is little published information regarding lamprey sensitivity to DO levels. Although both river lamprey and sea lamprey are known to require well-oxygenated gravels for spawning, both species are considered to be sensitive to pollution in estuaries (Maitland, 2003). The oxygen consumption of adult sea lamprey at various temperatures is comparable to salmonids of a similar weight (Maitland, 2003). Oxygen sags resulting in hypoxia have been shown to be an effective barrier for upstream migrating anadromous spawners (Maes et al., 2007). Although some direct effects (eg death or reduced scope for growth) are possible, the main effect of oxygen sags will be indirect, through spawning habitat loss. In estuaries the low levels of DO can arise naturally in the upper estuary where concentrations of re-suspended sediment are higher, causing a sag in DO. This condition can be made worse by the input of human organic matter from domestic sewage, wastewater and industry, causing a water quality barrier. The main natural, physical factors affecting the concentration of oxygen in the marine environment are temperature and salinity: levels of DO decreasing with increasing water temperature and salinity (Best et al., 2007). This can have a negative impact on fish as their demand for oxygen is known to increase with increasing temperature. Mariculture in some Scottish sea-lochs can also reduce DO levels (Best et al., 2007). Dissolved oxygen concentrations need to be considered in conjunction with other water quality variables, which will often operate synergistically on fish physiology, increasing their sensitivity to other contaminants, parasitism and predation. Site-specifics: The Humber Estuary SAC sits within four WFD water bodies: Humber Lower, Humber Middle, Humber Upper, Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the SAC have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body fails for WFD due to a drop in DO levels. There is a dissolved oxygen (DO) sag that occurs annually in the tidal Ouse during the summer months. The key migration periods for river lamprey are from October to April and therefore the current understanding is that this does not impact upstream migrating river lamprey. (Environment Agency, 2014) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Sea lamprey (Petromyzon marinus)	Supporting processes: water quality - dissolved oxygen (species)	Restore the dissolved oxygen (DO) concentration [at] levels equating to [Good] Ecological Status [(specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year)], avoiding deterioration from existing levels.	N/A	Dissolved Oxygen (DO) affects the condition and health of species. Excessive nutrients and / or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish, infaunal and epifaunal communities. However, there's a significant amount of natural variation that needs to be considered. Barriers to migration can be created as a result of poor water quality, in particular low levels of dissolved oxygen (DO), and can lead to species that migrate from the sea to spawn in freshwater (anadromous) being excluded from important habitat. There is little published information regarding lamprey sensitivity to DO levels. Although both river lamprey and sea lamprey are known to require well-oxygenated gravels for spawning, both species are considered to be sensitive to pollution in estuaries (Maitland, 2003). The oxygen consumption of adult sea lamprey at various temperatures is comparable to salmonids of a similar weight (Maitland, 2003). Oxygen sags resulting in hypoxia have been shown to be an effective barrier for upstream migrating anadromous spawners (Maes et al., 2007). Although some direct effects (eg death or reduced scope for growth) are possible, the main effect of oxygen sags will be indirect, through spawning habitat loss. In estuaries the low levels of DO can arise naturally in the upper estuary where concentrations of re-suspended sediment are higher, causing a sag in DO. This condition can be made worse by the input of human organic matter from domestic sewage, wastewater and industry, causing a water quality barrier. The main natural, physical factors affecting the concentration of oxygen in the marine environment are temperature and salinity: levels of DO decreasing with increasing water temperature and salinity (Best et al., 2007). This can have a negative impact on fish as their demand for oxygen is known to increase with increasing temperature. Mariculture in some Scottish sea-lochs can also reduce DO levels (Best et al., 2007). Dissolved oxygen concentrations need to be considered in conjunction with other water quality variables, which will often operate synergistically on fish physiology, increasing their sensitivity to other contaminants, parasitism and predation. Site-specifics: The Humber Estuary SAC sits within four WFD water bodies: Humber Lower, Humber Middle, Humber Upper, Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the SAC have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body fails for WFD due to a drop in DO levels. There is a dissolved oxygen (DO) sag that occurs annually in the tidal Ouse during the summer months. The key migration periods for sea lamprey are from March to July and therefore the current understanding is that there is a potential for the DO sag to cause a barrier to the upstream migrating sea lamprey (Environment Agency, 2014) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Estuaries	Supporting processes: water quality - nutrients (habitat)	Maintain water quality at mean winter dissolved inorganic nitrogen levels where biological indicators of eutrophication (opportunistic	N/A	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. These seaweeds can smother the sediment, preventing aeration and causing anoxia (lack of oxygen). This can impact sensitive fish, epifauna and infauna communities. The aim is to seek no further deterioration or improve water quality (Devlin et al., 2007), (Best, 2014). Nutrients affect primary production in the water column and benthos. Estuaries tend to be nutrient-rich and sources include freshwater input, direct discharges and coastal water exchange. Other factors affecting nutrient levels include tidal flushing, seasonality and climate. Excessive nutrients can lead to eutrophication due to extensive phytoplankton blooms and algal mats (WFD UKTAG, 2012), (Joint Nature Conservation Committee (JNCC), 2004), (Hiscock et al., 2006), (Environment Agency (EA), 2011), (OSPAR Commission, 2010), (Defra, 2010). Site-specifics:

		and phytoplankton blooms) do not affect the integrity of the site and features		The risk of eutrophication across the site has been assessed as low using the Environment Agency's Weight of Evidence approach. This takes into account assessments of the Water Framework Directive opportunistic macroalgae and phytoplankton quality elements using the respective assessment tools. Adverse effects to integrity should be avoided. Therefore opportunistic macroalgal levels should be maintained so there is no adverse effect to the feature through limited algal cover (<15%) and low biomass (< 500 g m2) of macroalgal blooms in the available intertidal habitat, with area of available intertidal habitat affected by opportunistic macroalgae less than 15 %. There should also be limited (<5%) entrainment of algae in the underlying sediment (all accounting for seasonal variations and fluctuations in growth). Phytoplankton levels should be maintained above a WFD assessment tool score of 0.6, where there is only a minor (a) decline in species richness, and (b) disturbance to the diatom-dinoflagellate succession in the spring bloom compared to reference conditions. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal sand	Supporting processes: water quality - nutrients (habitat)	Maintain water quality at mean winter dissolved inorganic nitrogen levels where biological indicators of eutrophication (opportunistic macroalgal and phytoplankton blooms) do not affect the integrity of the site and features	N/A	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. These seaweeds can smother the sediment, preventing aeration and causing anoxia (lack of oxygen). This can impact sensitive fish, epifauna and infauna communities. The aim is to seek no further deterioration or improve water quality (Devlin et al., 2007), (Best, 2014). Site-specifics: The risk of eutrophication across the site has been assessed as low using the Environment Agency's Weight of Evidence approach. This takes into account assessments of the Water Framework Directive opportunistic macroalgae and phytoplankton quality elements using the respective assessment tools. Adverse effects to integrity should be avoided. Therefore opportunistic macroalgal levels should be maintained so there is no adverse effect to the feature through limited algal cover (<15%) and low biomass (< 500 g m2) of macroalgal blooms in the available intertidal habitat, with area of available intertidal habitat affected by opportunistic macroalgae less than 15 %. There should also be limited (<5%) entrainment of algae in the underlying sediment (all accounting for seasonal variations and fluctuations in growth). Phytoplankton levels should be maintained above a WFD assessment tool score of 0.6, where there is only a minor (a) decline in species richness, and (b) disturbance to the diatom-dinoflagellate succession in the spring bloom compared to reference conditions. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal mud	Supporting processes: water quality - nutrients (habitat)	Maintain water quality at mean winter dissolved inorganic nitrogen levels where biological indicators of eutrophication (opportunistic macroalgal and phytoplankton blooms) do not affect the integrity of the site and features	N/A	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. These seaweeds can smother the sediment, preventing aeration and causing anoxia (lack of oxygen). This can impact sensitive fish, epifauna and infauna communities. The aim is to seek no further deterioration or improve water quality (Devlin et al., 2007), (Best, 2014). Site-specifics: The risk of eutrophication across the site has been assessed as low using the Environment Agency's Weight of Evidence approach. This takes into account assessments of the Water Framework Directive opportunistic macroalgae and phytoplankton quality elements using the respective assessment tools. Adverse effects to integrity should be avoided. Therefore opportunistic macroalgal levels should be maintained so there is no adverse effect to the feature through limited algal cover (<15%) and low biomass (< 500 g m2) of macroalgal blooms in the available intertidal habitat, with area of available intertidal habitat affected by opportunistic macroalgae less than 15 %. There should also be limited (<5%) entrainment of algae in the underlying sediment (all accounting for seasonal variations and fluctuations in growth). Phytoplankton levels should be maintained above a WFD assessment tool score of 0.6, where there is only a minor (a) decline in species richness, and (b) disturbance to the diatom-dinoflagellate succession in the spring bloom compared to reference conditions. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Sandbanks which are slightly covered by sea water all the time	Supporting processes: water quality - nutrients (habitat)	Maintain water quality at mean winter dissolved inorganic nitrogen levels where biological indicators of eutrophication (opportunistic macroalgal and phytoplankton blooms) do not affect the integrity of the site and features	N/A	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. These seaweeds can smother the sediment, preventing aeration and causing anoxia (lack of oxygen). This can impact sensitive fish, epifauna and infauna communities. The aim is to seek no further deterioration or improve water quality (Devlin et al., 2007), (Best, 2014). Site-specifics: The risk of eutrophication across the site has been assessed as low using the Environment Agency's Weight of Evidence approach. This takes into account assessments of the Water Framework Directive opportunistic macroalgae and phytoplankton quality elements using the respective assessment tools. Adverse effects to integrity should be avoided. Therefore opportunistic macroalgal levels should be maintained so there is no adverse effect to the feature through limited algal cover (<15%) and low biomass (< 500 g m2) of macroalgal blooms in the available intertidal habitat, with area of available intertidal habitat affected by opportunistic macroalgae less than 15 %. There should also be limited (<5%) entrainment of algae in the underlying sediment (all accounting for seasonal variations and fluctuations in growth). Phytoplankton levels should be maintained above a WFD assessment tool score of 0.6, where there is only a minor (a) decline in species richness, and (b) disturbance to the diatom-dinoflagellate succession in the spring bloom compared to reference conditions. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal mixed sediments	Supporting processes: water quality - nutrients (habitat)	Maintain water quality at mean winter dissolved inorganic nitrogen levels where biological indicators of eutrophication	N/A	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. These seaweeds can smother the sediment, preventing aeration and causing anoxia (lack of oxygen). This can impact sensitive fish, epifauna and infauna communities. The aim is to seek no further deterioration or improve water quality (Devlin et al., 2007), (Best, 2014). Site-specifics: The risk of eutrophication across the site has been assessed as low using the Environment Agency's Weight of Evidence approach. This takes into account assessments of the Water Framework Directive opportunistic macroalgae and phytoplankton quality elements using the respective assessment tools. Adverse effects to integrity should be

		macroalgal and phytoplankton blooms) do not affect the integrity of the site and features		avoided. Therefore opportunistic macroalgal levels should be maintained so there is no adverse effect to the feature through limited algal cover (<15%) and low biomass (< 500 g m2) of macroalgal blooms in the available intertidal habitat, with area of available intertidal habitat affected by opportunistic macroalgae less than 15 %. There should also be limited (<5%) entrainment of algae in the underlying sediment (all accounting for seasonal variations and fluctuations in growth). Phytoplankton levels should be maintained above a WFD assessment tool score of 0.6, where there is only a minor (a) decline in species richness, and (b) disturbance to the diatom-dinoflagellate succession in the spring bloom compared to reference conditions. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal seagrass beds	Supporting processes: water quality - nutrients (habitat)	Maintain water quality at mean winter dissolved inorganic nitrogen levels where biological indicators of eutrophication (opportunistic macroalgal and phytoplankton blooms) do not affect the integrity of the site and features	N/A	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. These seaweeds can smother the sediment, preventing aeration and causing anoxia (lack of oxygen). This can impact sensitive fish, epifauna and infauna communities. The aim is to seek no further deterioration or improve water quality (Devlin et al., 2007), (Best, 2014). Seagrasses also require a number of inorganic nutrients. In addition to inorganic carbon for photosynthesis (Koch, 2001), the most important are nitrogen and phosphorous. Site-specifics: The risk of eutrophication across the site has been assessed as low using the Environment Agency's Weight of Evidence approach. This takes into account assessments of the Water Framework Directive opportunistic macroalgae and phytoplankton quality elements using the respective assessment tools. Adverse effects to integrity should be avoided. Therefore opportunistic macroalgal levels should be maintained so there is no adverse effect to the feature through limited algal cover (<15%) and low biomass (< 500 g m2) of macroalgal blooms in the available intertidal habitat, with area of available intertidal habitat affected by opportunistic macroalgae less than 15 %. There should also be limited (<5%) entrainment of algae in the underlying sediment (all accounting for seasonal variations and fluctuations in growth). Phytoplankton levels should be maintained above a WFD assessment tool score of 0.6, where there is only a minor (a) decline in species richness, and (b) disturbance to the diatom-dinoflagellate succession in the spring bloom compared to reference conditions (Environment Agency, 2014). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal coarse sediment	Supporting processes: water quality - nutrients (habitat)	Maintain water quality at mean winter dissolved inorganic nitrogen levels where biological indicators of eutrophication (opportunistic macroalgal and phytoplankton blooms) do not affect the integrity of the site and features	N/A	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. These seaweeds can smother the sediment, preventing aeration and causing anoxia (lack of oxygen). This can impact sensitive fish, epifauna and infauna communities. The aim is to seek no further deterioration or improve water quality (Devlin et al., 2007), (Best, 2014). Site-specifics: The risk of eutrophication across the site has been assessed as low using the Environment Agency's Weight of Evidence approach. This takes into account assessments of the Water Framework Directive opportunistic macroalgae and phytoplankton quality elements using the respective assessment tools. Adverse effects to integrity should be avoided. Therefore opportunistic macroalgal levels should be maintained so there is no adverse effect to the feature through limited algal cover (<15%) and low biomass (< 500 g m2) of macroalgal blooms in the available intertidal habitat, with area of available intertidal habitat affected by opportunistic macroalgae less than 15 %. There should also be limited (<5%) entrainment of algae in the underlying sediment (all accounting for seasonal variations and fluctuations in growth). Phytoplankton levels should be maintained above a WFD assessment tool score of 0.6, where there is only a minor (a) decline in species richness, and (b) disturbance to the diatom-dinoflagellate succession in the spring bloom compared to reference conditions (Environment Agency, 2014). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal mixed sediments	Supporting processes: water quality - nutrients (habitat)	Maintain water quality at mean winter dissolved inorganic nitrogen levels where biological indicators of eutrophication (opportunistic macroalgal and phytoplankton blooms) do not affect the integrity of the site and features	N/A	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. These seaweeds can smother the sediment, preventing aeration and causing anoxia (lack of oxygen). This can impact sensitive fish, epifauna and infauna communities. The aim is to seek no further deterioration or improve water quality (Devlin et al., 2007), (Best, 2014). Site-specifics: The risk of eutrophication across the site has been assessed as low using the Environment Agency's Weight of Evidence approach. This takes into account assessments of the Water Framework Directive opportunistic macroalgae and phytoplankton quality elements using the respective assessment tools. Adverse effects to integrity should be avoided. Therefore opportunistic macroalgal levels should be maintained so there is no adverse effect to the feature through limited algal cover (<15%) and low biomass (< 500 g m2) of macroalgal blooms in the available intertidal habitat, with area of available intertidal habitat affected by opportunistic macroalgae less than 15 %. There should also be limited (<5%) entrainment of algae in the underlying sediment (all accounting for seasonal variations and fluctuations in growth). Phytoplankton levels should be maintained above a WFD assessment tool score of 0.6, where there is only a minor (a) decline in species richness, and (b) disturbance to the diatom-dinoflagellate succession in the spring bloom compared to reference conditions(Environment Agency, 2014). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal sand and muddy sand	Supporting processes: water quality - nutrients (habitat)	Maintain water quality at mean winter dissolved inorganic nitrogen levels where biological indicators of eutrophication (opportunistic	N/A	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. These seaweeds can smother the sediment, preventing aeration and causing anoxia (lack of oxygen). This can impact sensitive fish, epifauna and infauna communities. The aim is to seek no further deterioration or improve water quality (Devlin et al., 2007), (Best, 2014). Site-specifics: The risk of eutrophication across the site has been assessed as low using the Environment Agency's Weight of Evidence approach. This takes into account assessments of the Water Framework Directive opportunistic macroalgae and phytoplankton quality elements using the respective assessment tools. Adverse effects to integrity should be avoided. Therefore opportunistic macroalgal levels should be maintained so there is no adverse effect to the feature

		and phytoplankton blooms) do not affect the integrity of the site and features		through limited algal cover (<15%) and low biomass (< 500 g m2) of macroalgal blooms in the available intertidal habitat, with area of available intertidal habitat affected by opportunistic macroalgae less than 15 %. There should also be limited (<5%) entrainment of algae in the underlying sediment (all accounting for seasonal variations and fluctuations in growth). Phytoplankton levels should be maintained above a WFD assessment tool score of 0.6, where there is only a minor (a) decline in species richness, and (b) disturbance to the diatom-dinoflagellate succession in the spring bloom compared to reference conditions. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal mud	Supporting processes: water quality - nutrients (habitat)	Maintain water quality at mean winter dissolved inorganic nitrogen levels where biological indicators of eutrophication (opportunistic macroalgal and phytoplankton blooms) do not affect the integrity of the site and features	N/A	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. These seaweeds can smother the sediment, preventing aeration and causing anoxia (lack of oxygen). This can impact sensitive fish, epifauna and infauna communities. The aim is to seek no further deterioration or improve water quality (Devlin et al., 2007), (Best, 2014). Site-specifics: The risk of eutrophication across the Humber site has been assessed as low using the Environment Agency's Weight of Evidence approach. This takes into account assessments of the Water Framework Directive opportunistic macroalgae and phytoplankton quality elements using the respective assessment tools. Adverse effects to integrity should be avoided. Therefore opportunistic macroalgal levels should be maintained so there is no adverse effect to the feature through limited algal cover (<15%) and low biomass (< 500 g m2) of macroalgal blooms in the available intertidal habitat, with area of available intertidal habitat affected by opportunistic macroalgae less than 15 %. There should also be limited (<5%) entrainment of algae in the underlying sediment (all accounting for seasonal variations and fluctuations in growth). Phytoplankton levels should be maintained above a WFD assessment tool score of 0.6, where there is only a minor (a) decline in species richness, and (b) disturbance to the diatom-dinoflagellate succession in the spring bloom compared to reference conditions(Environment Agency, 2014). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Mudflats and sandflats not covered by seawater at low tide	Supporting processes: water quality - nutrients (habitat)	Maintain water quality at mean winter dissolved inorganic nitrogen levels where biological indicators of eutrophication (opportunistic macroalgal and phytoplankton blooms) do not affect the integrity of the site and features.	N/A	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. These seaweeds can smother the sediment, preventing aeration and causing anoxia (lack of oxygen). This can impact sensitive fish, epifauna and infauna communities. The aim is to seek no further deterioration or improve water quality (Devlin et al., 2007), (Best, 2014). Site-specifics: The risk of eutrophication across the site has been assessed as low using the Environment Agency's Weight of Evidence approach. This takes into account assessments of the Water Framework Directive opportunistic macroalgae and phytoplankton quality elements using the respective assessment tools. Adverse effects to integrity should be avoided. Therefore opportunistic macroalgal levels should be maintained so there is no adverse effect to the feature through limited algal cover (<15%) and low biomass (< 500 g m2) of macroalgal blooms in the available intertidal habitat, with area of available intertidal habitat affected by opportunistic macroalgae less than 15 %. There should also be limited (<5%) entrainment of algae in the underlying sediment (all accounting for seasonal variations and fluctuations in growth). Phytoplankton levels should be maintained above a WFD assessment tool score of 0.6, where there is only a minor (a) decline in species richness, and (b) disturbance to the diatom-dinoflagellate succession in the spring bloom compared to reference conditions. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Coastal lagoons	Supporting processes: water quality - nutrients (habitat)	Maintain water quality to nutrient levels at which biological indicators of eutrophication (opportunistic macroalgal and phytoplankton blooms) do not affect the integrity of the site and features.	N/A	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. This can impact sensitive fish, epifauna and infauna communities. The aim is to seek no further deterioration or improve water quality (Devlin et al., 2007), (Best, 2014). Nutrients in lagoons are mainly introduced through seawater, freshwater and groundwater and run-off from surrounding areas, and can be increased through a variety of land uses and airborne particles (Joint Nature Conservation Committee (JNCC), 2004). Coastal saline lagoons are sinks for organic matter, which is also generated within the lagoons and have a natural tendency to eutrophication. Lagoons show a high level of inherent environmental variability in both space and time which is not a feature of other aquatic habitats (Bamber, 2010). This includes nutrient levels and therefore high nutrient levels may not be a problem, but they can lead to the seasonal growth of algae and phytoplankton (Bamber, 2010), reducing dissolved oxygen availability and potentially affecting sensitive species. Site-specifics: The risk of eutrophication across the site has been assessed as low using the Environment Agency's Weight of Evidence approach. This takes into account assessments of the Water Framework Directive opportunistic macroalgae and phytoplankton quality elements using the respective assessment tools. However, it is thought that there is some nutrient and organic enrichment into Humberston Fitties from the adjacent farmland and caravan site. Adverse effects to integrity should be avoided. Therefore opportunistic macroalgal levels should be maintained so there is no adverse effect to the feature through limited algal cover (<15%) and low biomass (< 500 g m2) of macroalgal blooms in the available habitat, with area of available habitat affected by opportunistic macroalgae less than 15%. There should also be limited (<5%) entrainment of algae in the underlying sediment (all accounting for seasonal variations and fluctuations in growth). Phytoplankton levels should be maintained above a WFD assessment tool score of 0.6, where there is only a minor (a) decline in species richness, and (b) disturbance to the diatom-dinoflagellate succession in the spring bloom compared to reference conditions. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Sea lamprey (Petromyzon marinus)	Supporting processes: water quality - nutrients	Maintain water quality at mean winter dissolved	N/A	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. These seaweeds can smother the sediment, preventing aeration and causing anoxia (lack of oxygen). This can impact sensitive fish, epifauna and infauna communities. The aim is to seek no further deterioration or improve water quality (Devlin et al., 2007), (Best, 2014).

		nitrogen levels where biological indicators of eutrophication (opportunistic macroalgal and phytoplankton blooms) do not affect the integrity of the site and features [avoiding deterioration from e		Barriers to migration can be created as a result of poor water quality and can lead to species that migrate from the sea to spawn in freshwater (anadromous) being excluded from important habitats. There is little published information regarding lamprey sensitivity to DO levels that may be impacted by increased nutrient concentrations. Although both river lamprey and sea lamprey are known to require well-oxygenated gravels for spawning, both species are considered to be sensitive to pollution in estuaries (Maitland, 2003). High concentrations of nutrients can have a negative impact on fish if DO is impacted, as their demand for oxygen is known to increase with increasing temperature. The principal human activity resulting in changes in DO concentrations in the marine environment is the addition of organic matter, mainly from sewage treatment works, diffuse pollution from agriculture and industry, and also activities such as dredging, which may increase levels of suspended sediments. The input of nutrients from mariculture in some Scottish sea-lochs can also reduce DO levels (Best et al., 2007). Dissolved oxygen concentrations need to be considered in conjunction with other water quality variables, which will often operate synergistically on fish physiology, increasing their sensitivity to other contaminants, parasitism and predation. Site-specifics: The risk of eutrophication across the site has been assessed as low using the Environment Agency's Weight of Evidence approach. This takes into account assessments of the Water Framework Directive opportunistic macroalgae and phytoplankton quality elements using the respective assessment tools. Adverse effects to integrity should be avoided. Therefore opportunistic macroalgal levels should be maintained so there is no adverse effect to the feature through limited algal cover (<15%) and low biomass (< 500 g m2) of macroalgal blooms in the available intertidal habitat, with area of available intertidal habitat affected by opportunistic macroalgae less than 15 %. There should also be limited (<5%) entrainment of algae in the underlying sediment (all accounting for seasonal variations and fluctuations in growth). Phytoplankton levels should be maintained above a WFD assessment tool score of 0.6, where there is only a minor (a) decline in species richness, and (b) disturbance to the diatom-dinoflagellate succession in the spring bloom compared to reference conditions. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
River lamprey (Lampetra fluviatilis)	Supporting processes: water quality - nutrients (species)	Maintain water quality at mean winter dissolved inorganic nitrogen levels where biological indicators of eutrophication (opportunistic macroalgal and phytoplankton blooms) do not affect the integrity of the site and features [avoiding deterioration from e	N/A	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. These seaweeds can smother the sediment, preventing aeration and causing anoxia (lack of oxygen). This can impact sensitive fish, epifauna and infauna communities. The aim is to seek no further deterioration or improve water quality (Devlin et al., 2007), (Best, 2014). Barriers to migration can be created as a result of poor water quality and can lead to species that migrate from the sea to spawn in freshwater (anadromous) being excluded from important habitats. There is little published information regarding lamprey sensitivity to DO levels that may be impacted by increased nutrient concentrations. Although both river lamprey and sea lamprey are known to require well-oxygenated gravels for spawning, both species are considered to be sensitive to pollution in estuaries (Maitland, 2003). High concentrations of nutrients can have a negative impact on fish if DO is impacted, as their demand for oxygen is known to increase with increasing temperature. The principal human activity resulting in changes in DO concentrations in the marine environment is the addition of organic matter, mainly from sewage treatment works, diffuse pollution from agriculture and industry, and also activities such as dredging, which may increase levels of suspended sediments. The input of nutrients from mariculture in some Scottish sea-lochs can also reduce DO levels (Best et al., 2007). Dissolved oxygen concentrations need to be considered in conjunction with other water quality variables, which will often operate synergistically on fish physiology, increasing their sensitivity to other contaminants, parasitism and predation. Site-specifics: The risk of eutrophication across the site has been assessed as low using the Environment Agency's Weight of Evidence approach. This takes into account assessments of the Water Framework Directive opportunistic macroalgae and phytoplankton quality elements using the respective assessment tools. Adverse effects to integrity should be avoided. Therefore opportunistic macroalgal levels should be maintained so there is no adverse effect to the feature through limited algal cover (<15%) and low biomass (< 500 g m2) of macroalgal blooms in the available intertidal habitat, with area of available intertidal habitat affected by opportunistic macroalgae less than 15 %. There should also be limited (<5%) entrainment of algae in the underlying sediment (all accounting for seasonal variations and fluctuations in growth). Phytoplankton levels should be maintained above a WFD assessment tool score of 0.6, where there is only a minor (a) decline in species richness, and (b) disturbance to the diatom-dinoflagellate succession in the spring bloom compared to reference conditions. (Environment Agency, 2014) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Grey seal (Halichoerus grypus)	Supporting processes: water quality - nutrients (species)	Maintain water quality at mean winter dissolved inorganic nitrogen levels where biological indicators of eutrophication (opportunistic macroalgal and phytoplankton blooms) do not affect the integrity of the site and features avoiding deterioration from ex	N/A	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. These seaweeds can smother the sediment, preventing aeration and causing anoxia (lack of oxygen). This can impact sensitive fish, epifauna and infauna communities. The aim is to seek no further deterioration or improve water quality (Devlin et al., 2007), (Best, 2014). The prey species of the grey seal may be impacted by increased nutrients. Site-specifics: The risk of eutrophication across the site has been assessed as low using the Environment Agency's Weight of Evidence approach. This takes into account assessments of the Water Framework Directive opportunistic macroalgae and phytoplankton quality elements using the respective assessment tools. Adverse effects to integrity should be avoided. Therefore opportunistic macroalgal levels should be maintained so there is no adverse effect to the feature through limited algal cover (<15%) and low biomass (< 500 g m2) of macroalgal blooms in the available intertidal habitat, with area of available intertidal habitat affected by opportunistic macroalgae less than 15 %. There should also be limited (<5%) entrainment of algae in the underlying sediment (all accounting for seasonal variations and fluctuations in growth). Phytoplankton levels should be maintained above a WFD assessment tool score of 0.6, where there is only a minor (a) decline in species richness, and (b) disturbance to the diatom-dinoflagellate succession in the spring bloom compared to reference conditions. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.

Coastal lagoons	Supporting processes: water quality - turbidity (habitat)	Maintain natural levels of turbidity (eg concentrations of suspended sediment, plankton and other material) across the habitat.	N/A	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter washed into the sea from land sources. Lagoons show a high level of inherent environmental variability in both space and time which is not a feature of other aquatic habitats, including turbidity (Bamber, 2010). In coastal environments turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (e.g. coastal development) factors. However lagoons are generally sheltered habitats, with associated low levels of turbidity. Prolonged changes in turbidity may influence the amount of light penetration, affecting the primary production and nutrient levels of the habitat's associated communities. Water clarity can be a useful indicator in lagoons. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe (Joint Nature Conservation Committee (JNCC), 2004). Site-specifics: Characteristically, the estuary has a high background suspended sediment concentrations (SSC). However, there is currently no specific data for the coastal lagoons.(Allen et al., 2003) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Mudflats and sandflats not covered by seawater at low tide	Supporting processes: water quality - turbidity (habitat)	Maintain natural levels of turbidity (eg concentrations of suspended sediment, plankton and other material) across the habitat.	N/A	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter washed into the sea from land sources. In coastal environments turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg coastal development) factors. Prolonged changes in turbidity may influence the amount of light reaching the seabed, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe. A prolonged increase in turbidity is indicative of an increase in suspended particulates. This has a number of implications for the marine environment, such as affecting fish health, clogging the filtering organs of suspension feeding animals and affecting seabed sedimentation rates (Elliott et al., 1998). Site-specifics: Characteristically, the estuary has a high background suspended sediment concentration (SSC). This has been attributed to the macro tidal nature of the Humber combined with the dominance of muddy sediments. It has been estimated that up to 1.26 million tonnes of sediment may be in the water column, with around 170 tonnes deposited in the estuary on each tide, and 150 exported to the sea. Concentrations of suspended sediment are subject to natural variability, due to the influence of the tide, waves and seasonal changes, with the highest concentrations in the Estuary occurring in winter. SSC levels also vary along the Estuary, with concentrations above Hull being twice as high as those found downstream.(Allen et al., 2003) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Estuaries	Supporting processes: water quality - turbidity (habitat)	Maintain natural levels of turbidity (eg concentrations of suspended sediment, plankton and other material) across the habitat.	N/A	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter washed into the sea from land sources. In coastal environments turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg coastal development) factors. Prolonged changes in turbidity may influence the amount of light reaching the seabed, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe (Joint Nature Conservation Committee (JNCC), 2004), (Hiscock et al., 2006), (Environment Agency (EA), 2011), (Irving, 2012), (Department for Environment Food and Rural Affairs (Defra), 2010). Site-specifics: Characteristically, the estuary has high background suspended sediment concentrations (SSC). This has been attributed to the macro tidal nature of the Humber combined with the dominance of muddy sediments. It has been estimated that up to 1.26 million tonnes of sediment may be in the water column, with around 170 tonnes deposited in the estuary on each tide, and 150 exported to the sea . Concentrations of suspended sediment are subject to natural variability, due to the influence of the tide, waves and seasonal changes, with the highest concentrations in the Estuary occurring in winter. SSC levels also vary along the estuary, with concentrations above Hull being twice as high as those found downstream . (Allen et al., 2003), (Hemingway et al., 2008), (ABP Marine Environmental Research Ltd (ABPmer), 2011) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal mud	Supporting processes: water quality - turbidity (habitat)	Maintain natural levels of turbidity (eg concentrations of suspended sediment, plankton and other material) across the habitat.	N/A	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter washed into the sea from land sources. In coastal environments turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg coastal development) factors. Prolonged changes in turbidity may influence the amount of light reaching the seabed, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe. A prolonged increase in turbidity is indicative of an increase in suspended particulates. This has a number of implications for the marine environment, such as affecting fish health, clogging the filtering organs of suspension feeding animals and affecting seabed sedimentation rates (Elliott et al., 1998). Site-specifics: Characteristically, the estuary has a high background suspended sediment concentrations (SSC). This has been attributed to the macro tidal nature of the Humber combined with the dominance of muddy sediments. It has been estimated that up to 1.26 million tonnes of sediment may be in the water column, with around 170 tonnes deposited in the estuary on each tide, and 150 exported to the sea (Allen et al., 2003). Concentrations of suspended sediment are subject to natural variability, due to the influence of the tide, waves and seasonal changes, with the highest concentrations in the Estuary occurring in winter.

				downstream. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal sand and muddy sand	Supporting processes: water quality - turbidity (habitat)	Maintain natural levels of turbidity (eg concentrations of suspended sediment, plankton and other material) across the habitat.	N/A	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter washed into the sea from land sources. In coastal environments turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg coastal development) factors. Prolonged changes in turbidity may influence the amount of light reaching the seabed, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe. A prolonged increase in turbidity is indicative of an increase in suspended particulates. This has a number of implications for the marine environment, such as affecting fish health, clogging the filtering organs of suspension feeding animals and affecting seabed sedimentation rates (Elliott et al., 1998). Site-specifics: Characteristically, the estuary has a high background suspended sediment concentrations (SSC). This has been attributed to the macro tidal nature of the Humber combined with the dominance of muddy sediments. It has been estimated that up to 1.26 million tonnes of sediment may be in the water column, with around 170 tonnes deposited in the estuary on each tide, and 150 exported to the sea. Concentrations of suspended sediment are subject to natural variability, due to the influence of the tide, waves and seasonal changes, with the highest concentrations in the Estuary occurring in winter. SSC levels also vary along the Estuary, with concentrations above Hull being twice as high as those found down-estuary. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal mixed sediments	Supporting processes: water quality - turbidity (habitat)	Maintain natural levels of turbidity (eg concentrations of suspended sediment, plankton and other material) across the habitat.	N/A	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter washed into the sea from land sources. In coastal environments turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg coastal development) factors. Prolonged changes in turbidity may influence the amount of light reaching the seabed, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe. A prolonged increase in turbidity is indicative of an increase in suspended particulates. This has a number of implications for the marine environment, such as affecting fish health, clogging the filtering organs of suspension feeding animals and affecting seabed sedimentation rates (Elliott et al., 1998). Site-specifics: Characteristically, the estuary has a high background suspended sediment concentrations (SSC). This has been attributed to the macro tidal nature of the Humber combined with the dominance of muddy sediments. It has been estimated that up to 1.26 million tonnes of sediment may be in the water column, with around 170 tonnes deposited in the estuary on each tide, and 150 exported to the sea. Concentrations of suspended sediment are subject to natural variability, due to the influence of the tide, waves and seasonal changes, with the highest concentrations in the Estuary occurring in winter. SSC levels also vary along the Estuary, with concentrations above Hull being twice as high as those found down-estuary(Allen et al., 2003). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal coarse sediment	Supporting processes: water quality - turbidity (habitat)	Maintain natural levels of turbidity (eg concentrations of suspended sediment, plankton and other material) across the habitat.	N/A	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter washed into the sea from land sources. In coastal environments turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg coastal development) factors. Prolonged changes in turbidity may influence the amount of light reaching the seabed, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe. A prolonged increase in turbidity is indicative of an increase in suspended particulates. This has a number of implications for the marine environment, such as affecting fish health, clogging the filtering organs of suspension feeding animals and affecting seabed sedimentation rates (Elliott et al., 1998). Site-specifics: Characteristically, the estuary has high background suspended sediment concentrations (SSC). This has been attributed to the macro tidal nature of the Humber combined with the dominance of muddy sediments. It has been estimated that up to 1.26 million tonnes of sediment may be in the water column, with around 170 tonnes deposited in the estuary on each tide, and 150 exported to the sea (Allen et al., 2003). Concentrations of suspended sediment are subject to natural variability, due to the influence of the tide, waves and seasonal changes, with the highest concentrations in the Estuary occurring in winter. SSC levels also vary along the estuary, with concentrations above Hull being twice as high as those found downstream (Hemingway et al., 2008); (ABP Marine Environmental Research Ltd (ABPmer), 2011). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Intertidal seagrass beds	Supporting processes: water quality - turbidity (habitat)	Maintain natural levels of turbidity (eg concentrations of suspended sediment, plankton and other material) across the	N/A	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter washed into the sea from land sources. In coastal environments turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg coastal development) factors. Prolonged changes in turbidity may influence the amount of light reaching the seabed, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe (Jackson et al., 2013), (Hemminga and Duarte, 2000). Site-specifics:

				Characteristically, the estuary has a high background suspended sediment concentrations (SSC). This has been attributed to the macro tidal nature of the Humber combined with the dominance of muddy sediments. It has been estimated that up to 1.26 million tonnes of sediment may be in the water column, with around 170 tonnes deposited in the estuary on each tide, and 150 exported to the sea. Concentrations of suspended sediment are subject to natural variability, due to the influence of the tide, waves and seasonal changes, with the highest concentrations in the estuary occurring in winter. (Allen et al., 2003);(Hemingway et al., 2008);(ABP Marine Environmental Research Ltd (ABPmer), 2011) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal mixed sediments	Supporting processes: water quality - turbidity (habitat)	Maintain natural levels of turbidity (eg concentrations of suspended sediment, plankton and other material) across the habitat.	N/A	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter washed into the sea from land sources. In coastal environments turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg coastal development) factors. Prolonged changes in turbidity may influence the amount of light reaching the seabed, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe. A prolonged increase in turbidity is indicative of an increase in suspended particulates. This has a number of implications for the marine environment, such as affecting fish health, clogging the filtering organs of suspension feeding animals and affecting seabed sedimentation rates (Elliott et al., 1998). Site-specifics: Characteristically, the estuary has high background suspended sediment concentrations (SSC). This has been attributed to the macro tidal nature of the Humber combined with the dominance of muddy sediments (ABP Marine Environmental Research Ltd (ABPmer), 2011). It has been estimated that up to 1.26 million tonnes of sediment may be in the water column, with around 170 tonnes deposited in the estuary on each tide, and 150 exported to the sea (Allen et al., 2003). Concentrations of suspended sediment are subject to natural variability, due to the influence of the tide, waves and seasonal changes, with the highest concentrations in the Estuary occurring in winter. SSC levels also vary along the estuary, with concentrations above Hull being twice as high as those found downstream (ABP Marine Environmental Research Ltd (ABPmer), 2011). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Sandbanks which are slightly covered by sea water all the time	Supporting processes: water quality - turbidity (habitat)	Maintain natural levels of turbidity (eg concentrations of suspended sediment, plankton and other material) across the habitat.	N/A	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter washed into the sea from land sources. In coastal environments turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg coastal development) factors. Prolonged changes in turbidity may influence the amount of light reaching the seabed, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe. A prolonged increase in turbidity is indicative of an increase in suspended particulates. This has a number of implications for the marine environment, such as affecting fish health, clogging the filtering organs of suspension feeding animals and affecting seabed sedimentation rates (Elliott et al., 1998). Site-specifics: Characteristically, the estuary has high background suspended sediment concentrations (SSC). This has been attributed to the macro tidal nature of the Humber combined with the dominance of muddy sediments (ABP Marine Environmental Research Ltd (ABPmer), 2011). It has been estimated that up to 1.26 million tonnes of sediment may be in the water column, with around 170 tonnes deposited in the estuary on each tide, and 150 exported to the sea (Allen et al., 2003). Concentrations of suspended sediment are subject to natural variability, due to the influence of the tide, waves and seasonal changes, with the highest concentrations in the Estuary occurring in winter. SSC levels also vary along the estuary, with concentrations above Hull being twice as high as those found downstream (ABP Marine Environmental Research Ltd (ABPmer), 2011). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Subtidal mud	Supporting processes: water quality - turbidity (habitat)	Maintain natural levels of turbidity (eg concentrations of suspended sediment, plankton and other material) across the habitat.	N/A	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter washed into the sea from land sources. In coastal environments turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg coastal development) factors. Prolonged changes in turbidity may influence the amount of light reaching the seabed, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe. A prolonged increase in turbidity is indicative of an increase in suspended particulates. This has a number of implications for the marine environment, such as affecting fish health, clogging the filtering organs of suspension feeding animals and affecting seabed sedimentation rates (Elliott et al., 1998). Site-specifics: Characteristically, the estuary has high background suspended sediment concentrations (SSC). This has been attributed to the macro tidal nature of the Humber combined with the dominance of muddy sediments (ABP Marine Environmental Research Ltd (ABPmer), 2011). It has been estimated that up to 1.26 million tonnes of sediment may be in the water column, with around 170 tonnes deposited in the estuary on each tide, and 150 exported to the sea (Allen et al., 2003). Concentrations of suspended sediment are subject to natural variability, due to the influence of the tide, waves and seasonal changes, with the highest concentrations in the Estuary occurring in winter. SSC levels also vary along the estuary, with concentrations above Hull being twice as high as those found downstream (ABP Marine Environmental Research Ltd (ABPmer), 2011).

				are occurring / have occurred on the site.
Subtidal sand	Supporting processes: water quality - turbidity (habitat)	Maintain natural levels of turbidity (eg concentrations of suspended sediment, plankton and other material) across the habitat.	N/A	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter washed into the sea from land sources. In coastal environments turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg coastal development) factors. Prolonged changes in turbidity may influence the amount of light reaching the seabed, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe. A prolonged increase in turbidity is indicative of an increase in suspended particulates. This has a number of implications for the marine environment, such as affecting fish health, clogging the filtering organs of suspension feeding animals and affecting seabed sedimentation rates (Elliott et al., 1998). Site-specifics: Characteristically, the estuary has high background suspended sediment concentrations (SSC). This has been attributed to the macro tidal nature of the Humber combined with the dominance of muddy sediments. It has been estimated that up to 1.26 million tonnes of sediment may be in the water column, with around 170 tonnes deposited in the estuary on each tide, and 150 exported to the sea. Concentrations of suspended sediment are subject to natural variability, due to the influence of the tide, waves and seasonal changes, with the highest concentrations in the Estuary occurring in winter. SSC levels also vary along the estuary, with concentrations above Hull being twice as high as those found downstream. (Allen et al., 2003); (Hemingway et al., 2008); (ABP Marine Environmental Research Ltd (ABPmer), 2011) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Sea lamprey (Petromyzon marinus)	Supporting processes: water quality - turbidity (species)	Maintain natural levels of turbidity (eg concentrations of suspended sediment, plankton and other material) in areas where this species is, or could be, present.	N/A	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution, or other matter washed into the sea from land sources. In coastal environments turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg coastal development) factors. Prolonged increases in turbidity could impact the ability of the species to feed and respire. Site-specifics: Characteristically, the estuary has a high background suspended sediment concentrations (SSC). This has been attributed to the macro tidal nature of the Humber combined with the dominance of muddy sediments. It has been estimated that up to 1.26 million tonnes of sediment may be in the water column, with around 170 tonnes deposited in the estuary on each tide, and 150 exported to the sea. Concentrations of suspended sediment are subject to natural variability, due to the influence of the tide, waves and seasonal changes, with the highest concentrations in the Estuary occurring in winter. SSC levels also vary along the Estuary, with concentrations above Hull being twice as high as those found downstream. (Allen et al., 2003), (Hemingway et al., 2008), (ABP Marine Environmental Research Ltd (ABPmer), 2011) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Grey seal (Halichoerus grypus)	Supporting processes: water quality - turbidity (species)	Maintain natural levels of turbidity (eg concentrations of suspended sediment, plankton and other material) in areas where this species is, or could be, present.	N/A	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter washed into the sea from land sources. In coastal environments turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg coastal development) factors. Prolonged increases in turbidity could affect the ability of the species to feed and respire. Seals are able to forage in areas of high turbidity / poor visibility, however, prey species may be affected (Joint Nature Conservation Committee (JNCC), 2005). Site-specifics: Characteristically, the estuary has a high background suspended sediment concentrations (SSC). This has been attributed to the macro tidal nature of the Humber combined with the dominance of muddy sediments. It has been estimated that up to 1.26 million tonnes of sediment may be in the water column, with around 170 tonnes deposited in the estuary on each tide, and 150 exported to the sea. Concentrations of suspended sediment are subject to natural variability, due to the influence of the tide, waves and seasonal changes, with the highest concentrations in the Estuary occurring in winter. SSC levels also vary along the Estuary, with concentrations above Hull being twice as high as those found down-estuary. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
River lamprey (Lampetra fluviatilis)	Supporting processes: water quality - turbidity (species)	Maintain natural levels of turbidity (eg concentrations of suspended sediment, plankton and other material) in areas where this species is, or could be, present.	N/A	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution, or other matter washed into the sea from land sources. In coastal environments turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg coastal development) factors. Prolonged increases in turbidity could impact the ability of the species to feed and respire. Site-specifics: Characteristically, the estuary has a high background suspended sediment concentrations (SSC). This has been attributed to the macro tidal nature of the Humber combined with the dominance of muddy sediments. It has been estimated that up to 1.26 million tonnes of sediment may be in the water column, with around 170 tonnes deposited in the estuary on each tide, and 150 exported to the sea. Concentrations of suspended sediment are subject to natural variability, due to the influence of the tide, waves and seasonal changes, with the highest concentrations in the Estuary occurring in winter. SSC levels also vary along the Estuary, with concentrations above Hull being twice as high as those found downstream.

				(Allen et al., 2003), (Hemingway et al., 2008), (ABP Marine Environmental Research Ltd (ABPmer), 2011) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	Supporting processes: water quality (habitat)	Where the feature is dependent on estuarine water, ensure water quality and quantity is maintained to a standard that provides the necessary conditions to support the feature.	N/A	For many SAC features that are dependent on wetland habitats supported by surface and / or groundwater, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives, but in some cases more stringent standards may be needed. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC. (European Commission (EC), 2011) Site-specifics: The Environment Agency undertakes routine water quality monitoring within the Humber Estuary. The Humber Estuary SAC sits within four WFD water bodies: Humber Upper, Humber Middle, Humber Lower, Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the SAC have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body fails for WFD due to a drop in DO levels. However, this does not appear to affect the saltmarsh features as the DO SAG is located away from significant areas of saltmarsh and reedbeds.(Environment Agency, 2014) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Embryonic shifting dunes	Supporting processes: water quality (habitat)	Where the feature is dependent on surface water and / or groundwater, ensure water quality and quantity is maintained to a standard that provides the necessary conditions to support the feature.	N/A	For many SAC features that are dependent on wetland habitats supported by surface and / or groundwater, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives, but in some cases more stringent standards may be needed. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC. (European Commission (EC), 2011) Site-specifics: The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Fixed dunes with herbaceous vegetation ("Grey dunes")	Supporting processes: water quality (habitat)	Where the feature is dependent on surface water and / or groundwater, ensure water quality and quantity is maintained to a standard which provides the necessary conditions to support the feature.	N/A	For many SAC features that are dependent on wetland habitats supported by surface and / or groundwater, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives, but in some cases more stringent standards may be needed. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC. (European Commission (EC), 2011) Site-specifics: Detailed site specific information on this attribute will be available after the publication of the 2019 sand dune report. This report is expected in autumn 2020. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Salicornia and other annuals colonising mud and sand	Supporting processes: water quality (habitat)	Where the feature is dependent on surface water and / or groundwater, ensure water quality and quantity is maintained to a standard that provides the necessary conditions to support the feature	N/A	For many SAC features that are dependent on wetland habitats supported by surface and / or groundwater, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases more stringent standards may be needed. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC. (European Commission (EC), 2011) Site-specifics: The Environment Agency undertake routine water quality monitoring within the Humber Estuary. The Humber Estuary SAC sits within four WFD water bodies: Humber Upper, Humber Middle, Humber Lower, Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the SAC have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body fails for WFD due to a drop in DO levels. However, this does not appear to affect the saltmarsh features as the DO SAG is located away from large areas of saltmarsh and reedbeds. (Environment Agency, 2014) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Dunes with Hippophae rhamnoides	Supporting processes: water quality (habitat)	Where the feature is dependent on surface water and / or	N/A	For many SAC features that are dependent on wetland habitats supported by surface and / or groundwater, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives, but in

		ensure water quality and quantity is maintained to a standard that provides the necessary conditions to support the feature.		establish appropriate water quality standards for the SAC. Site-specifics: The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Shifting dunes along the shoreline with Ammophila arenaria ("White dunes")	Supporting processes: water quality (habitat)	Where the feature is dependent on surface water and / or groundwater, ensure water quality and quantity is maintained to a standard that provides the necessary conditions to support the feature.	N/A	For many SAC features that are dependent on wetland habitats supported by surface and / or groundwater, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases more stringent standards may be needed. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC. (European Commission (EC), 2011) Site-specifics: The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.

See further guidance on how to undertake an HRA for a plan or project on a European site.

These tables bring together the findings of the best available scientific evidence which may be updated or supplemented in further publications from Natural England and other sources. You may decide to use other additional sources of information.

These tables do not give advice about SSSI features or other legally protected species which may also be present within the European site.

European Site Conservation Objectives for Humber Estuary Special Protection Area Site Code: UK9006111

With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified (the 'Qualifying Features' listed below), and subject to natural change;

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.**

This document should be read in conjunction with the accompanying *Supplementary Advice* document, which provides more detailed advice and information to enable the application and achievement of the Objectives set out above.

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

This is a European Marine Site

This SPA is a part of the Humber Estuary European Marine Site (EMS). These Conservation Objectives should be used in conjunction with the Conservation Advice document for the EMS. Natural England's formal Conservation Advice for European Marine Sites can be found via GOV.UK.

Explanatory Notes: European Site Conservation Objectives

These Conservation Objectives are those referred to in the Conservation of Habitats and Species Regulations 2017 (as amended) ('the Habitats Regulations'). They must be considered when a competent authority is required to make a 'Habitats Regulations Assessment' including an Appropriate Assessment, under the relevant parts of this legislation.

These Conservation Objectives, and the accompanying Supplementary Advice (where this is available), will also provide a framework to inform the management of the European Site and the prevention of deterioration of habitats and significant disturbance of its qualifying features

These Conservation Objectives are set for each bird feature for a Special Protection Area (SPA).

Where these objectives are being met, the site will be considered to exhibit a high degree of integrity and to be contributing to achieving the aims of the Wild Birds Directive.

Publication date: 21 February 2019 (version 4). This document updates and replaces an earlier version dated 30 June 2014 to reflect the consolidation of the Habitats Regulations in 2017.

Humber Estuary SPA

Last updated: 13th September 2019

Supplementary advice

The Supplementary Advice on Conservation Objectives (SACOs) present attributes which are ecological characteristics or requirements of the classified species within a site. The listed attributes are considered to be those which best describe the site's ecological integrity and which if safeguarded will enable achievement of the Conservation Objectives.

Conservation Objectives relating to extent and distribution of habitat and population abundance are reflected in single attributes within the Supplementary Advice. Structure and function of habitats, and supporting processes for those habitats, are reflected in multiple attributes describing integrity of these ecological characteristics.

The Conservation Objective relating to the distribution of qualifying features (individual species or assemblages) may apply to most or all of the attributes listed in the SACOs and should be considered against them. Ensuring integrity of attributes relating to supporting habitats and processes should allow birds to distribute themselves optimally within (and, sometimes, outside) the SPA boundary. This is perhaps particularly relevant for food availability; extent and distribution of supporting habitat; quality of supporting habitat; predation; and disturbance caused by human activity.

Attributes have a target which is either quantified or qualified depending on the available evidence. The target identifies as far as possible the desired state to be achieved for the attribute. In many cases, the attribute targets show if the current objective is to either 'maintain' or 'restore' the attribute. The targets given for each attribute do not represent thresholds to assess the significance of any given impact in Habitats Regulation Assessments. You will need to assess this on a case-by-case basis using the most current information available.

Where there is no evidence to determine a marine feature's condition, a vulnerability assessment, which includes sensitivity and exposure information for features and activities in a site, has been used as a proxy for condition. Evidence used in preparing the SACO has been cited with hyperlinks included where possible. Where references have not been provided, Natural England has applied ecological knowledge and expert judgement.

Some, but not all, of these attributes can also be used for regular monitoring of the condition of the classified features. The attributes selected for monitoring the features, and the standards used to assess their condition, are listed in separate monitoring documents, which will be available from Natural England. As condition assessment information becomes available, the conservation advice package will be reviewed accordingly.

When to use

You should use this information, along with the conservation objectives and case-specific advice issued by Natural England when developing, proposing or assessing an activity, plan or project that may affect the site.

Any proposals or operations which may affect the site or its features should be designed so they do not adversely affect any of the attributes in the SACO or achievement of the conservation objectives.

Features:
Choose one or more features and/or their sub-features below by selecting the applicable boxes in the tree. This will show the relevant targets. Where a feature has sub-features this will be indicated with a greyed out triangle below, which can be expanded.

- ☑ Avocet (Recurvirostra avosetta), Breeding
- ☑ Avocet (Recurvirostra avosetta), Non-breeding
- ☑ Bar-tailed godwit (Limosa lapponica), Non-breeding
- ☑ Bittern (Botaurus stellaris), Breeding
- ☑ Bittern (Botaurus stellaris), Non-breeding
- ☑ Black-tailed godwit (Limosa limosa islandica), Non-breeding
- ☑ Dunlin (Calidris alpina alpina), Non-breeding
- ☑ Golden plover (Pluvialis apricaria), Non-breeding
- ☑ Hen harrier (Circus cyaneus), Non-breeding
- ☑ Knot (Calidris canutus), Non-breeding
- ☑ Little tern (Sternula albifrons), Breeding
- ☑ Marsh harrier (Circus aeruginosus), Breeding
- ☑ Redshank (Tringa totanus), Non-breeding
- ☑ Ruff (Calidris pugnax), Non-breeding
- ☑ Shelduck (Tadorna tadorna), Non-breeding
- ☑ Waterbird assemblage, Non-breeding

Reset | Select all | Show attributes and targets for selected features

Attributes:
You can filter to show only targets for certain attributes by selecting one or more attributes from the list below (use ctrl click to select multiple). Note that only attributes for the features you have chosen are shown.

Assemblage of species: abundance
Assemblage of species: diversity
Breeding population: abundance
Connectivity with supporting habitats
Disturbance caused by human activity
Non-breeding population: abundance

Feature target

'Maintain' targets do not preclude the need for management, now or in the future, to avoid a significant risk of damage or deterioration to the feature. The supporting and/or explanatory notes in the SACOs set out why the target was chosen and any relevant site based supporting information. This is based on the best available information, including that gathered during monitoring of the feature's current condition.

Feature/Subfeature name	Attribute	Target	Season	Supporting notes
Waterbird assemblage, Non-breeding	Assemblage of species: abundance	Restore the overall abundance of the assemblage to a level which is above 153,934 whilst avoiding deterioration from its current level as indicated by the latest peak mean count or	Non-breeding (winter and/or passage) season	This will sustain the assemblage population and contribute to viable local, national and bio-geographic populations of the component species. Assemblage abundance is the annual sum of peak counts of each assemblage component species (at any time of year, though peaks tend to occur in the non-breeding season), unless otherwise stated. Five year peak means are the average of these annual peak sums for the relevant period. An assemblage component is any waterbird[1] using the site. Due to the dynamic nature of assemblage component populations this target may be subject to periodic review. However, the target assemblage abundance is considered to be the minimum standard for conservation or restoration measures and therefore where at any time the assemblage abundance is greater than the target value given, any measure or impact assessment should take account of the greater

				abundance. This meets with the obligation to avoid deterioration of a European site or significant disturbance of the species for which the site is classified, and seeks to avoid plans or projects giving rise to the risk of such deterioration or disturbance. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account. Whether to maintain or restore depends on the overall assemblage abundance (i.e. the peak mean derived from the summed peak counts of components), and should only change in response to this value, excepting natural change. Fluctuations of individual assemblage component species alone should not necessarily change the target. Assemblage abundance is linked to the demographic rates of assemblage components, including survival (dependent on factors such as body condition which influences the ability to breed or make foraging and / or migration movements) and breeding productivity. Adverse anthropogenic impacts on either of these rates may precede changes in population abundance (e.g. by changing proportions of birds of different ages) but eventually may negatively affect abundance. These rates can be measured / estimated (particularly for the main or named components) to inform judgements of likely changes to the assemblage and associated impacts on abundance targets. Whilst we will endeavour to keep these values as up to date as possible, local Natural England staff can advise whether the figures stated are the best available.[1]Many SPA citations omitted gulls and terns from their assemblage totals. Assessments of abundance should be consistent with the waterbirds included in citation calculations (often limited to waders and wildfowl). --- Site-specifics: The figure provided is based on the count period from 1996/97 – 2000/01. Since classification there has been an overall decline in the numbers of non-breeding waterbirds on the Humber Estuary. A recent 5 year mean peak for the assemblage of 137,832 (2013/14-2017/18) was an improvement on previous count periods but not sufficent to change the target to maintain. The assemblage was as large as 175,768 in the mid-90s and therefore the site's ability to host these higher numbes in the future should not be affected. In addition, comparisons with national and regional trends indicate that site-specific factors may be affecting four species that make substantial numeric contributions to the waterbird assemblage: redshank, wigeon, ringed plover and lapwing (Cook et al., 2013);(Austin et al., 2014). N.B - Natural England are currently reviewing assembages as features so this target may be subject to change. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Waterbird assemblage, Non-breeding	Assemblage of species: diversity	Maintain the species diversity of the bird assemblage.	Non-breeding (winter and/or passage) season	This target is required to ensure the bird assemblage reflects the diversity of species the SPA supports. Assemblage diversity is a product of species richness (the number of different species present), abundance (population size of each assemblage component species) and relative 'importance' (an assessment of the conservation status of each assemblage component, described below). Each component makes a different contribution to the diversity of the assemblage, and changes to some components may be considered to affect diversity more than others. Negative changes to small numbers of relatively important assemblage components may have a similar overall effect to negative changes in larger numbers of less important components. To meet the target, the populations of each of the 'main component' assemblage species to be maintained or restored are i) those present in nationally important numbers (≥1% GB population); ii) migratory species present in internationally important numbers (≥1% biogeographic population); iii) those species comprising ≥2,000 individuals (≥10% of the minimum qualifying threshold for an internationally-important assemblage); and iv) 'named components' otherwise listed on the SPA citation. In addition to the main components, other components should be considered as these contribute collectively to the assemblage diversity, in particular proportionally abundant populations of species of conservation importance. Examples are those red-listed as Birds of Conservation Concern and / or those listed on Sections 41/42 of the NERC Act 2006 (UK Government, 2006). The species composition of an assemblage may change over time. However, to meet this target, the total number of all native waterbird species contributing to the assemblage diversity should not decline significantly. (Eaton et al., 2009) --- Site-specifics: In addition to comprising an exceptionally large numbers of birds, an assemblage of species will often be of value for the overall variety or diversity of different species which are represented and which contribute to the size of the assemblage. This diversity is a product of both species richness (the overall number of different species represented in the assemblage) and the abundance of those species within the assemblage. Maintaining this overall diversity is considered an important element of achieving the SPA Conservation Objective. Conservation priorities should focus on those species which make the greatest relative contribution to the non-breeding SPA assemblage i.e. those species present in either nationally important numbers or those comprising 2,000 or more individuals (i.e.10% of the minimum qualifying threshold for an internationally-important assemblage) where present in less than nationally important numbers. However, impact assessments should consider all elements of the assemblage, and take into account each species' site-specific contribution to the assemblage, and their status (including trends) on the site. Please seek guidance from a Natural England adviser regarding the assessment of impacts on the waterbird assemblage. In most instances, those species present in nationally important numbers or over 2000 individuals are listed on the citation . However, other species may also meet these criteria as waterbird populations change over time. The current status of the component species of an assemblage can be identified via BTO WeBS data: href="'https://app.bto.org/webs-reporting/'' The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Avocet (Recurvirostra avosetta)	Breeding population: abundance	Maintain the size of the breeding population at a level	Breeding (summer) season	This will sustain the site's population and contribute to a viable local, national and bio-geographic population. Due to the mobility of this feature and the dynamic nature of population change, the target-

Breeding		which is above 233 breeding pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.		conservation / restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size has significantly increased as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally at least 10 years). The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is classified, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account. Maintaining or restoring bird abundance depends on the suitability of the site. However, factors affecting suitability can also determine other demographic rates of birds using the site including survival (dependent on factors such as body condition which influences the ability to breed or make foraging and / or migration movements) and breeding productivity. Adverse human impacts on either of these rates may precede changes in population abundance (eg by changing proportions of birds of different ages) but eventually may negatively affect abundance. These rates can be measured / estimated to inform judgements of likely impacts on abundance targets. Unless otherwise stated, the population size will be that measured using standard methods such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of natural fluctuations and margins of error during data collection. While we will endeavour to keep these values as up to date as possible, local Natural England staff can advise whether the figures stated are the best available. --- Site-specifics: The figure provided is based on the count period from 2010-2015 and is a 5 year mean. There has been an overall increase in numbers of breeding avocet for this site, with a peak of 298 breeding pairs recorded in 2012. The site's ability to host this peak, or higher numbers recorded subsequently, should not be affected. The most recent population figures for this feature on this SPA can be obtained by contacting a Natural England Adviser. Breeding numbers vary greatly from year to year and predation, adverse weather conditions and flooding can result in the loss of young and therefore impact on the success of the breeding colonies. For example in 2018 a significant decline in numbers was observed after morphological changes led to increased predation in a formally isolated area. Management action is being taken by the RSPB and other agencies on the Humber to provide breeding habitat in other areas. (Catley, 2010);(Catley, 2008); (Catley, 2009); (Short, 2004 - 2010);(Rare Breeding Birds Panel (RBBP), 2014) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Breeding	Breeding population: abundance	Maintain the size of the breeding population at a level which is at or above 7 booming males, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	Breeding (summer) season	This will sustain the site's population and contribute to a viable local, national and bio-geographic population. Due to the mobility of this feature and the dynamic nature of population change, the target-value given for the population size of this feature is considered to be the minimum standard for conservation / restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size has significantly increased as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally at least 10 years). The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is classified, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account. Maintaining or restoring bird abundance depends on the suitability of the site. However, factors affecting suitability can also determine other demographic rates of birds using the site including survival (dependent on factors such as body condition which influences the ability to breed or make foraging and / or migration movements) and breeding productivity. Adverse human impacts on either of these rates may precede changes in population abundance (eg by changing proportions of birds of different ages) but eventually may negatively affect abundance. These rates can be measured / estimated to inform judgements of likely impacts on abundance targets. Unless otherwise stated, the population size will be that measured using standard methods such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of natural fluctuations and margins of error during data collection. While we will endeavour to keep these values as up to date as possible, local Natural England staff can advise whether the figures stated are the best available. --- Site-specifics: The figure provided is based on the cut period 2008 - 2017 and is an average; it should be noted that the population fluctuates and a peak of 9 booming males were recorded in 2009. The site's ability to host this peak, or higher numbers recorded subsequently, should not be affected. The most recent population figures for this feature on this SPA can be obtained by contacting a Natural England Adviser (Rare Breeding Birds Panel, 2019). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Marsh harrier (Circus aeruginosus), Breeding	Breeding population: abundance	Maintain the size of the non-breeding population at a level which is above 21	Breeding (summer) season	This will sustain the site's population and contribute to a viable local, national and bio-geographic population. Due to the mobility of this feature and the dynamic nature of population change, the target-value given for the population size of this feature is considered to be the minimum standard for

		whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.		evidence to show that a population's size has significantly increased as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally at least 10 years). The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is classified, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account. Maintaining or restoring bird abundance depends on the suitability of the site. However, factors affecting suitability can also determine other demographic rates of birds using the site including survival (dependent on factors such as body condition which influences the ability to breed or make foraging and / or migration movements) and breeding productivity. Adverse human impacts on either of these rates may precede changes in population abundance (eg by changing proportions of birds of different ages) but eventually may negatively affect abundance. These rates can be measured / estimated to inform judgements of likely impacts on abundance targets. Unless otherwise stated, the population size will be that measured using standard methods such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of natural fluctuations and margins of error during data collection. While we will endeavour to keep these values as up to date as possible, local Natural England staff can advise whether the figures stated are the best available. Site-specifics: The figure provided is base on the count period 2008 - 201 The site has hosted higher numbers, for example, 30 confirmed breeding pairs in 2012. The site's ability to host this peak, or higher numbers recorded subsequently, should not be affected (Rare Breeding Birds Panel, 2019) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Little tern (Sternula albifrons), Breeding	Breeding population: abundance	Restore the size of the breeding population to a level which is above 51 breeding pairs , whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	Breeding (summer) season	This will sustain the site's population and contribute to a viable local, national and bio-geographic population. Due to the mobility of this feature and the dynamic nature of population change, the target-value given for the population size of this feature is considered to be the minimum standard for conservation / restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size has significantly increased as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally at least 10 years). The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is classified, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account. Maintaining or restoring bird abundance depends on the suitability of the site. However, factors affecting suitability can also determine other demographic rates of birds using the site including survival (dependent on factors such as body condition which influences the ability to breed or make foraging and / or migration movements) and breeding productivity. Adverse human impacts on either of these rates may precede changes in population abundance (eg by changing proportions of birds of different ages) but eventually may negatively affect abundance. These rates can be measured / estimated to inform judgements of likely impacts on abundance targets. Unless otherwise stated, the population size will be that measured using standard methods such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of natural fluctuations and margins of error during data collection. While we will endeavour to keep these values as up to date as possible, local Natural England staff can advise whether the figures stated are the best available. Site-specifics: The figure provided is based on the count period from 1998 – 2002. Since classification, there has been an overall decline in the numbers of breeding little tern and the 5-year mean for 2014 -2018 breeding data was 34 pairs. Prior to classification numbers have been as high as 122 pairs of breeding little tern (in 1977). The most recent population figures for this feature on this SPA can be obtained by contacting a Natural England Adviser. (Bennett and Claiden-Yardley, 2013);(Bruce and Newton, 2012); (Allen et al., 2003); (Royal Society for the Protection of Birds (RSPB), 2002, 2005 - 2006, 2008 - 2012);(Sears and Avery, 1993); (Aitken and Amery, 2014);(Morren, 2014);(Rendell-Read, 2015);(Macleod-Nolan, 2016);(Rendell-Read, 2017) The target is set to restore on the basis of a signficant decline since classification, with the population nearly halved in numbers since 1998-2002.
Bittern (Botaurus stellaris), Non-breeding	Connectivity with supporting habitats	Maintain safe passage of birds moving between roosting and feeding areas.	Year round	This target has been included because the ability of the feature to safely and successfully move to and from feeding and roosting areas is critical to adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Marsh harrier (Circus	Connectivity with	Maintain safe passage of birds	Year round	This target has been included because the ability of the feature to safely and successfully move to and

aeruginosus), Breeding	supporting habitats	moving between nesting, roosting and feeding areas.		survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Little tern (Sternula albifrons), Breeding	Connectivity with supporting habitats	Maintain safe passage of birds moving between nesting and feeding areas.	Year round	This target has been included because the ability of the feature to safely and successfully move to and from nesting, feeding and roosting areas is critical to their breeding success and to the adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant. (del Hoyo et al., 1996), (Perrow et al., 2006), (Thaxter et al., 2012) Thaxter et al. (2012) summarised foraging range information for breeding seabirds. The mean of recorded maximum foraging ranges for little tern is 6.3 km, whilst the maximum reported foraging range is 11 km. Although birds might generally be expected to forage within these distances from the colony, all estimates come with associated uncertainty. Site-specific research will also be relevant where available. Additionally, any new studies of seabird foraging ranges should be taken into consideration. (Thaxter et al., 2012) Site-specifics: The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Bittern (Botaurus stellaris), Breeding	Connectivity with supporting habitats	Maintain safe passage of birds moving between nesting, roosting and feeding areas.	Year round	This target has been included because the ability of the feature to safely and successfully move to and from nesting, feeding and roosting areas is critical to their breeding success and to the adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant. Site-specifics: The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Avocet (Recurvirostra avosetta), Breeding	Connectivity with supporting habitats	Maintain safe passage of birds moving between nesting, roosting and feeding areas.	Year round	This target has been included because the ability of the feature to safely and successfully move to and from nesting, feeding and roosting areas is critical to their breeding success and to the adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Knot (Calidris canutus), Non-breeding	Connectivity with supporting habitats	Maintain safe passage of birds moving between roosting and feeding areas	Year round	This target has been included because the ability of the feature to safely and successfully move to and from feeding and roosting areas is critical to adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Dunlin (Calidris alpina alpina), Non-breeding	Connectivity with supporting habitats	Maintain safe passage of birds moving between roosting and feeding areas	Year round	This target has been included because the ability of the feature to safely and successfully move to and from feeding and roosting areas is critical to adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bar-tailed godwit (Limosa lapponica), Non-breeding	Connectivity with supporting habitats	Maintain safe passage of birds moving between roosting and feeding areas	Year round	This target has been included because the ability of the feature to safely and successfully move to and from feeding and roosting areas is critical to adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Black-tailed godwit (Limosa	Connectivity with	Maintain safe passage of birds	Year round	This target has been included because the ability of the feature to safely and successfully move to and from feeding and roosting areas is critical to adult fitness and survival. This target will apply within the site

islandica), Non-breeding	habitats	roosting and feeding areas.		Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Redshank (Tringa totanus), Non-breeding	Connectivity with supporting habitats	Maintain safe passage of birds moving between roosting and feeding areas.	Year round	This target has been included because the ability of the feature to safely and successfully move to and from feeding and roosting areas is critical to adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Ruff (Calidris pugnax), Non-breeding	Connectivity with supporting habitats	Maintain safe passage of birds moving between roosting and feeding areas.	Year round	This target has been included because the ability of the feature to safely and successfully move to and from feeding and roosting areas is critical to adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Avocet (Recurvirostra avosetta), Non-breeding	Connectivity with supporting habitats	Maintain safe passage of birds moving between roosting and feeding areas.	Year round	This target has been included because the ability of the feature to safely and successfully move to and from feeding and roosting areas is critical to adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Golden plover (Pluvialis apricaria), Non-breeding	Connectivity with supporting habitats	Maintain safe passage of birds moving between roosting and feeding areas.	Year round	This target has been included because the ability of the feature to safely and successfully move to and from feeding and roosting areas is critical to adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Hen harrier (Circus cyaneus), Non-breeding	Connectivity with supporting habitats	Maintain safe passage of birds moving between roosting and feeding areas.	Year round	This target has been included because the ability of the feature to safely and successfully move to and from feeding and roosting areas is critical to adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Shelduck (Tadorna tadorna), Non-breeding	Connectivity with supporting habitats	Maintain safe passage of birds moving between roosting and feeding areas.	Year round	This target has been included because the ability of the feature to safely and successfully move to and from feeding and roosting areas is critical to adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Shelduck (Tadorna tadorna), Non-breeding	Disturbance caused by human activity	Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed	Non-breeding (winter and/or passage) season	The nature, scale, timing and duration of some human activities can result in bird disturbance (defined as any human-induced activity sufficient to disrupt normal behaviours and / or distribution of birds in the absence of the activity) at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, presence of people, animals and structures. 'Significant' disturbance is defined by AEWA (The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), 2016):

				impacts on (water)birds in such a way as to be likely to cause impacts on populations of a species through either I. changed local distribution on a continuing basis; and/or II. changed local abundance on a sustained basis; and/or III. the reduction of ability of any significant group of birds to survive, breed, or rear their young." (Fox and Madsen, 1997) (Wolff et al., 1982);(Van der Meer, 1985);(Burton et al., 2002);(Kirby et al., 2004) --- Site-specifics: A study of recreational disturbance in winter 2013/14 (Ross and Liley, 2014) indicates that in parts of the SPA recreational disturbance may be at levels which could significantly influence waterbird usage, including evidence that waterbirds are vacating some areas during periods of increased disturbance. A wide range of activities that caused disturbance were identified, with dog walking being the principal source of bird responses. The 'Humber Hounds' initiative has been set up by the Humber Nature Partnership to raise awareness and encourage sensitive dog walking. In addition, the Humber Nature Partnership is developing a Recreational Disturbance Strategy to address disturbance issues in parts of the site (Cruickshanks et al., 2010);(Cutts and Allen, 1999). This target has been set to reduce using expert judgement, primarily on the basis that site-specific research has indicated that recreational disturbance in some parts of the site is at a level that has the potential to substantially affect waterbirds.
Avocet (Recurvirostra avosetta), Non-breeding	Disturbance caused by human activity	Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed	Non-breeding (winter and/or passage) season	The nature, scale, timing and duration of some human activities can result in bird disturbance (defined as any human-induced activity sufficient to disrupt normal behaviours and / or distribution of birds in the absence of the activity) at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, presence of people, animals and structures. 'Significant' disturbance is defined by AEWA (The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), 2016): "Disturbance should be judged as significant if an action (alone or in combination with other effects) impacts on (water)birds in such a way as to be likely to cause impacts on populations of a species through either I. changed local distribution on a continuing basis; and/or II. changed local abundance on a sustained basis; and/or III. the reduction of ability of any significant group of birds to survive, breed, or rear their young." (Fox and Madsen, 1997) (Holm and Laursen, 2009) --- Site-specifics: A study of recreational disturbance in winter 2013/14 (Ross and Liley, 2014) indicates that in parts of the SPA recreational disturbance may be at levels which could significantly influence waterbird usage, including evidence that waterbirds are vacating some areas during periods of increased disturbance. A wide range of activities that caused disturbance were identified, with dog walking being the principal source of bird responses. The 'Humber Hounds' initiative has been set up by the Humber Nature Partnership to raise awareness and encourage sensitive dog walking. In addition, the Humber Nature Partnership is developing a Recreational Disturbance Strategy to address disturbance issues in parts of the site(Cruickshanks et al., 2010);(Cutts and Allen, 1999). This target has been set to reduce using expert judgement, primarily on the basis that site-specific research has indicated that recreational disturbance in some parts of the site is at a level that has the potential to substantially affect waterbirds.
Knot (Calidris canutus), Non-breeding	Disturbance caused by human activity	Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed	Non-breeding (winter and/or passage) season	The nature, scale, timing and duration of some human activities can result in bird disturbance (defined as any human-induced activity sufficient to disrupt normal behaviours and / or distribution of birds in the absence of the activity) at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, presence of people, animals and structures. 'Significant' disturbance is defined by AEWA (The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), 2016): "Disturbance should be judged as significant if an action (alone or in combination with other effects) impacts on (water)birds in such a way as to be likely to cause impacts on populations of a species through either I. changed local distribution on a continuing basis; and/or II. changed local abundance on a sustained basis; and/or III. the reduction of ability of any significant group of birds to survive, breed, or rear their young." (Fox and Madsen, 1997)

				(Kirby et al., 2004) Site-specifics: A study of recreational disturbance in winter 2013/14 (Ross and Liley, 2014) indicates that in parts of the SPA recreational disturbance may be at levels which could significantly influence waterbird usage, including evidence that waterbirds are vacating some areas during periods of increased disturbance. A wide range of activities that caused disturbance were identified, with dog walking being the principal source of bird responses. The 'Humber Hounds' initiative has been set up by the Humber Nature Partnership to raise awareness and encourage sensitive dog walking. In addition, the Humber Nature Partnership is developing a Recreational Disturbance Strategy to address disturbance issues in parts of the site(Cruickshanks et al., 2010),(Cutts and Allen, 1999). This target has been set to reduce using expert judgement, primarily on the basis that site-specific research has indicated that recreational disturbance in some parts of the site is at a level that has the potential to substantially affect waterbirds.
Golden plover (Pluvialis apricaria), Non-breeding	Disturbance caused by human activity	Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed	Non-breeding (winter and/or passage) season	The nature, scale, timing and duration of some human activities can result in bird disturbance (defined as any human-induced activity sufficient to disrupt normal behaviours and / or distribution of birds in the absence of the activity) at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, presence of people, animals and structures. 'Significant' disturbance is defined by AEWA (The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), 2016): "Disturbance should be judged as significant if an action (alone or in combination with other effects) impacts on (water)birds in such a way as to be likely to cause impacts on populations of a species through either I. changed local distribution on a continuing basis; and/or II. changed local abundance on a sustained basis; and/or III. the reduction of ability of any significant group of birds to survive, breed, or rear their young." (Fox and Madsen, 1997) (Kirby et al., 2004) Site-specifics: A study of recreational disturbance in winter 2013/14 (Ross and Liley, 2014) indicates that in parts of the SPA recreational disturbance may be at levels which could significantly influence waterbird usage, including evidence that waterbirds are vacating some areas during periods of increased disturbance. A wide range of activities that caused disturbance were identified, with dog walking being the principal source of bird responses. The 'Humber Hounds' initiative has been set up by the Humber Nature Partnership to raise awareness and encourage sensitive dog walking. In addition, the Humber Nature Partnership is developing a Recreational Disturbance Strategy to address disturbance issues in parts of the site. (Cruickshanks et al., 2010), (Cutts and Allen, 1999) This target has been set to reduce using expert judgement, primarily on the basis that site-specific research has indicated that recreational disturbance in some parts of the site is at a level that has the potential to substantially affect waterbirds.
Ruff (Calidris pugnax), Non-breeding	Disturbance caused by human activity	Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed	Non-breeding (winter and/or passage) season	The nature, scale, timing and duration of some human activities can result in bird disturbance (defined as any human-induced activity sufficient to disrupt normal behaviours and / or distribution of birds in the absence of the activity) at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, presence of people, animals and structures. 'Significant' disturbance is defined by AEWA (The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), 2016): "Disturbance should be judged as significant if an action (alone or in combination with other effects) impacts on (water)birds in such a way as to be likely to cause impacts on populations of a species through either I. changed local distribution on a continuing basis; and/or II. changed local abundance on a sustained basis; and/or III. the reduction of ability of any significant group of birds to survive, breed, or rear their young." (Fox and Madsen, 1997) Site-specifics: A study of recreational disturbance in winter 2013/14 (Ross and Liley, 2014) indicates that in parts of the SPA recreational disturbance may be at levels which could significantly influence waterbird usage, including evidence that waterbirds are vacating some areas during periods of increased disturbance. A wide range of activities that caused disturbance were identified, with dog walking being the principal source of bird responses. The 'Humber Hounds' initiative has been set up by the Humber Nature Partnership to raise awareness and encourage sensitive dog walking. In addition, the Humber Nature Partnership is developing

				2010);(Cutts and Allen, 1999). This target has been set to reduce using expert judgement, primarily on the basis that site-specific research has indicated that recreational disturbance in some parts of the site is at a level that has the potential to substantially affect waterbirds.
Dunlin (Calidris alpina alpina), Non-breeding	Disturbance caused by human activity	Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed	Non-breeding (winter and/or passage) season	The nature, scale, timing and duration of some human activities can result in bird disturbance (defined as any human-induced activity sufficient to disrupt normal behaviours and / or distribution of birds in the absence of the activity) at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, presence of people, animals and structures. 'Significant' disturbance is defined by AEWA (The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), 2016): "Disturbance should be judged as significant if an action (alone or in combination with other effects) impacts on (water)birds in such a way as to be likely to cause impacts on populations of a species through either I. changed local distribution on a continuing basis; and/or II. changed local abundance on a sustained basis; and/or III. the reduction of ability of any significant group of birds to survive, breed, or rear their young." (Fox and Madsen, 1997) (Wolff et al., 1982);(Van der Meer, 1985);(Burton et al., 2002);(Kirby et al., 2004) --- Site-specifics: A study of recreational disturbance in winter 2013/14 (Ross and Liley, 2014) indicates that in parts of the SPA recreational disturbance may be at levels which could significantly influence waterbird usage, including evidence that waterbirds are vacating some areas during periods of increased disturbance. A wide range of activities that caused disturbance were identified, with dog walking being the principal source of bird responses. The 'Humber Hounds' initiative has been set up by the Humber Nature Partnership to raise awareness and encourage sensitive dog walking. In addition, the Humber Nature Partnership is developing a Recreational Disturbance Strategy to address disturbance issues in parts of the site.(Cruickshanks et al., 2010), (Cutts and Allen, 1999) This target has been set to reduce using expert judgement, primarily on the basis that site-specific research has indicated that recreational disturbance in some parts of the site is at a level that has the potential to substantially affect waterbirds.
Bar-tailed godwit (Limosa lapponica), Non-breeding	Disturbance caused by human activity	Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed	Non-breeding (winter and/or passage) season	The nature, scale, timing and duration of some human activities can result in bird disturbance (defined as any human-induced activity sufficient to disrupt normal behaviours and / or distribution of birds in the absence of the activity) at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, presence of people, animals and structures. 'Significant' disturbance is defined by AEWA (The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), 2016): "Disturbance should be judged as significant if an action (alone or in combination with other effects) impacts on (water)birds in such a way as to be likely to cause impacts on populations of a species through either I. changed local distribution on a continuing basis; and/or II. changed local abundance on a sustained basis; and/or III. the reduction of ability of any significant group of birds to survive, breed, or rear their young." (Fox and Madsen, 1997) (Wolff et al., 1982);(Van der Meer, 1985);(Kirby et al., 2004) --- Site-specifics: A study of recreational disturbance in winter 2013/14 (Ross and Liley, 2014) indicates that in parts of the SPA recreational disturbance may be at levels which could significantly influence waterbird usage, including evidence that waterbirds are vacating some areas during periods of increased disturbance. A wide range of activities that caused disturbance were identified, with dog walking being the principal source of bird responses. The 'Humber Hounds' initiative has been set up by the Humber Nature Partnership to raise awareness and encourage sensitive dog walking. In addition, the Humber Nature Partnership is developing a Recreational Disturbance Strategy to address disturbance issues in parts of the site.(Cruickshanks et al., 2010),(Cutts and Allen, 1999) This target has been set to reduce using expert judgement, primarily on the basis that site-specific research has indicated that recreational disturbance in some parts of the site is at a level that has the potential to substantially affect waterbirds.

godwit (Limosa limosa islandica), Non-breeding	caused by human activity	duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed	breeding (winter and/or passage) season	The nature, scale, timing and duration of some human activities can result in bird disturbance (defined as any human-induced activity sufficient to disrupt normal behaviours and / or distribution of birds in the absence of the activity) at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, presence of people, animals and structures. 'Significant' disturbance is defined by AEWA (The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), 2016): "Disturbance should be judged as significant if an action (alone or in combination with other effects) impacts on (water)birds in such a way as to be likely to cause impacts on populations of a species through either I. changed local distribution on a continuing basis; and/or II. changed local abundance on a sustained basis; and/or III. the reduction of ability of any significant group of birds to survive, breed, or rear their young." (Fox and Madsen, 1997) --- Site-specifics: A study of recreational disturbance in winter 2013/14 (Ross and Liley, 2014) indicates that in parts of the SPA recreational disturbance may be at levels which could significantly influence waterbird usage, including evidence that waterbirds are vacating some areas during periods of increased disturbance. A wide range of activities that caused disturbance were identified, with dog walking being the principal source of bird responses. The 'Humber Hounds' initiative has been set up by the Humber Nature Partnership to raise awareness and encourage sensitive dog walking. In addition, the Humber Nature Partnership is developing a Recreational Disturbance Strategy to address disturbance issues in parts of the site(Cruickshanks et al., 2010),(Cutts and Allen, 1999). This target has been set to reduce using expert judgement, primarily on the basis that site-specific research has indicated that recreational disturbance in some parts of the site is at a level that may substantially affect waterbirds.
Redshank (Tringa totanus), Non-breeding	Disturbance caused by human activity	Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed	Non-breeding (winter and/or passage) season	The nature, scale, timing and duration of some human activities can result in bird disturbance (defined as any human-induced activity sufficient to disrupt normal behaviours and / or distribution of birds in the absence of the activity) at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, presence of people, animals and structures. 'Significant' disturbance is defined by AEWA (The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), 2016): "Disturbance should be judged as significant if an action (alone or in combination with other effects) impacts on (water)birds in such a way as to be likely to cause impacts on populations of a species through either I. changed local distribution on a continuing basis; and/or II. changed local abundance on a sustained basis; and/or III. the reduction of ability of any significant group of birds to survive, breed, or rear their young." (Fox and Madsen, 1997) (Burton et al., 2002);(Kirby et al., 2004) --- Site-specifics: A study of recreational disturbance in winter 2013/14 (Ross and Liley, 2014) indicates that in parts of the SPA recreational disturbance may be at levels which could significantly influence waterbird usage, including evidence that waterbirds are vacating some areas during periods of increased disturbance. A wide range of activities that caused disturbance were identified, with dog walking being the principal source of bird responses. The 'Humber Hounds' initiative has been set up by the Humber Nature Partnership to raise awareness and encourage sensitive dog walking. In addition, the Humber Nature Partnership is developing a Recreational Disturbance Strategy to address disturbance issues in parts of the site (Cruickshanks et al., 2010); (Cutts and Allen, 1999). This target has been set to reduce using expert judgement, primarily on the basis that site-specific research has indicated that recreational disturbance in some parts of the site is at a level that has the potential to substantially affect waterbirds.
Waterbird assemblage, Non-breeding	Disturbance caused by human activity	Reduce the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed	Non-breeding (winter and/or passage) season	The nature, scale, timing and duration of some human activities can result in bird disturbance (defined as any human-induced activity sufficient to disrupt normal behaviours and / or distribution of birds in the absence of the activity) at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound,

				'Significant' disturbance is defined by AEWA (The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), 2016): "Disturbance should be judged as significant if an action (alone or in combination with other effects) impacts on (water)birds in such a way as to be likely to cause impacts on populations of a species through either I. changed local distribution on a continuing basis; and/or II. changed local abundance on a sustained basis; and/or III. the reduction of ability of any significant group of birds to survive, breed, or rear their young." (Fox and Madsen, 1997) --- Site-specifics: A study of recreational disturbance in winter 2013/14 (Ross and Liley, 2014) indicates that in parts of the SPA recreational disturbance may be at levels which could significantly influence waterbird usage, including evidence that waterbirds are vacating some areas during periods of increased disturbance. A wide range of activities that caused disturbance were identified, with dog walking being the principal source of bird responses. The 'Humber Hounds' initiative has been set up by the Humber Nature Partnership to raise awareness and encourage sensitive dog walking. In addition, the Humber Nature Partnership is developing a Recreational Disturbance Strategy to address disturbance issues in parts of the site (Cruickshanks et al., 2010); (Cutts and Allen, 1999). This target has been set to reduce using expert judgement, primarily on the basis that site-specific research has indicated that recreational disturbance in some parts of the site is at a level that has the potential to substantially affect waterbirds.
Little tern (Sternula albifrons), Breeding	Disturbance caused by human activity	Reduce the frequency, duration and / or intensity of disturbance affecting roosting, nesting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed	Breeding (summer) season	The nature, scale, timing and duration of some human activities can result in bird disturbance (defined as any human-induced activity sufficient to disrupt normal behaviours and / or distribution of birds in the absence of the activity) at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, presence of people, animals and structures. 'Significant' disturbance is defined by AEWA (The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), 2016): "Disturbance should be judged as significant if an action (alone or in combination with other effects) impacts on (water)birds in such a way as to be likely to cause impacts on populations of a species through either I. changed local distribution on a continuing basis; and/or II. changed local abundance on a sustained basis; and/or III. the reduction of ability of any significant group of birds to survive, breed, or rear their young." (Fox and Madsen, 1997) --- Site-specifics: The colony at Easington Lagoons is wardened annually, which reduces the pressure of recreational disturbance in this location. However it is likely that recreational pressure elsewhere within the estuary is, together with other factors, preventing little tern from breeding in otherwise suitable habitat.(Cruickshanks et al., 2010),(Cutts and Allen, 1999) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Marsh harrier (Circus aeruginosus), Breeding	Disturbance caused by human activity	Reduce the frequency, duration and / or intensity of disturbance affecting roosting, nesting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed	Breeding (summer) season	The nature, scale, timing and duration of some human activities can result in bird disturbance (defined as any human-induced activity sufficient to disrupt normal behaviours and / or distribution of birds in the absence of the activity) at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, presence of people, animals and structures. 'Significant' disturbance is defined by AEWA (The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), 2016): "Disturbance should be judged as significant if an action (alone or in combination with other effects) impacts on (water)birds in such a way as to be likely to cause impacts on populations of a species through either I. changed local distribution on a continuing basis; and/or II. changed local abundance on a sustained basis; and/or III. the reduction of ability of any significant group of birds to survive, breed, or rear their young." (Fox and Madsen, 1997) --- Site-specifics: Marsh harrier numbers have increased on the Humber in the last decade but this target has been set to 'reduce' in acknowledgment of wider recreational disturbance issues across the estuary.

				(Cruickshanks et al., 2010);(Cutts and Allen, 1999);(Royal Society for the Protection of Birds (RSPB), 2019) This target has been set to reduce using expert judgement, primarily on the basis that site-specific research has indicated that recreational disturbance in some parts of the site is at a level that has the potential to substantially affect wetland birds.
Hen harrier (Circus cyaneus), Non-breeding	Disturbance caused by human activity	Restrict the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed	Non-breeding (winter and/or passage) season	The nature, scale, timing and duration of some human activities can result in bird disturbance (defined as any human-induced activity sufficient to disrupt normal behaviours and / or distribution of birds in the absence of the activity) at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, presence of people, animals and structures. 'Significant' disturbance is defined by AEWA (The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), 2016): "Disturbance should be judged as significant if an action (alone or in combination with other effects) impacts on (water)birds in such a way as to be likely to cause impacts on populations of a species through either I. changed local distribution on a continuing basis; and/or II. changed local abundance on a sustained basis; and/or III. the reduction of ability of any significant group of birds to survive, breed, or rear their young." (Fox and Madsen, 1997) (Pearce-Higgins et al., 2009) --- Site-specifics: Hen harrier numbers on the Humber estuary are understood to be stable but this target has been set to 'reduce' in acknowledgement of wider recreational disturbance issues across the site. (Cruickshanks et al., 2010);(Cutts and Allen, 1999) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Non-breeding	Disturbance caused by human activity	Restrict the frequency, duration and / or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed	Non-breeding (winter and/or passage) season	The nature, scale, timing and duration of some human activities can result in bird disturbance (defined as any human-induced activity sufficient to disrupt normal behaviours and / or distribution of birds in the absence of the activity) at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, presence of people, animals and structures. 'Significant' disturbance is defined by AEWA (The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), 2016): "Disturbance should be judged as significant if an action (alone or in combination with other effects) impacts on (water)birds in such a way as to be likely to cause impacts on populations of a species through either I. changed local distribution on a continuing basis; and/or II. changed local abundance on a sustained basis; and/or III. the reduction of ability of any significant group of birds to survive, breed, or rear their young." (Fox and Madsen, 1997) --- Site-specifics: The Restrict tartget is appropriate for non-breeding bittern on the Humber as their prefered habitat, deep within marshland, means they are seldom subjetc to anthropogenic disturbance.(Cruickshanks et al., 2010), (Cutts and Allen, 1999) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Breeding	Disturbance caused by human activity	Restrict the frequency, duration and / or intensity of disturbance affecting roosting, nesting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed	Breeding (summer) season	The nature, scale, timing and duration of some human activities can result in bird disturbance (defined as any human-induced activity sufficient to disrupt normal behaviours and / or distribution of birds in the absence of the activity) at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, presence of people, animals and structures. 'Significant' disturbance is defined by AEWA (The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), 2016): "Disturbance should be judged as significant if an action (alone or in combination with other effects)

				either I. changed local distribution on a continuing basis; and/or II. changed local abundance on a sustained basis; and/or III. the reduction of ability of any significant group of birds to survive, breed, or rear their young." (Fox and Madsen, 1997) --- Site-specifics: The Restrict tartget is appropriate for breeding bittern on the Humber as their prefered habitat, deep within marshland, means they are seldom subjetc to anthropogenic disturbance.(Cruickshanks et al., 2010), (Cutts and Allen, 1999) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Avocet (Recurvirostra avosetta), Breeding	Disturbance caused by human activity	Restrict the frequency, duration and / or intensity of disturbance affecting roosting, nesting, foraging, feeding, moulting and/or loafing birds so that they are not significantly disturbed	Breeding (summer) season	The nature, scale, timing and duration of some human activities can result in bird disturbance (defined as any human-induced activity sufficient to disrupt normal behaviours and / or distribution of birds in the absence of the activity) at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, presence of people, animals and structures. 'Significant' disturbance is defined by AEWA (The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), 2016): "Disturbance should be judged as significant if an action (alone or in combination with other effects) impacts on (water)birds in such a way as to be likely to cause impacts on populations of a species through either I. changed local distribution on a continuing basis; and/or II. changed local abundance on a sustained basis; and/or III. the reduction of ability of any significant group of birds to survive, breed, or rear their young." (Fox and Madsen, 1997) (Holm and Laursen, 2009) --- Site-specifics: Breeding avocet are not known to be signifcantly impacted by human activity on the Humber Estuary. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Avocet (Recurvirostra avosetta), Non-breeding	Non-breeding population: abundance	Maintain the size of the non-breeding population at a level which is above 1213 individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	Non-breeding (winter and/or passage) season	This will sustain the site's population and contribute to a viable local, national and bio-geographic population. Due to the mobility of this feature and the dynamic nature of population change, the target-value given for the population size of this feature is considered to be the minimum standard for conservation / restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size has significantly increased as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally at least 10 years). The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is classified, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account. Maintaining or restoring bird abundance depends on the suitability of the site. However, factors affecting suitability can also determine other demographic rates of birds using the site including survival (dependent on factors such as body condition which influences the ability to breed or make foraging and / or migration movements) and breeding productivity. Adverse human impacts on either of these rates may precede changes in population abundance (eg by changing proportions of birds of different ages) but eventually may negatively affect abundance. These rates can be measured / estimated to inform judgements of likely impacts on abundance targets. Unless otherwise stated, the population size will be that measured using standard methods such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of natural fluctuations and margins of error during data collection. While we will endeavour to keep these values as up to date as possible, local Natural England staff can advise whether the figures stated are the best available. --- Site-specifics: The target is based on the 5-year mean peak from Wetland Bird Survey (WeBS) core counts from following winters: 2011/12 to 2015/16. Since classification, there has been an overall rise in numbers of avocet. This peak, or higher numbers recorded subsequently, should be taken into account. The most recent population figures for this feature on this SPA can be obtained via BTO WeBS data.(Austin et al., 2014),(Calbrade, 2013),(Allen et al., 2003) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.

canutus), Non-breeding	population: abundance	the non-breeding population at a level which is above 18,500 individuals on passage and 28,165 wintering individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	breeding (winter and/or passage) season	This will sustain the site's population and contribute to a viable local, national and bio-geographic population. Due to the mobility of this feature and the dynamic nature of population change, the target-value given for the population size of this feature is considered to be the minimum standard for conservation / restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size has significantly increased as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally at least 10 years). The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is classified, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account. Maintaining or restoring bird abundance depends on the suitability of the site. However, factors affecting suitability can also determine other demographic rates of birds using the site including survival (dependent on factors such as body condition which influences the ability to breed or make foraging and / or migration movements) and breeding productivity. Adverse human impacts on either of these rates may precede changes in population abundance (eg by changing proportions of birds of different ages) but eventually may negatively affect abundance. These rates can be measured / estimated to inform judgements of likely impacts on abundance targets. Unless otherwise stated, the population size will be that measured using standard methods such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of natural fluctuations and margins of error during data collection. While we will endeavour to keep these values as up to date as possible, local Natural England staff can advise whether the figures stated are the best available. --- Site-specifics: The figures provided is based on the count period from 1996/97 – 2000/01. Since classification, numbers have remained relatively steady. The most recent population figures for this feature on this SPA can be obtained via BTO WeBS data (https://www.bto.org/volunteer-surveys/webs) (Ross-Smith et al., 2013). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Black-tailed godwit (Limosa limosa islandica), Non-breeding	Non-breeding population: abundance	Maintain the size of the non-breeding population at a level which is above 2951, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	Non-breeding (winter and/or passage) season	This will sustain the site's population and contribute to a viable local, national and bio-geographic population. Due to the mobility of this feature and the dynamic nature of population change, the target-value given for the population size of this feature is considered to be the minimum standard for conservation / restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size has significantly increased as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally at least 10 years). The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is classified, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account. Maintaining or restoring bird abundance depends on the suitability of the site. However, factors affecting suitability can also determine other demographic rates of birds using the site including survival (dependent on factors such as body condition which influences the ability to breed or make foraging and / or migration movements) and breeding productivity. Adverse human impacts on either of these rates may precede changes in population abundance (eg by changing proportions of birds of different ages) but eventually may negatively affect abundance. These rates can be measured / estimated to inform judgements of likely impacts on abundance targets. Unless otherwise stated, the population size will be that measured using standard methods such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of natural fluctuations and margins of error during data collection. While we will endeavour to keep these values as up to date as possible, local Natural England staff can advise whether the figures stated are the best available. --- Site-specifics: The figure provided is based on the latest count period at publication, from 2012/13 - 2016/17. The figure at classification was based on the 1996/97 – 2000/01 count and was 1113. Since classification there has been a signficant rise in numbers of black-tailed godwit, with the 5-year mean peak for 2006/07 - 2010/11 being 4,351 individuals. The site's ability to host this peak, or higher numbers recorded subsequently, should not be affected. Since this peak, numbers have slowly declined (the 5-year peak for 2010/11 - 2014/15 was 3,413 individuals) but this is considered more likely related to wider changes than site specific conditions. The most recent population figures for this feature on this SPA can be obtained via BTO WeBS data. References:(Austin et al., 2014);(Calbrade, 2013); (Ross-Smith et al., 2013); (Catley, 2009);(Allen et al., 2003) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Golden plover (Pluvialis apricaria), Non-breeding	Non-breeding population: abundance	Maintain the size of the non-breeding population at a level which is above 30,709 wintering individuals, whilst avoiding deterioration from its current level as	Non-breeding (winter and/or passage) season	This will sustain the site's population and contribute to a viable local, national and bio-geographic population. Due to the mobility of this feature and the dynamic nature of population change, the target-value given for the population size of this feature is considered to be the minimum standard for conservation / restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size has significantly increased as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally at least 10 years). The values given here may also be updated in future to reflect any strategic objectives

		indicated by the latest mean peak count or equivalent.		impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is classified, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account. Maintaining or restoring bird abundance depends on the suitability of the site. However, factors affecting suitability can also determine other demographic rates of birds using the site including survival (dependent on factors such as body condition which influences the ability to breed or make foraging and / or migration movements) and breeding productivity. Adverse human impacts on either of these rates may precede changes in population abundance (eg by changing proportions of birds of different ages) but eventually may negatively affect abundance. These rates can be measured / estimated to inform judgements of likely impacts on abundance targets. Unless otherwise stated, the population size will be that measured using standard methods such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of natural fluctuations and margins of error during data collection. While we will endeavour to keep these values as up to date as possible, local Natural England staff can advise whether the figures stated are the best available. --- Site-specifics: The figure provided is based on the count period from 1996/97 – 2000/01. Following classification numbers of golden plover increased and the 5-year mean peak for 2002/03 - 2006/07 was 46,405 individuals. The site's ability to host this peak, or higher numbers recorded subsequently, should not be affected. Since this peak numbers of golden plover have declined and the 5-year peak mean for 2013/14 - 2017/18 was 35,181 individuals. The most recent population figures for this feature on this SPA can be obtained via BTO WeBS data: href=''https://app.bto.org/webs-reporting/''. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Non-breeding	Non-breeding population: abundance	Maintain the size of the non-breeding population at a level which is above 4 wintering individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	Non-breeding (winter and/or passage) season	This will sustain the site's population and contribute to a viable local, national and bio-geographic population. Due to the mobility of this feature and the dynamic nature of population change, the target-value given for the population size of this feature is considered to be the minimum standard for conservation / restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size has significantly increased as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally at least 10 years). The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is classified, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account. Maintaining or restoring bird abundance depends on the suitability of the site. However, factors affecting suitability can also determine other demographic rates of birds using the site including survival (dependent on factors such as body condition which influences the ability to breed or make foraging and / or migration movements) and breeding productivity. Adverse human impacts on either of these rates may precede changes in population abundance (eg by changing proportions of birds of different ages) but eventually may negatively affect abundance. These rates can be measured / estimated to inform judgements of likely impacts on abundance targets. Unless otherwise stated, the population size will be that measured using standard methods such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of natural fluctuations and margins of error during data collection. While we will endeavour to keep these values as up to date as possible, local Natural England staff can advise whether the figures stated are the best available. --- Site-specifics: The figure provided is based on the count period from 1998/99 – 2002/03. The most recent population figures for this feature on this SPA can be obtained via BTO WeBS data(Wotton, 2015). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Shelduck (Tadorna tadorna), Non-breeding	Non-breeding population: abundance	Maintain the size of the non-breeding population at a level which is above 4464, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	Non-breeding (winter and/or passage) season	This will sustain the site's population and contribute to a viable local, national and bio-geographic population. Due to the mobility of this feature and the dynamic nature of population change, the target-value given for the population size of this feature is considered to be the minimum standard for conservation / restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size has significantly increased as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally at least 10 years). The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is classified, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account. Maintaining or restoring bird abundance depends on the suitability of the site. However, factors affecting suitability can also determine other demographic rates of birds using the site including survival (dependent on factors such as body condition which influences the ability to breed or make foraging and / or migration movements) and breeding productivity. Adverse human impacts on either of these rates may

				precede changes in population abundance (eg by changing proportions of birds of different ages) but eventually may negatively affect abundance. These rates can be measured / estimated to inform judgements of likely impacts on abundance targets. Unless otherwise stated, the population size will be that measured using standard methods such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of natural fluctuations and margins of error during data collection. While we will endeavour to keep these values as up to date as possible, local Natural England staff can advise whether the figures stated are the best available. Site-specifics: The figure provided is based on the count period from 1996/97 – 2000/01. Whilst it is subject to natural fluctuation, the shelduck population has remained broadly stable since classification and the site appears to be supporting a large proportion of the regional population. On this basis a maintain target is considered appropriate. The most recent population figures for this feature on this SPA can be obtained via BTO WeBS data (Ross-Smith et al., 2013). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Hen harrier (Circus cyaneus), Non-breeding	Non-breeding population: abundance	Maintain the size of the non-breeding population at a level which is above 8 wintering individuals, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	Non-breeding (winter and/or passage) season	This will sustain the site's population and contribute to a viable local, national and bio-geographic population. Due to the mobility of this feature and the dynamic nature of population change, the target-value given for the population size of this feature is considered to be the minimum standard for conservation / restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size has significantly increased as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally at least 10 years). The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is classified, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account. Maintaining or restoring bird abundance depends on the suitability of the site. However, factors affecting suitability can also determine other demographic rates of birds using the site including survival (dependent on factors such as body condition which influences the ability to breed or make foraging and / or migration movements) and breeding productivity. Adverse human impacts on either of these rates may precede changes in population abundance (eg by changing proportions of birds of different ages) but eventually may negatively affect abundance. These rates can be measured / estimated to inform judgements of likely impacts on abundance targets. Unless otherwise stated, the population size will be that measured using standard methods such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of natural fluctuations and margins of error during data collection. While we will endeavour to keep these values as up to date as possible, local Natural England staff can advise whether the figures stated are the best available. Site-specifics: The figure provided is based on the count period from 1997/98 – 2001/02. The most recent population figures for this feature on this SPA can be obtained by contacting a Natural England Adviser. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Ruff (Calidris pugnax), Non-breeding	Non-breeding population: abundance	Restore the size of the non-breeding population to a level which is above 128 individuals during passage, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	Non-breeding (winter and/or passage) season	This will sustain the site's population and contribute to a viable local, national and bio-geographic population. Due to the mobility of this feature and the dynamic nature of population change, the target-value given for the population size of this feature is considered to be the minimum standard for conservation / restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size has significantly increased as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally at least 10 years). The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is classified, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account. Maintaining or restoring bird abundance depends on the suitability of the site. However, factors affecting suitability can also determine other demographic rates of birds using the site including survival (dependent on factors such as body condition which influences the ability to breed or make foraging and / or migration movements) and breeding productivity. Adverse human impacts on either of these rates may precede changes in population abundance (eg by changing proportions of birds of different ages) but eventually may negatively affect abundance. These rates can be measured / estimated to inform judgements of likely impacts on abundance targets. Unless otherwise stated, the population size will be that measured using standard methods such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of natural fluctuations and margins of error during data collection. While we will endeavour to keep these values as up to date as possible, local Natural England staff can advise whether the figures stated are the best available. Site-specifics: The figure provided is based on the count period from 1996 – 2000. Since designation, there has been a decline of over 50% in the numbers of ruff, with a recent 5-year mean peak of 85 birds between 2013/14

				WeBS data: href="https://app.bto.org/webs-reporting/". The ruff population has declined by over 50% since classification, and there is limited evidence to suggest that this can be ascribed to wider population level trends. Therefore a restore target is warranted. Nevertheless, given the limited information available regarding wider trends in passage populations, this target is set with low confidence.
Bar-tailed godwit (Limosa lapponica), Non-breeding	Non-breeding population: abundance	Restore the size of the non-breeding population to a level which is above 2,752, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	Non-breeding (winter and/or passage) season	This will sustain the site's population and contribute to a viable local, national and bio-geographic population. Due to the mobility of this feature and the dynamic nature of population change, the target-value given for the population size of this feature is considered to be the minimum standard for conservation / restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size has significantly increased as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally at least 10 years). The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is classified, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account. Maintaining or restoring bird abundance depends on the suitability of the site. However, factors affecting suitability can also determine other demographic rates of birds using the site including survival (dependent on factors such as body condition which influences the ability to breed or make foraging and / or migration movements) and breeding productivity. Adverse human impacts on either of these rates may precede changes in population abundance (eg by changing proportions of birds of different ages) but eventually may negatively affect abundance. These rates can be measured / estimated to inform judgements of likely impacts on abundance targets. Unless otherwise stated, the population size will be that measured using standard methods such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of natural fluctuations and margins of error during data collection. While we will endeavour to keep these values as up to date as possible, local Natural England staff can advise whether the figures stated are the best available. --- Site-specifics: The figure provided is based on the count period from 1996/97 – 2000/01. The site's ability to host the population recorded at classification, or higher numbers recorded subsequently, should not be affected. (Austin et al., 2014),(Calbrade, 2013),(Ross-Smith et al., 2013),(Allen et al., 2003) The most recent population figures for this feature on this SPA can be obtained via BTO WeBS data:href="https://app.bto.org/webs-reporting/" There has been a recent decline in the numbers of bar-tailed godwit since a peak of 3,011 in 2006/7 to 2010/11: the 5-year mean peak for 2013/14- 2017/18 was 1,395 individuals, so a restore target is now appropriate.
Dunlin (Calidris alpina alpina), Non-breeding	Non-breeding population: abundance	Restore the size of the non-breeding population to a level which is above 22,222 wintering individuals and 20,269 individuals during passage, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	Non-breeding (winter and/or passage) season	This will sustain the site's population and contribute to a viable local, national and bio-geographic population. Due to the mobility of this feature and the dynamic nature of population change, the target-value given for the population size of this feature is considered to be the minimum standard for conservation / restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size has significantly increased as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally at least 10 years). The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is classified, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account. Maintaining or restoring bird abundance depends on the suitability of the site. However, factors affecting suitability can also determine other demographic rates of birds using the site including survival (dependent on factors such as body condition which influences the ability to breed or make foraging and / or migration movements) and breeding productivity. Adverse human impacts on either of these rates may precede changes in population abundance (eg by changing proportions of birds of different ages) but eventually may negatively affect abundance. These rates can be measured / estimated to inform judgements of likely impacts on abundance targets. Unless otherwise stated, the population size will be that measured using standard methods such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of natural fluctuations and margins of error during data collection. While we will endeavour to keep these values as up to date as possible, local Natural England staff can advise whether the figures stated are the best available. --- Site-specifics: The figure provided is based on the count period from 1996/97 – 2000/01. Overall, there has been a decline in the numbers of dunlin since classification: the 5-year mean peak for 2013/14 - 2017/18 was 15,607 individuals. The site's ability to host the population recorded at classification, or higher numbers recorded subsequently, should not be affected. The most recent population figures for this feature on this SPA can be obtained via the BTO/WeBs website: href="https://app.bto.org/webs-reporting/" (Ross-Smith et al., 2013)

				Overall, there has been a decline in the numbers of dunlin in the Humber SPA since calssification - a drop of approximately 30% . There is some evidence that this trend mirrors regional and the national population trend for this species. However, Natural England consider that due to loss of habitat and other pressures (e.g. coastal squeeze and disturbance) at this site a restore tartget is appropriate.
Redshank (Tringa totanus), Non-breeding	Non-breeding population: abundance	Restore the size of the non-breeding population to a level which is at or above 4,632 wintering individuals and 7,462 individuals during passage, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent	Non-breeding (winter and/or passage) season	This will sustain the site's population and contribute to a viable local, national and bio-geographic population. Due to the mobility of this feature and the dynamic nature of population change, the target-value given for the population size of this feature is considered to be the minimum standard for conservation / restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size has significantly increased as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally at least 10 years). The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is classified, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account. Maintaining or restoring bird abundance depends on the suitability of the site. However, factors affecting suitability can also determine other demographic rates of birds using the site including survival (dependent on factors such as body condition which influences the ability to breed or make foraging and / or migration movements) and breeding productivity. Adverse human impacts on either of these rates may precede changes in population abundance (eg by changing proportions of birds of different ages) but eventually may negatively affect abundance. These rates can be measured / estimated to inform judgements of likely impacts on abundance targets. Unless otherwise stated, the population size will be that measured using standard methods such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of natural fluctuations and margins of error during data collection. While we will endeavour to keep these values as up to date as possible, local Natural England staff can advise whether the figures stated are the best available. --- Site-specifics: The figure provided is based on the count period from 1996/97 – 2000/01. Since classification, numbers have declined steadily, with a recent 5-year mean peak of 3324 (2013/14 to 2017/18). Comparisons with national and regional trends indicate that site-specific factors may be affecting this species on the Humber(Ross-Smith et al., 2013),(Cook et al., 2013). The most recent population figures for this feature on this SPA can be obtained via BTO WeBS data: href=''https://app.bto.org/webs-reporting/'' There is evidence of a significant and ongoing decline in both winter and passage redshank populations on the site over both short- and medium-term periods. This trend is not reflected in the regional and national population trend, and the proportion of the regional population that the site supports has decreased. Therefore the target for population abundance is set to restore.
Little tern (Sternula albifrons), Breeding	Predation - all habitats	Restrict predation and disturbance caused by native and non-native predators	Breeding (summer) season	This will ensure that breeding productivity (number of chicks per pair) and survival are sustained at rates that maintain or restore the abundance of the feature. Impacts to breeding productivity can result directly from predation of eggs, chicks, juveniles and adults, but also from significant disturbance. The presence of predators can influence bird behaviours, such as abandonment of nest sites or reduction of effective feeding. Where evidence suggests predator management is required, measures can include their exclusion through fencing, scaring and direct control. Any such measures must consider the legal protection of some predators, as well as the likely effects of such control on other qualifying features. Predation can influence distribution on a local scale (e.g. through abandonment) or at a wider population scale. (Smith et al., 2010), (Smith et al., 2011) --- Site-specifics: Although still occurring regularly, predation is guarded against by a range of measures at Easington Lagoons. However it is thought that predation by foxes still remains the biggest threat to this colony (Royal Society for the Protection of Birds (RSPB), 2019); (Envision Mapping Ltd., 1996). In addition, having only one regular breeding site within the SPA is likely to make the population much more susceptible to predation. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Avocet (Recurvirostra avosetta), Breeding	Predation - all habitats	Restrict predation and disturbance caused by native and non-native predators	Breeding (summer) season	This will ensure that breeding productivity (number of chicks per pair) and survival are sustained at rates that maintain or restore the abundance of the feature. Impacts to breeding productivity can result directly from predation of eggs, chicks, juveniles and adults, but also from significant disturbance. The presence of predators can influence bird behaviours, such as abandonment of nest sites or reduction of effective feeding. Where evidence suggests predator management is required, measures can include their exclusion through fencing, scaring and direct control. Any such measures must consider the legal protection of some predators, as well as the likely effects of such control on other qualifying features. Predation can influence distribution on a local scale (e.g. through abandonment) or at a wider population scale. (Smith et al., 2010), (Smith et al., 2011) --- Site-specifics: Avocet colonies can be susceptible to predation effects,though this varies between years. There is anecdotal evidence that avocets nesting at Read's Island can experience chick losses due to predation by lesser black-backed gull. The RSPB report that in the 2018 breeding season high accretion levels created a land bridge to Read's Island and led to a serious increase in predation on avocet chicks at this site, primarily by mammals. Some pairs fledged chicks sucessfully on the outer north bank (Andy Gibson, YWT - pers. comms) but overall the

				The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Marsh harrier (Circus aeruginosus), Breeding	Predation - all habitats	Restrict predation and disturbance caused by native and non-native predators	Breeding (summer) season	This will ensure that breeding productivity (number of chicks per pair) and survival are sustained at rates that maintain or restore the abundance of the feature. Impacts to breeding productivity can result directly from predation of eggs, chicks, juveniles and adults, but also from significant disturbance. The presence of predators can influence bird behaviours, such as abandonment of nest sites or reduction of effective feeding. Where evidence suggests predator management is required, measures can include their exclusion through fencing, scaring and direct control. Any such measures must consider the legal protection of some predators, as well as the likely effects of such control on other qualifying features. Predation can influence distribution on a local scale (e.g. through abandonment) or at a wider population scale. (Smith et al., 2010), (Smith et al., 2011) Site-specifics: There is no evidenvce of marsh harrier suffering from significant predation issues in the Humber SPA. This is reflected in increasing numbers of breeding pairs and good productivity levels (Royal Society for the Protection of Birds (RSPB), 2019). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Breeding	Predation - all habitats	Restrict predation and disturbance caused by native and non-native predators	Breeding (summer) season	This will ensure that breeding productivity (number of chicks per pair) and survival are sustained at rates that maintain or restore the abundance of the feature. Impacts to breeding productivity can result directly from predation of eggs, chicks, juveniles and adults, but also from significant disturbance. The presence of predators can influence bird behaviours, such as abandonment of nest sites or reduction of effective feeding. Where evidence suggests predator management is required, measures can include their exclusion through fencing, scaring and direct control. Any such measures must consider the legal protection of some predators, as well as the likely effects of such control on other qualifying features. Predation can influence distribution on a local scale (e.g. through abandonment) or at a wider population scale. (Smith et al., 2010), (Smith et al., 2011) Site-specifics: No site-specific information on this attribute is available. The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Hen harrier (Circus cyaneus), Non-breeding	Supporting habitat: air quality	Maintain concentrations and deposition of air pollutants [at] below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because the structure and function of habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of feeding or roosting habitats. Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH_3), oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. More information about site-relevant Critical Loads and Levels for this site is available by using the 'search by site' tool on the Air Pollution Information System (Centre for Ecology & Hydrology (CEH), 2014). It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. Site-specifics: The target is set as 'maintain' based on current information on the Air Pollution Information System (APIS - accessed 24/06/19) which indicates levels are within an acceptable range, based on the sensitivity of this species and its supporting habitat . Please refer to the website (APIS) for further information and details. For further information regarding air quality, please contact a Natural England adviser. The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Avocet (Recurvirostra avosetta), Non-breeding	Supporting habitat: air quality	Maintain concentrations and deposition of air pollutants [at] below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because the structure and function of habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of feeding or roosting habitats. Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH_3), oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. More information about site-relevant Critical Loads and Levels for this site is available by using the 'search

				It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. Site-specifics: The target is set as 'maintain' based on current information on the Air Pollution Information System (APIS - accessed 24/06/19) which indicates levels are within an acceptable range, based on the sensitivity of this species and its supporting habitat . Please refer to the website (APIS) for further information and details. For further information regarding air quality, please contact a Natural England adviser. The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Golden plover (Pluvialis apricaria), Non-breeding	Supporting habitat: air quality	Maintain concentrations and deposition of air pollutants [at] below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because the structure and function of habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of feeding or roosting habitats. Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH_3), oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. More information about site-relevant Critical Loads and Levels for this site is available by using the 'search by site' tool on the Air Pollution Information System (Centre for Ecology & Hydrology (CEH), 2014). It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. Site-specifics: The target is set as 'maintain' based on current information on the Air Pollution Information System (APIS - accessed 24/06/19) which indicates levels are within an acceptable range, based on the sensitivity of this species and its supporting habitat . Please refer to the website (APIS) for further information and details. For further information regarding air quality, please contact a Natural England adviser. The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Bar-tailed godwit (Limosa lapponica), Non-breeding	Supporting habitat: air quality	Maintain concentrations and deposition of air pollutants [at] below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because the structure and function of habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of feeding or roosting habitats. Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH_3), oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. More information about site-relevant Critical Loads and Levels for this site is available by using the 'search by site' tool on the Air Pollution Information System (Centre for Ecology & Hydrology (CEH), 2014). It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. Site-specifics: The target is set as 'maintain' based on current information on the Air Pollution Information System (APIS - accessed 24/06/19) which indicates levels are within an acceptable range, based on the sensitivity of this species and its supporting habitat . Please refer to the website (APIS) for further information and details. For further information regarding air quality, please contact a Natural England adviser. The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Redshank (Tringa totanus), Non-breeding	Supporting habitat: air quality	Maintain concentrations and deposition of air pollutants at below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because the structure and function of habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of feeding or roosting habitats. Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH_3), oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. More information about site-relevant Critical Loads and Levels for this site is available by using the 'search by site' tool on the Air Pollution Information System (Centre for Ecology & Hydrology (CEH), 2014).

				It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. Site-specifics: The target is set as 'maintain' based on current information on the Air Pollution Information System (APIS - accessed 24/06/19) which indicates levels are within an acceptable range, based on the sensitivity of this species and its supporting habitat . Please refer to the website (APIS) for further information and details. For further information regarding air quality, please contact a Natural England adviser. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Ruff (Calidris pugnax), Non-breeding	Supporting habitat: air quality	Maintain concentrations and deposition of air pollutants at below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because the structure and function of habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of feeding or roosting habitats. Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH_3), oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. More information about site-relevant Critical Loads and Levels for this site is available by using the 'search by site' tool on the Air Pollution Information System (Centre for Ecology & Hydrology (CEH), 2014). It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. Site-specifics: The target is set as 'maintain' based on current information on the Air Pollution Information System (APIS - accessed 24/06/19) which indicates levels are within an acceptable range, based on the sensitivity of this species and its supporting habitat . Please refer to the website (APIS) for further information and details. For further information regarding air quality, please contact a Natural England adviser. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Dunlin (Calidris alpina alpina), Non-breeding	Supporting habitat: air quality	Maintain concentrations and deposition of air pollutants at below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because the structure and function of habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of feeding or roosting habitats. Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH_3), oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. More information about site-relevant Critical Loads and Levels for this site is available by using the 'search by site' tool on the Air Pollution Information System (Centre for Ecology & Hydrology (CEH), 2014). It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. Site-specifics: The target is set as 'maintain' based on current information on the Air Pollution Information System (APIS - accessed 24/06/19) which indicates levels are within an acceptable range, based on the sensitivity of this species and its supporting habitat . Please refer to the website (APIS) for further information and details. For further information regarding air quality, please contact a Natural England adviser. The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Black-tailed godwit (Limosa limosa islandica), Non-breeding	Supporting habitat: air quality	Maintain concentrations and deposition of air pollutants at below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because the structure and function of habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of feeding or roosting habitats. Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH_3), oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. More information about site-relevant Critical Loads and Levels for this site is available by using the 'search by site' tool on the Air Pollution Information System (Centre for Ecology & Hydrology (CEH), 2014).

				of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. Site-specifics: The target is set as 'maintain' based on current information on the Air Pollution Information System (APIS - accessed 24/06/19) which indicates levels are within an acceptable range, based on the sensitivity of this species and its supporting habitat . Please refer to the website (APIS) for further information and details. For further information regarding air quality, please contact a Natural England adviser. The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Little tern (Sternula albifrons), Breeding	Supporting habitat: air quality	Maintain concentrations and deposition of air pollutants at below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because the structure and function of habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of nesting, feeding or roosting habitats. Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH_3), oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. More information about site-relevant Critical Loads and Levels for this site is available by using the 'search by site' tool on the Air Pollution Information System (Centre for Ecology & Hydrology (CEH), 2014). It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. Site-specifics: The target is set as 'maintain' based on current information on the Air Pollution Information System (APIS - accessed 24/06/19) which indicates levels are within an acceptable range, based on the sensitivity of this species and its supporting habitat . Please refer to the website (APIS) for further information and details. For further information regarding air quality, please contact a Natural England adviser. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Waterbird assemblage, Non-breeding	Supporting habitat: air quality	Maintain concentrations and deposition of air pollutants at below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because the structure and function of habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of feeding or roosting habitats. Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH_3), oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. More information about site-relevant Critical Loads and Levels for this site is available by using the 'search by site' tool on the Air Pollution Information System (Centre for Ecology & Hydrology (CEH), 2014). It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. Site-specifics: Site-relevant critical loads are not available for all the components of this feature. However, the Humber Estuary has an average critical load level of 12.8 kg N/ha/yr which is within tolerance range for saltmarsh habitat, which is important for many of these component species. Levels may vary across the site but overall the current levels, as given on the the Air Pollution Information System (APIS - accessed 24/06/19) are not known to have a significant effect on birds within the SPA. Please refer to the website (APIS) for further information and details. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Knot (Calidris canutus), Non-breeding	Supporting habitat: air quality	Maintain concentrations and deposition of air pollutants at below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because the structure and function of habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of feeding or roosting habitats. Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH_3), oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. More information about site-relevant Critical Loads and Levels for this site is available by using the 'search

				by site' tool on the Air Pollution Information System (Centre for Ecology & Hydrology (CEH), 2014). It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. --- Site-specifics: The target is set as 'maintain' based on current information on the Air Pollution Information System (APIS - accessed 24/06/19) which indicates levels are within an acceptable range, based on the sensitivity of this species and its supporting habitat . Please refer to the website (APIS) for further information and details. For further information regarding air quality, please contact a Natural England adviser. The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Avocet (Recurvirostra avosetta), Breeding	Supporting habitat: air quality	Maintain concentrations and deposition of air pollutants at below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because the structure and function of habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of nesting, feeding or roosting habitats. Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH_3), oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. More information about site-relevant Critical Loads and Levels for this site is available by using the 'search by site' tool on the Air Pollution Information System (Centre for Ecology & Hydrology (CEH), 2014). It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. --- Site-specifics: The target is set as 'maintain' based on current information on the Air Pollution Information System (APIS - accessed 24/06/19) which indicates levels are within an acceptable range, based on the sensitivity of this species and its supporting habitat . Please refer to the website (APIS) for further information and details. For further information regarding air quality, please contact a Natural England ader. The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Marsh harrier (Circus aeruginosus), Breeding	Supporting habitat: air quality	Maintain concentrations and deposition of air pollutants at below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because the structure and function of habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of nesting, feeding or roosting habitats. Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH_3), oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. More information about site-relevant Critical Loads and Levels for this site is available by using the 'search by site' tool on the Air Pollution Information System (Centre for Ecology & Hydrology (CEH), 2014). It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. --- Site-specifics: The target is set as 'maintain' based on current information on the Air Pollution Information System (APIS - accessed 24/06/19) which indicates levels are within an acceptable range, based on the sensitivity of this species and its supporting habitat . Please refer to the website (APIS) for further information and details. The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Shelduck (Tadorna tadorna), Non-breeding	Supporting habitat: air quality	Maintain concentrations and deposition of air pollutants at below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because the structure and function of habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of feeding or roosting habitats. Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH_3), oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. More information about site-relevant Critical Loads and Levels for this site is available by using the 'search

				It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. Site-specifics: The target is set as 'maintain' based on current information on the Air Pollution Information System (APIS - accessed 24/06/19) which indicates levels are within an acceptable range, based on the sensitivity of this species and its supporting habitat . Please refer to the website (APIS) for further information and details. For further information regarding air quality, please contact a Natural England adviser. The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Bittern (Botaurus stellaris), Breeding	Supporting habitat: air quality	Maintain concentrations and deposition of air pollutants at below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because the structure and function of habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of nesting, feeding or roosting habitats. Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH_3), oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. More information about site-relevant Critical Loads and Levels for this site is available by using the 'search by site' tool on the Air Pollution Information System (Centre for Ecology & Hydrology (CEH), 2014). It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. Site-specifics: The target is set as 'maintain' based on current information on the Air Pollution Information System (APIS - accessed 24/06/19) which indicates levels are within an acceptable range, based on the sensitivity of this species and its supporting habitat . Please refer to the website (APIS) for further information and details. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Non-breeding	Supporting habitat: air quality	Maintain concentrations and deposition of air pollutants at below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because the structure and function of habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of feeding or roosting habitats. Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH_3), oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. More information about site-relevant Critical Loads and Levels for this site is available by using the 'search by site' tool on the Air Pollution Information System (Centre for Ecology & Hydrology (CEH), 2014). It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. Site-specifics: The target is set as 'maintain' based on current information on the Air Pollution Information System (APIS - accessed 24/06/19) which indicates levels are within an acceptable range, based on the sensitivity of this species and its supporting habitat . Please refer to the website (APIS) for further information and details. For further information regarding air quality, please contact a Natural England adviser. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Waterbird assemblage, Non-breeding	Supporting habitat: conservation measures	Maintain the structure, function and supporting processes associated with the feature and its supporting habitat through management or other measures (whether within and/or outside the site boundary as appropriate) and ensure these measures are not being undermined or compromised.	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Further details about the necessary conservation measures for this site can be provided by Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and / or management agreements. Site-specifics: Further details about the necessary conservation measures for this site and site-specific management plans can be provided by Natural England if required. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to

Black-tailed godwit (Limosa limosa islandica), Non-breeding	Supporting habitat: conservation measures	Maintain the structure, function and supporting processes associated with the feature and its supporting habitat through management or other measures (whether within and/or outside the site boundary as appropriate) and ensure these measures are not being undermined or compromised.	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Further details about the necessary conservation measures for this site can be provided by Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and / or management agreements. Site-specifics: Further details about the necessary conservation measures for this site and site-specific management plans can be provided by Natural England if required. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Dunlin (Calidris alpina alpina), Non-breeding	Supporting habitat: conservation measures	Maintain the structure, function and supporting processes associated with the feature and its supporting habitat through management or other measures (whether within and/or outside the site boundary as appropriate) and ensure these measures are not being undermined or compromised.	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Further details about the necessary conservation measures for this site can be provided by Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and / or management agreements. Site-specifics: Further details about the necessary conservation measures for this site and site-specific management plans can be provided by Natural England if required. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Ruff (Calidris pugnax), Non-breeding	Supporting habitat: conservation measures	Maintain the structure, function and supporting processes associated with the feature and its supporting habitat through management or other measures (whether within and/or outside the site boundary as appropriate) and ensure these measures are not being undermined or compromised.	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Further details about the necessary conservation measures for this site can be provided by Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and / or management agreements. Site-specifics: Further details about the necessary conservation measures for this site and site-specific management plans can be provided by Natural England if required. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Redshank (Tringa totanus), Non-breeding	Supporting habitat: conservation measures	Maintain the structure, function and supporting processes associated with the feature and its supporting habitat through management or other measures (whether within and/or outside the site boundary as appropriate) and ensure these measures are not being undermined or compromised.	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Further details about the necessary conservation measures for this site can be provided by Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and / or management agreements. Site-specifics: Further details about the necessary conservation measures for this site and site-specific management plans can be provided by Natural England if required. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bar-tailed godwit (Limosa lapponica), Non-breeding	Supporting habitat: conservation measures	Maintain the structure, function and supporting processes associated with the feature and its supporting habitat through management or other measures (whether within and/or outside the site boundary as appropriate) and ensure these measures are not being undermined or compromised.	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Further details about the necessary conservation measures for this site can be provided by Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and / or management agreements. Site-specifics: Further details about the necessary conservation measures for this site and site-specific management plans can be provided by Natural England if required. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus	Supporting	Maintain the	Year	This target has been included because active and ongoing conservation management is often needed to

stellaris), Non-breeding	habitat: conservation measures	structure, function and supporting processes associated with the feature and its supporting habitat through management or other measures (whether within and/or outside the site boundary as appropriate) and ensure these measures are not being undermined or compromised.	round – to ensure the habitat remains suitable for when the feature is present	protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Further details about the necessary conservation measures for this site can be provided by Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. Site-specifics: Further details about the necessary conservation measures for this site and site-specific management plans can be provided by Natural England if required. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Breeding	Supporting habitat: conservation measures	Maintain the structure, function and supporting processes associated with the feature and its supporting habitat through management or other measures (whether within and/or outside the site boundary as appropriate) and ensure these measures are not being undermined or compromised.	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Further details about the necessary conservation measures for this site can be provided by Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and / or management agreements. Site-specifics: Further details about the necessary conservation measures for this site and site-specific management plans can be provided by Natural England if required. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Shelduck (Tadorna tadorna), Non-breeding	Supporting habitat: conservation measures	Maintain the structure, function and supporting processes associated with the feature and its supporting habitat through management or other measures (whether within and/or outside the site boundary as appropriate) and ensure these measures are not being undermined or compromised.	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Further details about the necessary conservation measures for this site can be provided by Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and / or management agreements. Site-specifics: Further details about the necessary conservation measures for this site and site-specific management plans can be provided by Natural England if required. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Marsh harrier (Circus aeruginosus), Breeding	Supporting habitat: conservation measures	Maintain the structure, function and supporting processes associated with the feature and its supporting habitat through management or other measures (whether within and/or outside the site boundary as appropriate) and ensure these measures are not being undermined or compromised.	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Further details about the necessary conservation measures for this site can be provided by Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and / or management agreements. Site-specifics: Further details about the necessary conservation measures for this feature and site-specific management plans can be provided by Natural England if required. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Hen harrier (Circus cyaneus), Non-breeding	Supporting habitat: conservation measures	Maintain the structure, function and supporting processes associated with the feature and its supporting habitat through management or other measures (whether within and/or outside the site boundary as appropriate) and ensure these measures are not being undermined or compromised.	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Further details about the necessary conservation measures for this site can be provided by Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and / or management agreements. Site-specifics: Further details about the necessary conservation measures for this site and site-specific management plans can be provided by Natural England if required. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Avocet (Recurvirostra avosetta),	Supporting habitat: conservation	Maintain the structure, function and supporting	Year round – to ensure	This target has been included because active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some

		with the feature and its supporting habitat through management or other measures (whether within and/or outside the site boundary as appropriate) and ensure these measures are not being undermined or compromised.	habitat remains suitable for when the feature is present	target. Further details about the necessary conservation measures for this site can be provided by Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and / or management agreements. Site-specifics: This target has been included because active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other conservation measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. Further details about the necessary conservation measures for this site and site-specific management plans can be provided by Natural England if required. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Avocet (Recurvirostra avosetta), Non-breeding	Supporting habitat: conservation measures	Maintain the structure, function and supporting processes associated with the feature and its supporting habitat through management or other measures (whether within and/or outside the site boundary as appropriate) and ensure these measures are not being undermined or compromised.	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Further details about the necessary conservation measures for this site can be provided by Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and / or management agreements. Site-specifics: Further details about the necessary conservation measures for this site and site-specific management plans can be provided by Natural England if required. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Knot (Calidris canutus), Non-breeding	Supporting habitat: conservation measures	Maintain the structure, function and supporting processes associated with the feature and its supporting habitat through management or other measures (whether within and/or outside the site boundary as appropriate) and ensure these measures are not being undermined or compromised.	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Further details about the necessary conservation measures for this site can be provided by Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and / or management agreements. Site-specifics: Further details about the necessary conservation measures for this site and site-specific management plans can be provided by Natural England if required. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Golden plover (Pluvialis apricaria), Non-breeding	Supporting habitat: conservation measures	Maintain the structure, function and supporting processes associated with the feature and its supporting habitat through management or other measures (whether within and/or outside the site boundary as appropriate) and ensure these measures are not being undermined or compromised.	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Further details about the necessary conservation measures for this site can be provided by Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and / or management agreements. Site-specifics: Further details about the necessary conservation measures for this site and site-specific management plans can be provided by Natural England if required. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Little tern (Sternula albifrons), Breeding	Supporting habitat: conservation measures	Restore the structure, function and supporting processes associated with the feature and its supporting habitat through management or other measures (whether within and/or outside the site boundary as appropriate) and ensure these measures are not being undermined or	Year round – to ensure the habitat remains suitable for when the feature is present	This target has been included because active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Further details about the necessary conservation measures for this site can be provided by Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and / or management agreements. Site-specifics: A significant amount of conservation effort is employed annually to protect the little tern breeding site. During breeding seasons wardens monitor the site, 24 hours a day at critical times, and electric fences are erected to prevent predation by foxes (Royal Society for the Protection of Birds (RSPB), 2019). There is currently only one breeding site in the SPA and future conservation management should focus on the

				Further details about the necessary conservation measures for this site and site-specific management plans can be provided by Natural England if required. The target set relates to the decline of the feature population as well as the abandonment of the south bank as a breeding location. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Marsh harrier (Circus aeruginosus), Breeding	Supporting habitat: extent and distribution of supporting habitat for the breeding season	Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of its breeding cycle (courtship, nesting, feeding) at: current level. Exact ha not known at this time.	Year round – to ensure the habitat remains suitable for when the feature is present	To maintain or restore the extent of supporting habitats and their range in order to maintain the population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending to the nature, age and accuracy of data collection. Inappropriate management and direct or indirect impacts which may affect the extent and distribution of habitats may adversely affect the population and alter the distribution of birds. Site-specifics: The following habitats support this feature during the breeding season: Tidal reedbeds Intertidal mixed sediments Intertidal sand and muddy sand Freshwater wetlands Inland areas of wet grassland, rough grassland and agricultural land (both arable land and permanent pasture) Further information on specific areas used by this feature can be found in the feature description. (Fearnley et al., 2012); (Mander and Cutts, 2005);(Black & Veatch Ltd., 2005);(Short, 2004 - 2010);(Allen et al., 2003) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Breeding	Supporting habitat: extent and distribution of supporting habitat for the breeding season	Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of its breeding cycle (courtship, nesting, feeding).	Year round – to ensure the habitat remains suitable for when the feature is present	To maintain or restore the extent of supporting habitats and their range in order to maintain the population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending to the nature, age and accuracy of data collection. Inappropriate management and direct or indirect impacts which may affect the extent and distribution of habitats may adversely affect the population and alter the distribution of birds. Site-specifics: This target is provided to maintain the extent of supporting habitats and their range in order to maintain the population. . The following habitats support this feature during the breeding season: Freshwater and tidal reedbeds Freshwater wetlands Further information on specific areas used by this feature can be found in the feature description(Fearnley et al., 2012),(Baylis, 2010),(Cruickshanks et al., 2010),(Black & Veatch Ltd., 2005). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Avocet (Recurvirostra avosetta), Breeding	Supporting habitat: extent and distribution of supporting habitat for the breeding season	Restore the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of its breeding cycle (courtship, nesting, feeding) to: an unspecified extent, based on restoring natural estuarine functioning.	Year round – to ensure the habitat remains suitable for when the feature is present	To maintain or restore the extent of supporting habitats and their range in order to maintain the population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending to the nature, age and accuracy of data collection. Inappropriate management and direct or indirect impacts which may affect the extent and distribution of habitats may adversely affect the population and alter the distribution of birds. Site-specifics: This target is provided to maintain the extent of supporting habitats and their range in order to maintain the population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection(Calbrade, 2013),(Allen et al., 2003). The following habitats support this feature during the breeding season: Coastal lagoons Intertidal sand and mudfla/ts N.B This target may apply to supporting habitat which lies outside the site boundary (optional sentence). Generally, birds will not be nesting on habitat regularly flooded by the tide but they will be found in intertidal habitats above the Mean High Water Mark (which may not have been mapped) Further information on specific areas used by this feature can be found in the feature description. There is a loss of extent to the SAC mudflat and sand flat feature, as well as the Atlantic Saltmeadow feature. There is also predicted long-term loss to supporting habitats based on EA modelling of future coastal squeeze. For this reason a 'maintain' target is inappropropriate and a 'Restore' target has been selected. A specific target in ha has not been set due to the multiple habitats involved and the dynamic nature of the estuarine system.
Little tern (Sternula	Supporting habitat: extent	Restore the extent, distribution and	Year round –	To maintain or restore the extent of supporting habitats and their range in order to maintain the

Breeding	distribution of supporting habitat for the breeding season	habitat (either within or outside the site boundary) which supports the feature for all necessary stages of its breeding cycle (courtship, nesting, feeding) to: an unspecified extent, based on restoring natural estuarine functioning.	the habitat remains suitable for when the feature is present	feature may be approximate depending to the nature, age and accuracy of data collection. Inappropriate management and direct or indirect impacts which may affect the extent and distribution of habitats may adversely affect the population and alter the distribution of birds. Site-specifics: This target is provided to restore the extent of supporting habitats and their range in order to maintain the population. The following habitats support this feature during the breeding season: Sand dunes Intertidal mixed sediments Intertidal sand and muddy sand Coastal lagoons Water column Further information on specific areas used by this feature can be found in the feature description. The distribution of little tern has become increasingly concentrated at Easington lagoons, where wardening is carried out annually. Furthermore, Little tern once regularly bred on the south bank of the Humber, but no longer do so. This represents a significant loss in terms of distribution. (Bruce and Newton, 2012);(Henderson and Moore, 2011);(Mander and Cutts, 2005);(Royal Society for the Protection of Birds (RSPB), 2002, 2005 - 2006, 2008 - 2012) N.B This target may apply to supporting habitat which lies outside the site boundary. Generally, birds will not be nesting on habitat regularly flooded by the tide but they will be found in intertidal habitats above the Mean High Water Mark (which may not have been mapped). This target is set to restore on the basis that breeding little tern are only regularly present in one location, and no longer breed on the south bank of the estuary.
Bittern (Botaurus stellaris), Non-breeding	Supporting habitat: extent and distribution of supporting habitat for the non-breeding season	Maintain the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) to an unspecified extent, based on restoring natural estuarine functioning.	Year round – to ensure the habitat remains suitable for when the feature is present	This target may apply to supporting habitat which also lies outside the site boundary. Inappropriate management and direct or indirect impacts which may affect the extent and distribution of habitats may adversely affect the population and alter the distribution of birds. Site-specifics: This target is provided to maintain the extent of supporting habitats and their range in order to maintain the population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection. The following habitats support this feature: reshwater and tidal reedbeds Freshwater wetlands This target may also apply to supporting habitat which also lies outside the site boundary. Further information on specific areas used by this feature can be found in the feature description. (Calbrade, 2013);(Cruickshanks et al., 2010);(Black & Veatch Ltd., 2005); (Allen et al., 2003) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Hen harrier (Circus cyaneus), Non-breeding	Supporting habitat: extent and distribution of supporting habitat for the non-breeding season	Maintain the extent, distribution and availability of suitable habitat either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) [at] [unspecified levels]	Year round – to ensure the habitat remains suitable for when the feature is present	This target may apply to supporting habitat which also lies outside the site boundary. Inappropriate management and direct or indirect impacts which may affect the extent and distribution of habitats may adversely affect the population and alter the distribution of birds. Site-specifics: This target is provided to maintain the extent of supporting habitats and their range in order to maintain the population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection. The following habitats support this feature: Tidal reedbeds Saltmarsh Intertidal mixed sediments Intertidal sand and muddy sand Inland areas of wet grassland, rough grassland and agricultural land (both arable land and permanent pasture) >/ul> This target may also apply to supporting habitat which lies outside the SPA site boundary (Royal Society for the Protection of Birds (RSPB), 2014),(Black & Veatch Ltd., 2005),() Further information on specific areas used by this feature can be found in the feature description. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bar-tailed godwit (Limosa lapponica), Non-breeding	Supporting habitat: extent and distribution of supporting habitat for the	Restore the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which	Year round – to ensure the habitat remains	This target may apply to supporting habitat which also lies outside the site boundary. Inappropriate management and direct or indirect impacts which may affect the extent and distribution of habitats may adversely affect the population and alter the distribution of birds. Site-specifics:

	season	for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) [to] [an unknown extent, based on restoring natural estuarine functioning]	for when the feature is present	the population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection. The following habitats support this feature: Intertidal mud Coastal lagoons Freshwater and coastal grazing marsh Salicornia and other annuals coloning mud and sand Saltmarsh Intertidal sand and muddy sand This target may also apply to supporting habitat which also lies outside the site boundary. Further information on specific areas used by this feature can be found in the feature description. (Calbrade, 2013),(Ross-Smith et al., 2013), (), (Mander et al., 2006),(Catley, 2000) There is a loss of extent to the SAC mudflat and sand flat feature, as well as the Atlantic saltmeadow feature. There is also predicted long-term loss to supporting habitats based on EA modelling of future coastal squeeze. For this reason a 'maintain' target is inappropropriate and a 'Restore' target has been selected. A specific target in ha has not been set due to the multiple habitats involved and the dynamic nature of the estuarine system.
Golden plover (Pluvialis apricaria), Non-breeding	Supporting habitat: extent and distribution of supporting habitat for the non-breeding season	Restore the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) [to] [an unspecifiedextent, based on restoring natural estuarine functioning]	Year round – to ensure the habitat remains suitable for when the feature is present	This target may apply to supporting habitat which also lies outside the site boundary. Inappropriate management and direct or indirect impacts which may affect the extent and distribution of habitats may adversely affect the population and alter the distribution of birds. Site-specifics: This target is provided to maintain the extent of supporting habitats and their range in order to maintain the population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection. The following habitats support this feature: Intertidal sand and mudflats Coastal lagoons Saltmarsh Inland areas of wet grassland and agricultural land (both arable land and permanent pasture) Grassland is the most important feeding habitat, with earthworm-rich permanent pastures preferred over leys and arable This target may also apply to supporting habitat which also lies outside the site boundary. Further information on specific areas used by this feature can be found in the feature description.(Calbrade, 2013); (Ross-Smith et al., 2013);(Mander, 2012);(Coates, 2011);(Cruickshanks et al., 2010); (Mander et al., 2006); (Mander and Cutts, 2003) There is a loss of extent to the SAC mudflat and sand flat feature, as well as the Atlantic saltmeadow feature. There is also predicted long-term loss to supporting habitats based on EA modelling of future coastal squeeze. For this reason a 'maintain' target is inappropropriate and a 'Restore' target has been selected. A specific target in ha has not been set due to the multiple habitats involved and the dynamic nature of the estuarine system.
Avocet (Recurvirostra avosetta), Non-breeding	Supporting habitat: extent and distribution of supporting habitat for the non-breeding season	Restore the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) at [unspecified extent]	Year round – to ensure the habitat remains suitable for when the feature is present	This target may apply to supporting habitat which also lies outside the site boundary. Inappropriate management and direct or indirect impacts which may affect the extent and distribution of habitats may adversely affect the population and alter the distribution of birds. Site-specifics: This target is provided to maintain the extent of supporting habitats and their range in order to maintain the population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection. The following habitats support this feature: Intertidal sand and mudflats Coastal lagoons Saltmarsh This target may also apply to supporting habitat which also lies outside the site boundary. Further information on areas used by this feature can be found in the feature description.(Calbrade, 2013) (Black & Veatch Ltd., 2005)(Allen et al., 2003)(Catley, 2000) There is a loss of extent to the SAC mudflat and sand flat feature, as well as the Atlantic saltmeadow feature. There is also predicted long-term loss to supporting habitats based on EA modelling of future coastal squeeze. For this reason a 'maintain' target is inappropropriate and a 'Restore' target has been selected. A specific target in ha has not been set due to the multiple habitats involved and the dynamic nature of the estuarine system.
Shelduck (Tadorna tadorna), Non-breeding	Supporting habitat: extent and distribution of supporting habitat for the non-breeding season	Restore the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary	Year round – to ensure the habitat remains suitable for when	This target may apply to supporting habitat which also lies outside the site boundary. Inappropriate management and direct or indirect impacts which may affect the extent and distribution of habitats may adversely affect the population and alter the distribution of birds. Site-specifics: This target is provided to maintain the extent of supporting habitats and their range in order to maintain the population. The information available on the extent and distribution of supporting habitat used by the

		breeding/wintering period (moulting, roosting, loafing, feeding) to an unknown extent, based on restoring natural estuarine functioning.	feature is present	feature may be approximate depending on the nature, age and accuracy of data collection. The following habitats support this feature: Intertidal sand and mudflats Coastal lagoons Saltmarsh The Humber Flood Risk Management Strategy HRA predicts that approximately 300ha of intertidal habitat (including habitats supporting this species) will be lost to coastal squeeze by 2056 (EA, 2011). This was modelled in 2008 and will be reviewed as part of the comprehensive review of the Humber FRMS, scheduled for completion in 2020. This target may also apply to supporting habitat which also lies outside the site boundary. Further information on specific areas used by this feature can be found in the feature description(Calbrade, 2013);(Holt et al., 2012); (Mander and Cutts, 2005);(Catley, 2000). There is a loss of extent to the SAC mudflat and sand flat feature, as well as the Atlantic saltmeadow feature. There is also predicted long-term loss to supporting habitats based on EA modelling of future coastal squeeze. For this reason a 'maintain' target is inappropropriate and a 'Restore' target has been selected. A specific target in ha has not been set due to the multiple habitats involved and the dynamic nature of the estuarine system.
Waterbird assemblage, Non-breeding	Supporting habitat: extent and distribution of supporting habitat for the non-breeding season	Restore the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) to an unknown extent, based on restoring natural estuarine functioning.	Year round – to ensure the habitat remains suitable for when the feature is present	The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection. This target may apply to supporting habitat which also lies outside the site boundary. Inappropriate management and direct or indirect impacts which may affect the extent and distribution of habitats may adversely affect the population and alter the distribution of birds. --- Site-specifics: The site's ability to support and sustain an assemblage comprising a very large number of birds (in excess of 20,000) made up of a diverse mix of species will be reliant on the overall quality and diversity of the habitats that support them. The feeding and roosting habitats which support the assemblage will occur within, and in some cases outside, the site boundary. This target is applicable to both circumstances. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending to the nature, age and accuracy of data collection. The principal habitats known or likely to support the assemblage feature at this SPA are: Intertidal sand and mudflats Coastal lagoons Saltmarsh Tidal reedbeds Freshwater wetlands Inland areas of wet grassland, rough grassland and agricultural land (both arable land and permanent pasture) Annual vegetation of driftlines (sand and shingle) Artificial structures such as derelict pier/jetty structures, flood defences Further information on specific areas used by this feature can be found in the feature description. References: (Cutts, 2014 Pers Comm);(Baylis, 2013); (Calbrade, 2013); (Ross-Smith et al., 2013); (Holt et al., 2012); (Mander, 2012);(Shepherd, Various); (Shepherd, Various);(Coates, 2011); (Cruickshanks et al., 2010); (Catley, 2009)(McParland and Folland, 2009); ();(Black & Veatch Ltd., 2008); (Mander et al., 2006); (Black & Veatch Ltd., 2005); (Mander and Cutts, 2005);(Stillman et al., 2005) (Allen et al., 2003); (Mander and Cutts, 2003);(Catley, 2000) There is a loss of extent to the SAC mudflat and sand flat feature, as well as the Atlantic saltmeadow feature. There is also predicted long-term loss to supporting habitats based on EA modelling of future coastal squeeze. For this reason a 'Maintain' target is inappropropriate and a 'Restore' target has been selected. A specific target in ha has not been set due to the multiple habitats involved and the dynamic nature of the estuarine system.
Black-tailed godwit (Limosa limosa islandica), Non-breeding	Supporting habitat: extent and distribution of supporting habitat for the non-breeding season	Restore the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) to an unspecified extent,	Year round – to ensure the habitat remains suitable for when the feature is present	This target may apply to supporting habitat which also lies outside the site boundary. Inappropriate management and direct or indirect impacts which may affect the extent and distribution of habitats may adversely affect the population and alter the distribution of birds. --- Site-specifics: This target is provided to maintain the extent of supporting habitats and their range in order to maintain the population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection. The following habitats support this feature: Intertidal sand and mudflats Coastal lagoons Saltmarsh Inland areas of wet grassland and agricultural land (both arable land and permanent pasture) This target may also apply to supporting habitat which also lies outside the site boundary. Further information on specific areas used by this feature can be found in the feature description. (Calbrade, 2013),(Catley, 2009),(Mander and Cutts, 2005), (Stillman et al., 2005),(Catley, 2000) There is a loss of extent to the SAC mudflat and sand flat feature, as well as the Atlantic Saltmeadow feature. There is also predicted long-term loss to supporting habitats based on EA modelling of future coastal squeeze. For this reason a 'Maintain' target is inappropropriate and a 'Restore' target has been selected. A specific target in ha has not been set due to the multiple habitats involved and the dynamic nature of the estuarine system.

Dunlin (Calidris alpina alpina), Non-breeding	Supporting habitat: extent and distribution of supporting habitat for the non-breeding season	Restore the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) to an unspecified extent, based on restoring natural estuarine functioning	Year round – to ensure the habitat remains suitable for when the feature is present	This target may apply to supporting habitat which also lies outside the site boundary. Inappropriate management and direct or indirect impacts which may affect the extent and distribution of habitats may adversely affect the population and alter the distribution of birds. Site-specifics: This target is provided to maintain the extent of supporting habitats and their range in order to maintain the population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection. The following habitats support this feature: Intertidal sand and mudflats Coastal lagoons Saltmarsh Inland areas of wet grassland and agricultural land (both arable land and permanent pasture) Salicornia and other annuals colonising mud and sand This target may also apply to supporting habitat whi lies outside the site boundary. Further information on specific areas used by this feature can be found in the feature description. (Cutts, 2014 Pers Comm); (Calbrade, 2013); (Mander et al., 2006);(Allen et al., 2003); (Catley, 2000) There is a loss of extent to the SAC mudflat and sand flat feature, as well as the Atlantic saltmeadow feature. There is also predicted long-term loss to supporting habitats based on EA modelling of future coastal squeeze. For this reason a 'maintain' target is inappropropriate and a 'Restore' target has been selected. A specific target in ha has not been set due to the multiple habitats involved and the dynamic nature of the estuarine system.
Ruff (Calidris pugnax), Non-breeding	Supporting habitat: extent and distribution of supporting habitat for the non-breeding season	Restore the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) to an unspecified extent, based on restoring natural estuarine functioning.	Year round – to ensure the habitat remains suitable for when the feature is present	This target may apply to supporting habitat which also lies outside the site boundary. Inappropriate management and direct or indirect impacts which may affect the extent and distribution of habitats may adversely affect the population and alter the distribution of birds. Site-specifics: This target is provided to maintain the extent of supporting habitats and their range in order to maintain the population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection. The target has been set to restore as Ruff make use of intertidal habitat, which has reduced in extent, but it is acknowledged that ruff make limited use of this habitat on the Humber. The following habitats support this feature: Intertidal sand and mudflats Coastal lagoons Saltmarsh Inland areas of wet grassland and agricultural land (both arable land and permanent pasture) Further information on specific areas used by this feature can be found in the feature description. (Calbrade, 2013);(Baylis, 2013); (McParland and Folland, 2009);(Mander and Cutts, 2005);(Allen et al., 2003); (Catley, 2000) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Redshank (Tringa totanus), Non-breeding	Supporting habitat: extent and distribution of supporting habitat for the non-breeding season	Restore the extent, distribution and availability of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) to an unspecified extent, based on restoring natural estuarine functioning.	Year round – to ensure the habitat remains suitable for when the feature is present	This target may apply to supporting habitat which also lies outside the site boundary. Inappropriate management and direct or indirect impacts which may affect the extent and distribution of habitats may adversely affect the population and alter the distribution of birds. Site-specifics: This target is provided to maintain the extent of supporting habitats and their range in order to maintain the population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection. The following habitats support this feature: Intertidal sand and mudflats Coastal lagoons Saltmarsh Inland areas of wet grassland and agricultural land (both arable land and permanent pasture) Supralittoral sand and shingle Artificial structures such as derelict pier/jetty structures, flood defences This target may also apply to supporting habitat which also lies outside the site boundary. Further information on specific areas used by this feature can be found in the feature description. (Calbrade, 2013);(Allen et al., 2003);(Shepherd, Various) (Shepherd, Various); (Catley, 2000) There is a loss of extent to the SAC mudflat and sand flat feature, as well as the Atlantic saltmeadow feature. There is also predicted long-term loss to this supporting habitat based on EA modelling of future coastal squeeze. For this reason a 'Maintain' target is inappropropriate and a 'Restore' target has been selected.
Knot (Calidris canutus), Non-breeding	Supporting habitat: extent and distribution of	Restore the extent, distribution and availability of suitable habitat (either within	Year round – to ensure the	This target may apply to supporting habitat which also lies outside the site boundary. Inappropriate management and direct or indirect impacts which may affect the extent and distribution of habitats may adversely affect the population and alter the distribution of birds.

	habitat for the non-breeding season	boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) to] an unknown extent, based on restoring natural estuarine functioning.	remains suitable for when the feature is present	Site-specifics: This target is provided to maintain the extent of supporting habitats and their range in order to maintain the population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection. The following habitats support this feature: Intertidal sand and mudflats Coastal lagoons Saltmarsh Annual vegetation of driftlines (sand and shingle) Artificial structures such as derelict pier/jetty structures, flood defences This target may also apply to supporting habitat which also lies outside the site boundary(Calbrade, 2013); (Ross-Smith et al., 2013); (Holt et al., 2012); (Black & Veatch Ltd., 2008). Further information on specific areas used by this feature can be found in the feature description. There is a loss of extent to the SAC mudflat and sand flat feature, as well as the Atlantic saltmeadow feature. There is also predicted long-term loss to supporting habitats based on EA modelling of future coastal squeeze. For this reason a 'maintain' target is inappropropriate and a 'Restore' target has been selected. A specific target in ha has not been set due to the multiple habitats involved and the dynamic nature of the estuarine system.
Little tern (Sternula albifrons), Breeding	Supporting habitat: food availability (bird)	Maintain abundance and availability of key food and prey items (eg. crustacea, annelids, sandeel, herring, clupeidae) at preferred sizes.	Year round	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population and alter the distribution of birds. Main food sources can be found within: coastal and offshore waters. (Cramp et al., 1974), (del Hoyo et al., 1996), (Perrow et al., 2006) --- Site-specifics: This target relates both to the SPA and coastal waters outside the site. Important prey species for little tern include crustacea, annelids, sandeel, herring and clupeidae(Allen et al., 2003);(Garner et al., 2012). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Black-tailed godwit (Limosa limosa islandica), Non-breeding	Supporting habitat: food availability (bird)	Maintain the distribution, abundance and availability of key food and prey items (eg. earthworm, leatherjacket, chironomids, Macoma, Cardium, Nereis) at preferred sizes.	Year round	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population and alter the distribution of birds. Main food sources can be found within: grassland (marsh), lagoons and the intertidal. (Goss-Custard et al., 1991), (del Hoyo et al., 1996), (Cramp and Simmons, 1983), (Hutchinson and O'Halloran, 1994), (Green et al., 1987) --- Site-specifics: Important prey species for black-tailed godwit on the Humber Estuary include *Macoma balthica* , *Cardium spp.* and *Nereis spp.* in intertidal feeding areas and earthworm, leatherjacket and chironomids in terrestrial feeding areas(Stillman et al., 2005),(Allen et al., 2003). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Breeding	Supporting habitat: food availability (bird)	Maintain the distribution, abundance and availability of key food and prey items (eg. eel, rudd, roach, frogs, toads) at preferred sizes (eg. roach of 6-35 cm).	Year round	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population and alter the distribution of birds. Main food sources can be found within: freshwater marsh and reedbed. (Cramp and Simmons, 1977), (English Nature, 1994), (Noble et al., 2004), (Gilbert et al., 2007) --- Site-specifics: Important prey species for bittern on the Humber include eel, rudd, roach, frogs and toads. An example of the preferred size of prey for bittern is roach between 6-35 cm long (Cramp and Simmons, 1977). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bar-tailed godwit (Limosa lapponica), Non-breeding	Supporting habitat: food availability (bird)	Maintain the distribution, abundance and availability of key food and prey items (eg. Arenicola, Nereis) at preferred sizes.	Year round	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population and alter the distribution of birds. Main food sources can be found within: lagoons. (Smith and Evans, 1973), (Goss-Custard et al., 1991), (del Hoyo et al., 1996) --- Site-specifics: Important prey species for bar-tailed godwit include *Arenicola marina* and *Nereis spp.*.

				The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Ruff (Calidris pugnax), Non-breeding	Supporting habitat: food availability (bird)	Maintain the distribution, abundance and availability of key food and prey items (eg. Caddis flies, crustaceans, molluscs, worms dipteran flies, beetles, earthworms) at preferred sizes.	Year round	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population and alter the distribution of birds. Main food sources can be found within: the intertidal and grassland (marsh). (Cramp and Simmons, 1983), (del Hoyo et al., 1996), (del Hoyo et al., 1992) --- Site-specifics: This target relates to both the use of intertidal areas and the use of inland areas of wet grassland and agricultural land (both arable land and permanent pasture) for foraging. Important prey species for ruff include crustaceans, molluscs and worms in intertidal feeding areas and dipteran flies, beetles and earthworms in terrestrial feeding areas (McParland and Folland, 2009); (del Hoyo et al., 1992) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Redshank (Tringa totanus), Non-breeding	Supporting habitat: food availability (bird)	Maintain the distribution, abundance and availability of key food and prey items (eg. earthworm, leatherjacket, grassland/marsh invertebrates, Hydrobia, Macoma, Corophium, Nereis) at preferred sizes.	Year round	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population and alter the distribution of birds. Main food sources can be found within: the intertidal, lagoons and grassland (marsh). (Cramp and Simmons, 1983), (del Hoyo et al., 1996), (Goss-Custard et al., 1977) --- Site-specifics: This target relates to both the use of intertidal areas and the use of inland areas of wet grassland and agricultural land (both arable land and permanent pasture) for foraging. Important prey species for Redshank include *Peringia ulvae, Macoma balthica, Corophium spp.* and *Nereis spp.*in intertidal feeding areas and earthworm, leatherjacket and other grassland/marsh invertebrates in terrestrial feeding areas (Allen et al., 2003);(Goss-Custard et al., 1977). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Golden plover (Pluvialis apricaria), Non-breeding	Supporting habitat: food availability (bird)	Maintain the distribution, abundance and availability of key food and prey items (eg. earthworm, leatherjackets, beetles, spiders) at preferred sizes.	Year round	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population and alter the distribution of birds. (Cramp and Simmons, 1983), (Barnard and Thompson, 1985), (del Hoyo et al., 1996), (Pearce-Higgins and Yalden, 2003), (Pearce-Higgins and Yalden, 2004) --- Site-specifics: As noted within feature descriptions, golden plover primarily feed outside the SPA boundary on inland areas of wet grassland and agricultural land (both arable land and permanent pasture). This target mainly relates to this habita Important prey species for golden plover include earthworm, leatherjackets, beetles and spiders.(Calbrade, 2013),(Mander et al., 2006),(Allen et al., 2003). It is recommended that you speak with a Natural England adviser for case specific advice. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Non-breeding	Supporting habitat: food availability (bird)	Maintain the distribution, abundance and availability of key food and prey items (eg. eel, rudd, roach, frogs, toads) at preferred sizes (eg. roach of 6-35 cm).	Year round	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population and alter the distribution of birds. Main food sources can be found within: freshwater marsh and reedbed. (Cramp and Simmons, 1977), (English Nature, 1994), (Noble et al., 2004), (Gilbert et al., 2007) --- Site-specifics: Important prey species for bittern on the Humber include eel, rudd, roach, frogs and toads. An example of the preferred size of prey for bittern is roach between 6-35 cm long (Cramp and Simmons, 1977). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Avocet (Recurvirostra avosetta), Non-	Supporting habitat: food availability	Maintain the distribution, abundance and	Year round	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely

		food and prey items (eg. Gammarus, Corophium, flies, beetles, Nereis, Hydrobia, Cardium, gobies) at preferred sizes (eg. fish or worms between 4-15 mm long).		intertidal and lagoons. (Cramp and Simmons, 1983), (Hill et al., 1989), (Reay, 1991), (Moreira, 1995), (del Hoyo et al., 1996) Site-specifics: Important prey species for avocet include *Gammas spp., Corophium spp., Nereis spp., Hydrobia ulvae, Cardium spp.*, gobies, flies and beetles. An example of the preferred size of prey for avocet is fish or worms between 4-15 mm long (Allen et al., 2003). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Avocet (Recurvirostra avosetta), Breeding	Supporting habitat: food availability (bird)	Maintain the distribution, abundance and availability of key food and prey items (eg. Gammarus, Corophium, flies, beetles, Nereis, Hydrobia, Cardium, gobies) at preferred sizes (eg. fish or worms between 4-15 mm long).	Year round	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population and alter the distribution of birds. Main food sources can be found within: the intertidal and lagoons. (Cramp and Simmons, 1983), (Hill et al., 1989), (Reay, 1991), (Moreira, 1995), (del Hoyo et al., 1996) Site-specifics: Important prey species for avocet include Gammarus, Corophium, Nereis, Hydrobia, Cardium, gobies, flies and beetles. An example of the preferred size of prey for avocet is fish or worms between 4-15 mm long (Allen et al., 2003). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Shelduck (Tadorna tadorna), Non-breeding	Supporting habitat: food availability (bird)	Maintain the distribution, abundance and availability of key food and prey items (eg. Hydrobia, Corophium, Nereis, hatching midges) at preferred sizes.	Year round	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population and alter the distribution of birds. Main food sources can be found within: lagoons and the intertidal. (Buxton and Young, 1981), (Thompson, 1982), (Cramp and Simmons, 1977), (Giles, 1992), (del Hoyo et al., 1992), (Kear, 2005) Site-specifics: This target relates to both the use of intertidal areas and the use of inland areas of wet grassland and agricultural land (both arable land and permanent pasture) for foraging. Hydrobia (*Peringia ulvae*) is a particularly important prey species for shelduck, as well as Nereis and Corophium species (Allen et al., 2003). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Knot (Calidris canutus), Non-breeding	Supporting habitat: food availability (bird)	Maintain the distribution, abundance and availability of key food and prey items (eg. Macoma, Mytilus/Cerastoderma spat, Hydrobia) at preferred sizes.	Year round	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population and alter the distribution of birds. Main food sources can be found within: the intertidal. (Prater, 1972), (del Hoyo et al., 1996) Site-specifics: Important prey species for knot in the Humber Estuary include *Macoma balthica, Mytilus edulis* and *Cerastoderma edule* spat and the mud snail *Peringia ulvae* (Allen et al., 2003). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Hen harrier (Circus cyaneus), Non-breeding	Supporting habitat: food availability (bird)	Maintain the distribution, abundance and availability of key food and prey items (eg. Mammals, birds) at preferred sizes (eg. Pipits to gamebirds; voles to young rabbit size).	Year round	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population and alter the distribution of birds. (Watson, 1977), (Cramp and Simmons, 1980), (Cadbury, 1992), (Cadbury, 1993), (Clarke et al., 1997), (Redpath et al., 1998), (Redpath et al., 2002) Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Marsh harrier (Circus aeruginosus), Breeding	Supporting habitat: food availability (bird)	Maintain the distribution, abundance and availability of key food and prey items	Year round	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population and alter the distribution of birds. Main food sources can be found within: freshwater

		(eg. mammals, birds) at preferred sizes (eg. voles, mice, rabbit; birds of pipit to duck size).		(Cramp and Simmons, 1980), (Sills, 1984), (Underhill-Day, 1985) Site-specifics: Marsh harrier prey on mammals and birds, with the preferred size of prey being mice/vole to rabbit and pipit to duck size respectively(Allen et al., 2003);(Short, 2004 - 2010). The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Dunlin (Calidris alpina alpina), Non-breeding	Supporting habitat: food availability (bird)	Maintain the distribution, abundance and availability of key food and prey items (eg. Nereis, Macoma, Hydrobia, Crangon, Carcinus, dipertan flies, beetles, caddisfly, wasps, sawflies, mayflies) at preferred sizes.	Year round	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population and alter the distribution of birds. Main food sources can be found within: the intertidal. (Cramp and Simmons, 1983), (Worrall, 1984), (Nehls and Tiedemann, 1993), (del Hoyo et al., 1996) Site-specifics: This target relates to both the use of intertidal areas and the use of inland areas of wet grassland and agricultural land (both arable land and permanent pasture) for foraging. Important prey species for dunlin include *Nereis spp, Macoma balthica, Peringia ulvae, Crangon spp* and *Carcinus spp* in intertidal feeding areas and grassland/marsh invertebrates in terrestrial feeding areas. (Stillman et al., 2005),(Allen et al., 2003) The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Black-tailed godwit (Limosa limosa islandica), Non-breeding	Supporting habitat: hydrology/flow within grassland (marsh)	Maintain high water tables that provide surface water and/or damp field conditions with [20-30%] of the area soggy or flooded overall.	Year round – to ensure the habitat remains suitable for when the feature is present	Changes in source, depth, duration, frequency, magnitude and timing of water supply or flow can have important implications for this feature. Such changes may affect the quality and suitability of habitats used by birds for drinking, preening, feeding or roosting. Unless these have already been undertaken, further site-specific investigations may be required to fully inform conservation measures for this feature and / or the likelihood of impacts on this attribute. (Green, 1986), (Green et al., 1987) Site-specifics: This target relates specifically to wet grassland habitat in the Humber SPA. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Golden plover (Pluvialis apricaria), Non-breeding	Supporting habitat: hydrology/flow within grassland (marsh)	Maintain water availability in feeding sites and Maintain the area of soggy or flooded land overall.	Year round – to ensure the habitat remains suitable for when the feature is present	Changes in source, depth, duration, frequency, magnitude and timing of water supply or flow can have important implications for this feature. Such changes may affect the quality and suitability of habitats used by birds for drinking, preening, feeding or roosting. Unless these have already been undertaken, further site-specific investigations may be required to fully inform conservation measures for this feature and/or the likelihood of impacts on this attribute. (Royal Society for the Protection of Birds (RSPB), 1997) Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Redshank (Tringa totanus), Non-breeding	Supporting habitat: hydrology/flow within grassland (marsh)	Maintain water availability within feeding areas to maintain moderately high water tables that provide shallow surface water.	Year round – to ensure the habitat remains suitable for when the feature is present	Changes in source, depth, duration, frequency, magnitude and timing of water supply or flow can have important implications for this feature. Such changes may affect the quality and suitability of habitats used by birds for drinking, preening, feeding or roosting. Unless these have already been undertaken, further site-specific investigations may be required to fully inform conservation measures for this feature and / or the likelihood of impacts on this attribute. (Royal Society for the Protection of Birds (RSPB), 1997), (Sutherland and Hill, 1995), (Ausden et al., 2003), (Smart et al., 2006) Site-specifics: This target relates to wet grassland and lagoons used by Redshank. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Redshank (Tringa totanus), Non-breeding	Supporting habitat: hydrology/flow within intertidal	Maintain the availability of fresh water on mudflats within feeding and resting areas.	Year round – to ensure the habitat remains suitable for when the	Changes in source, depth, duration, frequency, magnitude and timing of water supply or flow can have important implications for this feature. Such changes may affect the quality and suitability of habitats used by birds for drinking, preening, feeding or roosting. Unless these have already been undertaken, further site-specific investigations may be required to fully inform conservation measures for this feature and/or the likelihood of impacts on this attribute. (Ravenscroft and Beardall, 2003) Site-specifics:

			present	The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bar-tailed godwit (Limosa lapponica), Non-breeding	Supporting habitat: hydrology/flow within intertidal	Maintain the availability of fresh water on mudflats within feeding and resting areas.	Year round – to ensure the habitat remains suitable for when the feature is present	Changes in source, depth, duration, frequency, magnitude and timing of water supply or flow can have important implications for this feature. Such changes may affect the quality and suitability of habitats used by birds for drinking, preening, feeding or roosting. Unless these have already been undertaken, further site-specific investigations may be required to fully inform conservation measures for this feature and/or the likelihood of impacts on this attribute. (Ravenscroft and Beardall, 2003) Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Black-tailed godwit (Limosa limosa islandica), Non-breeding	Supporting habitat: hydrology/flow within intertidal	Maintain the availability of fresh water on mudflats within feeding and resting areas.	Year round – to ensure the habitat remains suitable for when the feature is present	Changes in source, depth, duration, frequency, magnitude and timing of water supply or flow can have important implications for this feature. Such changes may affect the quality and suitability of habitats used by birds for drinking, preening, feeding or roosting. Unless these have already been undertaken, further site-specific investigations may be required to fully inform conservation measures for this feature and / or the likelihood of impacts on this attribute. (Ravenscroft and Beardall, 2003) Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Dunlin (Calidris alpina alpina), Non-breeding	Supporting habitat: hydrology/flow within intertidal	Maintain the availability of fresh water on mudflats within feeding and resting areas.	Year round – to ensure the habitat remains suitable for when the feature is present	Changes in source, depth, duration, frequency, magnitude and timing of water supply or flow can have important implications for this feature. Such changes may affect the quality and suitability of habitats used by birds for drinking, preening, feeding or roosting. Unless these have already been undertaken, further site-specific investigations may be required to fully inform conservation measures for this feature and/or the likelihood of impacts on this attribute. (Ravenscroft and Beardall, 2003) Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Knot (Calidris canutus), Non-breeding	Supporting habitat: hydrology/flow within intertidal	Maintain the availability of fresh water on mudflats within feeding and resting areas.	Year round – to ensure the habitat remains suitable for when the feature is present	Changes in source, depth, duration, frequency, magnitude and timing of water supply or flow can have important implications for this feature. Such changes may affect the quality and suitability of habitats used by birds for drinking, preening, feeding or roosting. Unless these have already been undertaken, further site-specific investigations may be required to fully inform conservation measures for this feature and / or the likelihood of impacts on this attribute. (Ravenscroft and Beardall, 2003) Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Avocet (Recurvirostra avosetta), Non-breeding	Supporting habitat: hydrology/flow within intertidal	Maintain the availability of fresh water on mudflats within feeding and resting areas.	Year round – to ensure the habitat remains suitable for when the feature is present	Changes in source, depth, duration, frequency, magnitude and timing of water supply or flow can have important implications for this feature. Such changes may affect the quality and suitability of habitats used by birds for drinking, preening, feeding or roosting. Unless these have already been undertaken, further site-specific investigations may be required to fully inform conservation measures for this feature and / or the likelihood of impacts on this attribute. (Ravenscroft and Beardall, 2003) Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Shelduck (Tadorna tadorna), Non-breeding	Supporting habitat: hydrology/flow within intertidal	Maintain the availability of fresh water on mudflats within feeding and resting areas.	Year round – to ensure the habitat remains suitable for when the feature is present	Changes in source, depth, duration, frequency, magnitude and timing of water supply or flow can have important implications for this feature. Such changes may affect the quality and suitability of habitats used by birds for drinking, preening, feeding or roosting. Unless these have already been undertaken, further site-specific investigations may be required to fully inform conservation measures for this feature and / or the likelihood of impacts on this attribute. (Ravenscroft and Beardall, 2003) Site-specifics:

				activities that are occurring / have occurred on the site.
Avocet (Recurvirostra avosetta), Non-breeding	Supporting habitat: hydrology/flow within standing water	Maintain the stability of standing water levels (<2 cm fluctuation)	Year round – to ensure the habitat remains suitable for when the feature is present	This attribute ensures that important habitats used by the feature are not impacted, regardless of whether the bird is present at that time. Changes in source, depth, duration, frequency, magnitude and timing of water supply or flow can have important implications for this feature. Such changes may affect the quality and suitability of habitats used by birds for drinking, preening, feeding or roosting. Unless these have already been undertaken, further site-specific investigations may be required to fully inform conservation measures for this feature and/or the likelihood of impacts on this attribute. (Cadbury et al., 1989) --- Site-specifics: Non-breeding Avocet on the Humber primarily make use of tidally influenced water. Some use may be made of coastal lagoons, where there are no known issues around water level fluctuation for this feature. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Avocet (Recurvirostra avosetta), Breeding	Supporting habitat: hydrology/flow within standing water	Maintain the stability of standing water levels (<2 cm fluctuation) in order to prevent flooding of	Year round – to ensure the habitat remains suitable for when the feature is present	Changes in source, depth, duration, frequency, magnitude and timing of water supply or flow can have important implications for this feature. Such changes may affect the quality and suitability of habitats used by birds for nesting, drinking, preening, rearing, feeding or roosting. Unless these have already been undertaken, further site-specific investigations may be required to fully inform conservation measures for this feature and / or the likelihood of impacts on this attribute. (Cadbury et al., 1989) --- Site-specifics: <2 cm fluctuation of standing water levels is preferred to minimise the risk of nest flooding. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Breeding	Supporting habitat: hydrology/flow within standing water	Maintain the stability of standing water levels in order to prevent flooding of nests.	Year round – to ensure the habitat remains suitable for when the feature is present	Changes in source, depth, duration, frequency, magnitude and timing of water supply or flow can have important implications for this feature. Such changes may affect the quality and suitability of habitats used by birds for nesting, drinking, preening, rearing, feeding or roosting. Unless these have already been undertaken, further site-specific investigations may be required to fully inform conservation measures for this feature and/or the likelihood of impacts on this attribute. --- Site-specifics: No site-specific information on this attribute is available. The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Avocet (Recurvirostra avosetta), Non-breeding	Supporting habitat: landform	Maintain a high density of channel networks within intertidal feeding areas.	Year round – to ensure the habitat remains suitable for when the feature is present	The physical topography and landform of a site will strongly influence the quality and extent of supporting habitats used by this feature for feeding and / or roosting as appropriate. This will also influence the interactions with underlying supporting processes on which the supporting habitat may rely. Any changes or modifications to site topography may adversely affect the ability of the supporting habitats to support and sustain this feature. --- Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Dunlin (Calidris alpina alpina), Non-breeding	Supporting habitat: landform	Maintain a high density of channel networks within intertidal feeding areas.	Year round – to ensure the habitat remains suitable for when the feature is present	The physical topography and landform of a site will strongly influence the quality and extent of supporting habitats used by this feature for feeding and / or roosting as appropriate. This will also influence the interactions with underlying supporting processes on which the supporting habitat may rely. Any changes or modifications to site topography may adversely affect the ability of the supporting habitats to support and sustain this feature. (Lourenço et al., 2005) --- Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bar-tailed godwit (Limosa lapponica), Non-breeding	Supporting habitat: landform	Maintain a high density of channel networks within intertidal feeding areas.	Year round – to ensure the habitat remains suitable for when the feature is present	The physical topography and landform of a site will strongly influence the quality and extent of supporting habitats used by this feature for feeding and/or roosting as appropriate. This will also influence the interactions with underlying supporting processes on which the supporting habitat may rely. Any changes or modifications to site topography may adversely affect the ability of the supporting habitats to support and sustain this feature. (Lourenço et al., 2005) --- Site-specifics:

				The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Redshank (Tringa totanus), Non-breeding	Supporting habitat: landform	Maintain a high density of channel networks within intertidal feeding areas.	Year round – to ensure the habitat remains suitable for when the feature is present	The physical topography and landform of a site will strongly influence the quality and extent of supporting habitats used by this feature for feeding and / or roosting as appropriate. This will also influence the interactions with underlying supporting processes on which the supporting habitat may rely. Any changes or modifications to site topography may adversely affect the ability of the supporting habitats to support and sustain this feature. (Lourenço et al., 2005) Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Ruff (Calidris pugnax), Non-breeding	Supporting habitat: landform	Maintain shallow slope gradients to the length/perimeter of ditches, drains, pools and scrapes.	Year round – to ensure the habitat remains suitable for when the feature is present	This attribute ensures that important habitats used by the feature are not impacted, regardless of whether the bird is present at that time. The physical topography and landform of a site will strongly influence the quality and extent of supporting habitats used by this feature for feeding and / or roosting as appropriate. This will also influence the interactions with underlying supporting processes on which the supporting habitat may rely. Any changes or modifications to site topography may adversely affect the ability of the supporting habitats to support and sustain this feature. (Royal Society for the Protection of Birds (RSPB), 1997), (Sutherland and Hill, 1995), (Smart et al., 2006), (Natural England (NE), 2013) Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Little tern (Sternula albifrons), Breeding	Supporting habitat: landform	Maintain the availability of shallow sloping nesting sites, grading to <30 cm above water level, restricting the probability that they will flood.	Year round – to ensure the habitat remains suitable for when the feature is present	The physical topography and landform of a site will strongly influence the quality and extent of supporting habitats used by this feature for nesting / rearing, feeding and / or roosting as appropriate. This will also influence the interactions with underlying supporting processes on which the supporting habitat may rely. Any changes or modifications to site topography may adversely affect the ability of the supporting habitats to support and sustain this feature. (del Hoyo et al., 1996) Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Avocet (Recurvirostra avosetta), Breeding	Supporting habitat: landform	Maintain the availability of shallow sloping nesting sites, grading to above water level, restricting the probability that they will flood.	Year round – to ensure the habitat remains suitable for when the feature is present	The physical topography and landform of a site will strongly influence the quality and extent of supporting habitats used by this feature for nesting / rearing, feeding and / or roosting as appropriate. This will also influence the interactions with underlying supporting processes on which the supporting habitat may rely. Any changes or modifications to site topography may adversely affect the ability of the supporting habitats to support and sustain this feature. (Hill, 1988), (Goutner, 1986), (del Hoyo et al., 1996) Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Knot (Calidris canutus), Non-breeding	Supporting habitat: landform	Maintain the density of channel networks within intertidal feeding areas.	Year round – to ensure the habitat remains suitable for when the feature is present	The physical topography and landform of a site will strongly influence the quality and extent of supporting habitats used by this feature for feeding and / or roosting as appropriate. This will also influence the interactions with underlying supporting processes on which the supporting habitat may rely. Any changes or modifications to site topography may adversely affect the ability of the supporting habitats to support and sustain this feature. (Lourenço et al., 2005) Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Black-tailed godwit (Limosa limosa islandica), Non-breeding	Supporting habitat: landform	Maintain the density of channel networks within intertidal feeding areas.	Year round – to ensure the habitat remains suitable for when the feature is present	The physical topography and landform of a site will strongly influence the quality and extent of supporting habitats used by this feature for feeding and / or roosting as appropriate. This will also influence the interactions with underlying supporting processes on which the supporting habitat may rely. Any changes or modifications to site topography may adversely affect the ability of the supporting habitats to support and sustain this feature. (Lourenço et al., 2005) Site-specifics:

				The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Breeding	Supporting habitat: landform	Maintain the extent of wet ditches and/or pools with suitable profiles (typically, with a deep central channel of 1.5-2.5 m deep and one or more 1 m deep with 5 m wide shallow margins).	Year round – to ensure the habitat remains suitable for when the feature is present	The physical topography and landform of a site will strongly influence the quality and extent of supporting habitats used by this feature for nesting/rearing, feeding and/or roosting as appropriate. This will also influence the interactions with underlying supporting processes on which the supporting habitat may rely. Any changes or modifications to site topography may adversely affect the ability of the supporting habitats to support and sustain this feature. (Tyler, 1994) Site-specifics: Bittern typically favour wet ditches and/or pools with a deep central channel of 1.5-2.5 m deep and one or more 1 m deep with 5 m wide shallow margins. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Non-breeding	Supporting habitat: landform	Maintain the extent of wet ditches and/or pools with suitable profiles (typically, with a deep central channel of 1.5-2.5 m deep and one or more 1 m deep with 5 m wide shallow margins).	Year round – to ensure the habitat remains suitable for when the feature is present	The physical topography and landform of a site will strongly influence the quality and extent of supporting habitats used by this feature for feeding and/or roosting as appropriate. This will also influence the interactions with underlying supporting processes on which the supporting habitat may rely. Any changes or modifications to site topography may adversely affect the ability of the supporting habitats to support and sustain this feature. Site-specifics: Bittern typically favour wet ditches and/or pools with a deep central channel of 1.5-2.5 m deep and one or more 1 m deep with 5 m wide shallow margins. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Marsh harrier (Circus aeruginosus), Breeding	Supporting habitat: landscape	Maintain continuous reed cover over large areas avoiding fragmentation of extensive reedbeds.	Year round – to ensure the habitat remains suitable for when the feature is present	This feature is known to favour large areas of open terrain, largely free of obstructions, in and around its nesting, roosting and feeding areas. Often there is a need to maintain an unobstructed line of sight within nesting, feeding or roosting habitat to detect approaching predators, or to ensure visibility of displaying behaviour. An open landscape may also be required to facilitate movement of birds between the SPA and any off-site supporting habitat. (English Nature, 1994) Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Ruff (Calidris pugnax), Non-breeding	Supporting habitat: landscape	Maintain open and unobstructed terrain around nesting, roosting and feeding sites.	Year round – to ensure the habitat remains suitable for when the feature is present	This feature is known to favour large areas of open terrain, largely free of obstructions, in and around its roosting and feeding areas. Often there is a need to maintain an unobstructed line of sight within feeding or roosting habitat to detect approaching predators, or to ensure visibility of displaying behaviour. An open landscape may also be required to facilitate movement of birds between the SPA and any off-site supporting habitat. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Redshank (Tringa totanus), Non-breeding	Supporting habitat: landscape	Maintain open and unobstructed terrain around nesting, roosting and feeding sites.	Year round – to ensure the habitat remains suitable for when the feature is present	This feature is known to favour large areas of open terrain, largely free of obstructions, in and around its roosting and feeding areas. Often there is a need to maintain an unobstructed line of sight within feeding or roosting habitat to detect approaching predators, or to ensure visibility of displaying behaviour. An open landscape may also be required to facilitate movement of birds between the SPA and any off-site supporting habitat. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Golden plover (Pluvialis apricaria), Non-breeding	Supporting habitat: landscape	Maintain open and unobstructed terrain around roosting and feeding sites, and no overall reduction in field size.	Year round – to ensure the habitat remains suitable for when the feature is present	This feature is known to favour large areas of open terrain, largely free of obstructions, in and around its roosting and feeding areas. Often there is a need to maintain an unobstructed line of sight within feeding or roosting habitat to detect approaching predators, or to ensure visibility of displaying behaviour. An open landscape may also be required to facilitate movement of birds between the SPA and any off-site supporting habitat. (Tucker et al., 1994), Stroud et al., 1987 del Hoyo et al., 1996 Site-specifics:

				The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Knot (Calidris canutus), Non-breeding	Supporting habitat: landscape	Maintain open and unobstructed terrain around roosting and feeding sites.	Year round – to ensure the habitat remains suitable for when the feature is present	This feature is known to favour large areas of open terrain, largely free of obstructions, in and around its roosting and feeding areas. Often there is a need to maintain an unobstructed line of sight within feeding or roosting habitat to detect approaching predators, or to ensure visibility of displaying behaviour. An open landscape may also be required to facilitate movement of birds between the SPA and any off-site supporting habitat. (del Hoyo et al., 1996) Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bar-tailed godwit (Limosa lapponica), Non-breeding	Supporting habitat: landscape	Maintain open and unobstructed terrain around roosting and feeding sites.	Year round – to ensure the habitat remains suitable for when the feature is present	This feature is known to favour large areas of open terrain, largely free of obstructions, in and around its roosting and feeding areas. Often there is a need to maintain an unobstructed line of sight within feeding or roosting habitat to detect approaching predators, or to ensure visibility of displaying behaviour. An open landscape may also be required to facilitate movement of birds between the SPA and any off-site supporting habitat. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Dunlin (Calidris alpina alpina), Non-breeding	Supporting habitat: landscape	Maintain open and unobstructed terrain around, roosting and feeding sites.	Year round – to ensure the habitat remains suitable for when the feature is present	This feature is known to favour large areas of open terrain, largely free of obstructions, in and around its roosting and feeding areas. Often there is a need to maintain an unobstructed line of sight within feeding or roosting habitat to detect approaching predators, or to ensure visibility of displaying behaviour. An open landscape may also be required to facilitate movement of birds between the SPA and any off-site supporting habitat. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Hen harrier (Circus cyaneus), Non-breeding	Supporting habitat: landscape	Maintain the amount of open and unobstructed terrain, with short vegetation, for hunting.	Year round – to ensure the habitat remains suitable for when the feature is present	This attribute ensures that important habitats used by the feature are not impacted, regardless of whether the bird is present at that time. This feature is known to favour large areas of open terrain, largely free of obstructions, in and around its roosting and feeding areas. Often there is a need to maintain an unobstructed line of sight within feeding or roosting habitat to detect approaching predators, or to ensure visibility of displaying behaviour. An open landscape may also be required to facilitate movement of birds between the SPA and any off-site supporting habitat. (Snow and Perrins, 1998), (Amar et al., 2008), (Madders, 2003) Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Shelduck (Tadorna tadorna), Non-breeding	Supporting habitat: landscape	Maintain the area of open and unobstructed terrain around roosting and feeding sites, and no overall reduction in field size, where relevant.	Year round – to ensure the habitat remains suitable for when the feature is present	This feature is known to favour large areas of open terrain, largely free of obstructions, in and around its roosting and feeding areas. Often there is a need to maintain an unobstructed line of sight within feeding or roosting habitat to detect approaching predators, or to ensure visibility of displaying behaviour. An open landscape may also be required to facilitate movement of birds between the SPA and any off-site supporting habitat. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Black-tailed godwit (Limosa limosa islandica), Non-breeding	Supporting habitat: landscape	Maintain the area of open and unobstructed terrain around roosting and feeding sites, and no overall reduction in field size.	Year round – to ensure the habitat remains suitable for when the feature is present	This feature is known to favour large areas of open terrain, largely free of obstructions, in and around its roosting and feeding areas. Often there is a need to maintain an unobstructed line of sight within feeding or roosting habitat to detect approaching predators, or to ensure visibility of displaying behaviour. An open landscape may also be required to facilitate movement of birds between the SPA and any off-site supporting habitat. (Royal Society for the Protection of Birds (RSPB), 1997) Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Avocet (Recurvirostra	Supporting habitat:	Maintain the area of open and	Year round	This attribute ensures that important habitats used by the feature are not impacted, regardless of whether

avosetta), Breeding	landscape	unobstructed terrain around roosting and feeding sites.	to ensure the habitat remains suitable for when the feature is present	obstructions, in and around its nesting, roosting and feeding areas. Often there is a need to maintain an unobstructed line of sight within nesting, feeding or roosting habitat to detect approaching predators, or to ensure visibility of displaying behaviour. An open landscape may also be required to facilitate movement of birds between the SPA and any off-site supporting habitat. --- Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Avocet (Recurvirostra avosetta), Non-breeding	Supporting habitat: landscape	Maintain the area of open and unobstructed terrain around roosting and feeding sites.	Year round – to ensure the habitat remains suitable for when the feature is present	This feature is known to favour large areas of open terrain, largely free of obstructions, in and around its roosting and feeding areas. Often there is a need to maintain an unobstructed line of sight within feeding or roosting habitat to detect approaching predators, or to ensure visibility of displaying behaviour. An open landscape may also be required to facilitate movement of birds between the SPA and any off-site supporting habitat. --- Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Non-breeding	Supporting habitat: landscape	Maintain the supporting habitats within an open landscape which provides safe passage for birds moving between roosting and feeding areas across the site.	Year round – to ensure the habitat remains suitable for when the feature is present	This feature is known to favour large areas of open terrain, largely free of obstructions, in and around its roosting and feeding areas. Often there is a need to maintain an unobstructed line of sight within feeding or roosting habitat to detect approaching predators, or to ensure visibility of displaying behaviour. An open landscape may also be required to facilitate movement of birds between the SPA and any off-site supporting habitat. --- Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Breeding	Supporting habitat: landscape	Maintain the supporting habitats within an open landscape which provides safe passage for birds moving between roosting and feeding areas across the site.	Year round – to ensure the habitat remains suitable for when the feature is present	This feature is known to favour large areas of open terrain, largely free of obstructions, in and around its nesting, roosting and feeding areas. Often there is a need to maintain an unobstructed line of sight within nesting, feeding or roosting habitat to detect approaching predators, or to ensure visibility of displaying behaviour. An open landscape may also be required to facilitate movement of birds between the SPA and any off-site supporting habitat. (Tyler, 1994), (English Nature, 1994), (Tyler et al., 1998), (Marion et al., 2000), (Kushlan and Hancock, 2005) --- Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Waterbird assemblage, Non-breeding	Supporting habitat: quality of supporting non-breeding habitat	Maintain the structure, function and availability of the following habitats (site specific notes) which support the assemblage feature for all stages (moulting, roosting, loafing, feeding) of the non-breeding period.	Year round – to ensure the habitat remains suitable for when the feature is present	The site's ability to support and sustain an assemblage comprising a very large number of birds (in excess of 20,000) made up of a diverse mix of species will be reliant on the overall quality and diversity of the habitats that support them. The feeding and roosting habitats which support the assemblage will occur within, and in some cases outside, the site boundary. This target is applicable to both circumstances. Due to the large number of species and natural fluctuations in the overall composition of an assemblage, it is not practical to provide specific targets relating to each supporting habitat relevant to the assemblage. Generally speaking, the specific attributes of each supporting habitat may include vegetation characteristics and structure, water depth, food availability, connectivity between nesting, roosting and feeding areas both within and outside the SPA. Further advice will be provided by Natural England on a case by case basis. The main component-species of the assemblage at this SPA include: --- Site-specifics: Components of the assemblage may have specific requirements and it is recommended that you seek further advice from a Natural England adviser. The principal habitats known or likely to support the assemblage feature at this SPA are: Intertidal sand and mudflats Coastal lagoons Saltmarsh Tidal reedbeds Freshwater wetlands Inland areas of wet grassland, rough grassland and agricultural land (both arable land and permanent pasture) Annual vegetation of driftlines (sand and shingle)Artificial structures such as derelict pier/jetty structures, flood defences water column The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Breeding	Supporting habitat: salinity	Maintain water salinity at <0.5%	Year round – to ensure the	This feature is known to be particularly susceptible to changes in the salinity (concentration of salt) of its shallow brackish/fresh water habitat; Salinity is a major factor determining the distribution and composition of communities of fish, amphibians and aquatic invertebrates such as insects, crustaceans and worms on

			remains suitable for when the feature is present	and chicks. The principal factors governing the temporal and spatial nature of the salinity regime of coastal sites are the diurnal incursion of the tide and fresh water flow from the river(s). Any activity changing either of these factors can result in a change to the salinity regime. (English Nature, 1994), (Kushlan and Hancock, 2005), (del Hoyo et al., 1992), (Gilbert et al., 2010) Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Non-breeding	Supporting habitat: salinity	Maintain water salinity at <0.5%	Year round – to ensure the habitat remains suitable for when the feature is present	This feature is known to be particularly susceptible to changes in the salinity (concentration of salt) of its shallow brackish/fresh water habitat; Salinity is a major factor determining the distribution and composition of communities of fish, amphibians and aquatic invertebrates such as insects, crustaceans and worms on which this feature feeds. High levels of salinity may adversely affect fish and invertebrate food for adults and chicks. The principal factors governing the temporal and spatial nature of the salinity regime of coastal sites are the diurnal incursion of the tide and fresh water flow from the river(s). Any activity changing either of these factors can result in a change to the salinity regime. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Avocet (Recurvirostra avosetta), Non-breeding	Supporting habitat: salinity	Maintain water salinity at <2.5%	Year round – to ensure the habitat remains suitable for when the feature is present	This attribute ensures that important habitats used by the feature are not impacted, regardless of whether the bird is present at that time. This feature is known to be particularly susceptible to changes in the salinity (concentration of salt) of its shallow brackish / fresh water habitat. Salinity is a major factor determining the distribution and composition of communities of aquatic invertebrates such as insects, crustaceans and worms on which this feature feeds. High levels of salinity can adversely affect invertebrate food for adults and chicks. The principal factors governing the temporal and spatial nature of the salinity regime of coastal sites are the diurnal incursion of the tide and fresh water flow from the river(s). Any activity changing either of these factors can result in a change to the salinity regime. (Cadbury and Richards, 1978), (Hill et al., 1989), (del Hoyo et al., 1996) Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Avocet (Recurvirostra avosetta), Breeding	Supporting habitat: salinity	Maintain water salinity at <2.5%	Year round – to ensure the habitat remains suitable for when the feature is present	This feature is known to be particularly susceptible to changes in the salinity (concentration of salt) of its shallow brackish / fresh water habitat. Salinity is a major factor determining the distribution and composition of communities of aquatic invertebrates such as insects, crustaceans and worms on which this feature feeds. High levels of salinity can adversely affect invertebrate food for adults and chicks. The principal factors governing the temporal and spatial nature of the salinity regime of coastal sites are the diurnal incursion of the tide and fresh water flow from the river(s). Any activity changing either of these factors can result in a change to the salinity regime. (Cadbury and Richards, 1978), (Hill et al., 1989), (del Hoyo et al., 1996) Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Hen harrier (Circus cyaneus), Non-breeding	Supporting habitat: vegetation characteristics	Maintain optimal mix of vegetation to provide open, prey rich, areas for hunting.	Year round – to ensure the habitat remains suitable for when the feature is present	The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enables successful concealment/roosting/foraging/feeding and/or displaying. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Non-breeding	Supporting habitat: vegetation characteristics	Maintain the cover of scrub-free areas of reed-bed with common reed Phragmites australis at or above 90% cover and with a diverse age structure (typically at least 30% of the reedbed should be uncut with the remainder<7 years old with ><20% cut in any yea	Year round – to ensure the habitat remains suitable for when the feature is present	The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enables successful concealment/roosting/foraging/feeding and/or displaying. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature. Site-specifics: Bittern favour areas with common red *Phragmites australis* at or above 90% cover and with a diverse age structure. Typically at least 30% of the reedbed should be uncut with the remainder <7 years old with > <20% cut in any season. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.

(Pluvialis apricaria), Non-breeding	habitat: vegetation characteristics for feeding	and distribution of predominantly short (<10 cm) grassland swards or arable fields in areas used for feeding.	round – to ensure the habitat remains suitable for when the feature is present	The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enables successful concealment/roosting/foraging/feeding and/or displaying. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature. (Gregory, 1987), (Sutherland and Hill, 1995), (Gillings et al., 2007) Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Ruff (Calidris pugnax), Non-breeding	Supporting habitat: vegetation characteristics for feeding	Maintain the extent and distribution of predominantly short (<10 cm) grassland swards or arable fields in areas used for feeding.	Year round – to ensure the habitat remains suitable for when the feature is present	The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enables successful concealment / roosting / foraging / feeding and / or displaying. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Little tern (Sternula albifrons), Breeding	Supporting habitat: vegetation characteristics for nesting	Maintain vegetation cover (generally<15%) throughout areas used for nesting, providing sufficient bare ground for the colony as a whole.	Year round – to ensure the habitat remains suitable for when the feature is present	The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enables successful nesting / rearing / concealment / roosting / foraging / feeding and / or displaying. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature. (Richards, 1990), (Burgess and Hirons, 1992), (del Hoyo et al., 1996) Site-specifics: Little tern favour sparsely vegetated ground for nesting, preferably with<15% vegetation cover. This target also relates to historically occupied little tern sites away from the main colony, which are currently not being used. Please refer to feature description for details. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Marsh harrier (Circus aeruginosus), Breeding	Supporting habitat: vegetation characteristics for nesting	Maintain a management regime that ensures the constant availability of areas of dense reed stands as nesting cover.	Year round – to ensure the habitat remains suitable for when the feature is present	The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enables successful nesting / rearing / concealment / roosting / foraging / feeding and / or displaying. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature. (Cramp and Simmons, 1980) Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Breeding	Supporting habitat: vegetation characteristics for nesting	Maintain the cover of scrub-free areas of reed-bed with common reed Phragmites australis at or above 90% cover and with a diverse age structure (typically at least 30% of the reedbed should be uncut with the remainder<7 years old with <20% cut in any year	Year round – to ensure the habitat remains suitable for when the feature is present	The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enables successful nesting/rearing/concealment/roosting/foraging/feeding and/or displaying. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature. (Tyler, 1994), (Tyler et al., 1998), (Kushlan and Hancock, 2005), (Brown et al., 2012), (Gilbert et al., 2007) Site-specifics: Bittern favour areas with common ree *Phragmites australis* at or above 90% cover and with a diverse age structure. Typically at least 30% of the reedbed should be uncut with the remainder <7 years old with <20% cut in any year. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Avocet (Recurvirostra avosetta), Breeding	Supporting habitat: vegetation characteristics for nesting	Maintain the proportion of vegetated to bare ground within nesting areas with generally<40%	Year round – to ensure the habitat remains suitable for when the	The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enables successful nesting / rearing / concealment / roosting / foraging / feeding and / or displaying. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature. (Goutner, 1986)

			present	Site-specifics: Avocet require bare areas for nesting, and generally favour areas with <40% vegetation cover overall for nesting. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Avocet (Recurvirostra avosetta), Non-breeding	Supporting habitat: vegetation characteristics for nesting	Maintain the proportion of vegetated to bare ground within nesting areas with generally<40%	Year round – to ensure the habitat remains suitable for when the feature is present	This attribute ensures that important habitats used by the feature are not impacted, regardless of whether the bird is present at that time. The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enables successful concealment / roosting / foraging / feeding and / or displaying. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature. (Goutner, 1986) Site-specifics: Management measures may be needed at times across the site to ensure this habitat is suitable for the nesting season. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Redshank (Tringa totanus), Non-breeding	Supporting habitat: vegetation characteristics for nesting	Restore an optimal mix of vegetation comprising both short and tussocky conditions.	Year round – to ensure the habitat remains suitable for when the feature is present	This attribute ensures that important habitats used by the feature are not impacted, regardless of whether the bird is present at that time. The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enables successful concealment / roosting / foraging / feeding and / or displaying. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature. (Stroud et al., 1987), (Cadbury, 1992), (Cadbury, 1993), (Royal Society for the Protection of Birds (RSPB), 1997), (Vickery et al., 1996), (Newbold, 1997), (Milsom et al., 2000), (Vickery et al., 2001), (Smart et al., 2006) Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Redshank (Tringa totanus), Non-breeding	Supporting habitat: vegetation characteristics for roosting	Maintain a vegetation structure of key roost sites dominated by bare ground or a short sparsely-vegetated sward.	Year round – to ensure the habitat remains suitable for when the feature is present	The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enables successful concealment / roosting / foraging / feeding and / or displaying. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bar-tailed godwit (Limosa lapponica), Non-breeding	Supporting habitat: vegetation characteristics for roosting	Maintain a vegetation structure of key roost sites dominated by bare ground or a short sparsely-vegetated sward.	Year round – to ensure the habitat remains suitable for when the feature is present	The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enables successful concealment/roosting/foraging/feeding and/or displaying. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Ruff (Calidris pugnax), Non-breeding	Supporting habitat: vegetation characteristics for roosting	Maintain a vegetation structure of key roost sites dominated by bare ground or a short sparsely-vegetated sward.	Year round – to ensure the habitat remains suitable for when the feature is present	The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enables successful concealment / roosting / foraging / feeding and / or displaying. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Dunlin (Calidris alpina alpina), Non-breeding	Supporting habitat: vegetation characteristics for roosting	Maintain a vegetation structure of key roost sites dominated by bare ground or a short sparsely-	Year round – to ensure the habitat	The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enables successful concealment / roosting / foraging / feeding and / or displaying. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the

			suitable for when the feature is present	Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Black-tailed godwit (Limosa limosa islandica), Non-breeding	Supporting habitat: vegetation characteristics for roosting	Maintain a vegetation structure of key roost sites dominated by bare ground or a short sparsely-vegetated sward.	Year round – to ensure the habitat remains suitable for when the feature is present	The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enables successful concealment / roosting / foraging / feeding and / or displaying. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Golden plover (Pluvialis apricaria), Non-breeding	Supporting habitat: vegetation characteristics for roosting	Maintain a vegetation structure of key roost sites dominated by bare ground or a short sparsely-vegetated sward.	Year round – to ensure the habitat remains suitable for when the feature is present	The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enables successful concealment/roosting/foraging/feeding and/or displaying. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Knot (Calidris canutus), Non-breeding	Supporting habitat: vegetation characteristics for roosting	Maintain a vegetation structure of key roost sites dominated by bare ground or a short sparsely-vegetated sward.	Year round – to ensure the habitat remains suitable for when the feature is present	The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enables successful concealment / roosting / foraging / feeding and / or displaying. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature. Site-specifics: The target has been set due to a lack of evidence that the feature is being impacted by any anthropogenic activities.
Hen harrier (Circus cyaneus), Non-breeding	Supporting habitat: vegetation characteristics for roosting	Maintain an optimal mix of vegetation (flat or gently sloping areas with wet rush, heather, cotton grass, Juncus or other wetland vegetation) in areas used for roosting.	Year round – to ensure the habitat remains suitable for when the feature is present	The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enables successful concealment/roosting/foraging/feeding and/or displaying. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature. (Middleton, 2007) Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Breeding	Supporting habitat: water area	Maintain the number of open waterbodies of optimal size (>0.5 ha), and the percentage cover of pools overall, with shallow water extending at least 30 m landward into surrounding dense vegetation.	Year round – to ensure the habitat remains suitable for when the feature is present	This feature depends on the presence and continuity of open water habitat; often requiring water bodies of a particular size to in order to successfully nest, rear their young, feed and/or roost. Changes in water area, and associated marginal habitat, can adversely affect the suitability of supporting open water habitat. (Bibby and Lunn, 1982), (Gilbert et al., 2005), (Gilbert et al., 2005), (Brown et al., 2012) Site-specifics: Bittern favour open waterbodies of >0.5ha and shallow water extending at least 30 m landward into surrounding dense vegetation. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Non-breeding	Supporting habitat: water area	Maintain the number of open waterbodies of optimal size (>0.5 ha), and the percentage cover of pools overall, with shallow water extending at least 30 m landward into surrounding dense vegetation.	Year round – to ensure the habitat remains suitable for when the feature is present	This feature depends on the presence and continuity of open water habitat; often requiring water bodies of a particular size to in order to successfully feed and/or roost. Changes in water area, and associated marginal habitat, can adversely affect the suitability of supporting open water habitat. (Bibby and Lunn, 1982), (Gilbert et al., 2005), (Gilbert et al., 2005), (Brown et al., 2012) Site-specifics: Bittern favour open waterbodies of >0.5ha and shallow water extending at least 30 m landward into surrounding dense vegetation.

				activities that are occurring / have occurred on the site.
Avocet (Recurvirostra avosetta), Breeding	Supporting habitat: water depth	Maintain the availability and area of standing water of 3-5 cm deep over an unspecified extent.	Year round – to ensure the habitat remains suitable for when the feature is present	This feature is known to require extensive areas of water in which to feed. Birds are visual predators, with some having the ability to dive or to feed from the surface. As they will rely on detecting their prey within the water to hunt, the depth of water at critical times of year may be paramount for successful feeding and therefore their fitness and survival. Deep water surrounding nesting sites may also be important to deterring predators. (Cadbury et al., 1989) --- Site-specifics: Avocet favour areas of standing water of 3-5 cm deep over at least 50% of the total standing water area. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Black-tailed godwit (Limosa limosa islandica), Non-breeding	Supporting habitat: water depth	Maintain the availability and area of standing water of appropriate depth and extent.	Year round – to ensure the habitat remains suitable for when the feature is present	This feature is known to require extensive areas of water in which to feed. Birds are visual predators, with some having the ability to dive or to feed from the surface. As they will rely on detecting their prey within the water to hunt, the depth of water at critical times of year may be paramount for successful feeding and therefore their fitness and survival. This target relates specifically to coastal lagoon habitats. --- Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Redshank (Tringa totanus), Non-breeding	Supporting habitat: water depth	Maintain the availability of standing water of 1-5 cm deep, over an unquanitifed number of hectares.	Year round – to ensure the habitat remains suitable for when the feature is present	This feature is known to require extensive areas of water in which to feed. Birds are visual predators, with some having the ability to dive or to feed from the surface. As they will rely on detecting their prey within the water to hunt, the depth of water at critical times of year may be paramount for successful feeding and therefore their fitness and survival. Deep water surrounding nesting sites may also be important to deterring predators. This feature needs shallow water pools for its breeding habitat and may also prefer to feed in grasslands in the winter which are partly flooded. --- Site-specifics: Redshank favour standing water of 1-5 cm deep over at least 50% of the total water area. This target relates specifically to lagoons and wet grassland. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Avocet (Recurvirostra avosetta), Non-breeding	Supporting habitat: water depth	Maintain the availability of standing water of 3-5 cm deep over an unquanitifed number of hectares based on natural estuarine functioning.	Year round – to ensure the habitat remains suitable for when the feature is present	This attribute ensures that important habitats used by the feature are not impacted, regardless of whether the bird is present at that time. This feature is known to require extensive areas of water in which to feed. Birds are visual predators, with some having the ability to dive or to feed from the surface. As they will rely on detecting their prey within the water to hunt, the depth of water at critical times of year may be paramount for successful feeding and therefore their fitness and survival. Deep water surrounding nesting sites may also be important to deterring predators. (Cadbury et al., 1989) --- Site-specifics: Avocet favour areas of standing water of 3-5 cm deep over at least 50% of the total standing water area. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Shelduck (Tadorna tadorna), Non-breeding	Supporting habitat: water depth	Maintain the availability of water at optimal depths, typically <0.4 m deep over an unspecified extent of habitat.	Year round – to ensure the habitat remains suitable for when the feature is present	This feature is known to require extensive areas of water in which to feed. Birds are visual predators, with some having the ability to dive or to feed from the surface. As they will rely on detecting their prey within the water to hunt, the depth of water at critical times of year may be paramount for successful feeding and therefore their fitness and survival. Deep water surrounding nesting sites may also be important to deterring predators. (Bryant and Leng, 1975), (Kear, 2005) --- Site-specifics: Shelduck favour areas of water of<0.4 m deep over at least 50% of the total water area. This target relates specifically to lagoon habitats. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Ruff (Calidris pugnax), Non-breeding	Supporting habitat: water depth	Maintain the availability of water at optimal depths, typically 1-3 cm deep over an unquanitifed number of hectares.	Year round – to ensure the habitat remains suitable	This feature is known to require extensive areas of water in which to feed. Birds are visual predators, with some having the ability to dive or to feed from the surface. As they will rely on detecting their prey within the water to hunt, the depth of water at critical times of year may be paramount for successful feeding and therefore their fitness and survival. Deep water surrounding nesting sites may also be important to deterring predators. (Stroud et al., 1990), (van Rhijn, 1991)

			the feature is present	Site-specifics: This feature is known to require extensive areas of standing water in which to feed. As they will rely on detecting their prey within the water to hunt, the depth of water at critical times of year may be paramount for successful feeding and therefore their fitness and survival. Ruff favour areas of water of 1-3 cm deep over at least 50% of the total water area. This target relates specifically to lagoons and wet grassland. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Marsh harrier (Circus aeruginosus), Breeding	Supporting habitat: water depth	Maintain the availability of water over the entire reedbed area, with a high proportion of the area with a water depth of 0.1 m to 0.3 m.	Year round – to ensure the habitat remains suitable for when the feature is present	This feature is known to require extensive areas of water in which to feed. Birds are visual predators, with some having the ability to dive or to feed from the surface. As they will rely on detecting their prey within the water to hunt, the depth of water at critical times of year may be paramount for successful feeding and therefore their fitness and survival. Deep water surrounding nesting sites may also be important to deterring predators. (Newbold, 1997) Site-specifics: Marsh harrier favour reedbeds where a high proportion of the area has a water depth of 0.1 m-0.3 m. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Non-breeding	Supporting habitat: water depth	Maintain the overall depth of swamp and marginal water which is typically between 30 – 100 cm, and/or within pools and dykes at typically 200-400 cm deep.	Year round – to ensure the habitat remains suitable for when the feature is present	This feature is known to require extensive areas of water in which to feed. Birds are visual predators, with some having the ability to dive or to feed from the surface. As they will rely on detecting their prey within the water to hunt, the depth of water at critical times of year may be paramount for successful feeding and therefore their fitness and survival. Deep water surrounding nesting sites may also be important to deterring predators. Site-specifics: Bittern favour areas of swamp and marginal water which are typically 30-100 cm deep, and/or pools and dykes of 200-400 cm deep. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Breeding	Supporting habitat: water depth	Maintain the overall depth of swamp and marginal water which is typically between 30 – 100 cm, and/or within pools and dykes at typically 200-400 cm deep.	Year round – to ensure the habitat remains suitable for when the feature is present	This feature is known to require extensive areas of water in which to feed. Birds are visual predators, with some having the ability to dive or to feed from the surface. As they will rely on detecting their prey within the water to hunt, the depth of water at critical times of year may be paramount for successful feeding and therefore their fitness and survival. Deep water surrounding nesting sites may also be important to deterring predators. (Tyler, 1994), (Gilbert et al., 2007) Site-specifics: Bittern favour areas of swamp and marginal water which are typically 30-100 cm deep, and/or pools and dykes of 200-400 cm deep. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Breeding	Supporting habitat: water quality - contaminants	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	Year round	Contaminants may have a range of biological effects on different species within the supporting habitat, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). This in turn can adversely affect the availability of bird breeding, rearing, feeding and roosting habitats, and potentially bird survival. Site-specifics: This target has been set based on data provided by the Environment Agency. Their assessment covers all Humber water bodies and found no contaminant issues at the last available sampling in 2015.(Environment Agency, 2014) There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Bittern (Botaurus stellaris), Non-breeding	Supporting habitat: water quality - contaminants	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	Year round	Contaminants may have a range of biological effects on different species within the supporting habitat, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). This in turn can adversely affect the availability of bird breeding, rearing, feeding and roosting habitats, and potentially bird survival. Site-specifics: This target has been set based on data provided by the Environment Agency. Their assessment covers all Humber water bodies and found no contaminant issues at the last available sampling in 2015.(Environment Agency, 2014)

				There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Marsh harrier (Circus aeruginosus), Breeding	Supporting habitat: water quality - contaminants	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	Year round	Contaminants may have a range of biological effects on different species within the supporting habitat, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). This in turn can adversely affect the availability of bird breeding, rearing, feeding and roosting habitats, and potentially bird survival. Site-specifics: This target has been set based on data provided by the Environment Agency. Their assessment covers all Humber water bodies and found no contaminant issues at the last available sampling in 2015.(Environment Agency, 2014) There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Shelduck (Tadorna tadorna), Non-breeding	Supporting habitat: water quality - contaminants	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	Year round	Contaminants may have a range of biological effects on different species within the supporting habitat, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). This in turn can adversely affect the availability of bird breeding, rearing, feeding and roosting habitats, and potentially bird survival. Site-specifics: This target has been set based on data provided by the Environment Agency. Their assessment covers all Humber water bodies and found no contaminant issues at the last available sampling in 2015.(Environment Agency, 2014) There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Avocet (Recurvirostra avosetta), Breeding	Supporting habitat: water quality - contaminants	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	Year round	Contaminants may have a range of biological effects on different species within the supporting habitat, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). This in turn can adversely affect the availability of bird breeding, rearing, feeding and roosting habitats, and potentially bird survival. Site-specifics: This target has been set based on data provided by the Environment Agency. Their assessment covers all Humber water bodies and found no contaminant issues at the last available sampling in 2015.(Environment Agency, 2014) There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Hen harrier (Circus cyaneus), Non-breeding	Supporting habitat: water quality - contaminants	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	Year round	Contaminants may have a range of biological effects on different species within the supporting habitat, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). This in turn can adversely affect the availability of bird breeding, rearing, feeding and roosting habitats, and potentially bird survival. Site-specifics: This target has been set based on data provided by the Environment Agency. Their assessment covers all Humber water bodies and found no contaminant issues at the last available sampling in 2015.(Environment Agency, 2014) There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Knot (Calidris canutus), Non-breeding	Supporting habitat: water quality - contaminants	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	Year round	Contaminants may have a range of biological effects on different species within the supporting habitat, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). This in turn can adversely affect the availability of bird breeding, rearing, feeding and roosting habitats, and potentially bird survival. Site-specifics: This target has been set based on data provided by the Environment Agency. Their assessment covers all Humber water bodies and found no contaminant issues at the last available sampling in 2015.(Environment Agency, 2014) There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Golden plover (Pluvialis	Supporting habitat: water	Restrict aqueous contaminants to levels	Year round	Contaminants may have a range of biological effects on different species within the supporting habitat,

breeding	contaminants	Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.		Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). This in turn can adversely affect the availability of bird breeding, rearing, feeding and roosting habitats, and potentially bird survival. Site-specifics: This target has been set based on data provided by the Environment Agency. Their assessment covers all Humber water bodies and found no contaminant issues at the last available sampling in 2015.(Environment Agency, 2014) There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Avocet (Recurvirostra avosetta), Non-breeding	Supporting habitat: water quality - contaminants	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	Year round	Contaminants may have a range of biological effects on different species within the supporting habitat, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). This in turn can adversely affect the availability of bird breeding, rearing, feeding and roosting habitats, and potentially bird survival. Site-specifics: This target has been set based on data provided by the Environment Agency. Their assessment covers all Humber water bodies and found no contaminant issues at the last available sampling in 2015.(Environment Agency, 2014) There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Dunlin (Calidris alpina alpina), Non-breeding	Supporting habitat: water quality - contaminants	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	Year round	Contaminants may have a range of biological effects on different species within the supporting habitat, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). This in turn can adversely affect the availability of bird breeding, rearing, feeding and roosting habitats, and potentially bird survival. Site-specifics: This target has been set based on data provided by the Environment Agency. Their assessment covers all Humber water bodies and found no contaminant issues at the last available sampling in 2015.(Environment Agency, 2014) There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Ruff (Calidris pugnax), Non-breeding	Supporting habitat: water quality - contaminants	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	Year round	Contaminants may have a range of biological effects on different species within the supporting habitat, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). This in turn can adversely affect the availability of bird breeding, rearing, feeding and roosting habitats, and potentially bird survival. Site-specifics: This target has been set based on data provided by the Environment Agency. Their assessment covers all Humber water bodies and found no contaminant issues at the last available sampling in 2015.(Environment Agency, 2014) There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Redshank (Tringa totanus), Non-breeding	Supporting habitat: water quality - contaminants	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	Year round	Contaminants may have a range of biological effects on different species within the supporting habitat, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). This in turn can adversely affect the availability of bird breeding, rearing, feeding and roosting habitats, and potentially bird survival. Site-specifics: This target has been set based on data provided by the Environment Agency. Their assessment covers all Humber water bodies and found no contaminant issues at the last available sampling in 2015.(Environment Agency, 2014) There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Bar-tailed godwit (Limosa lapponica), Non-breeding	Supporting habitat: water quality - contaminants	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding	Year round	Contaminants may have a range of biological effects on different species within the supporting habitat, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). This in turn can adversely affect the availability of bird breeding, rearing, feeding and roosting habitats, and potentially bird survival. Site-specifics: This target has been set based on data provided by the Environment Agency. Their assessment covers all

		existing levels.		Humber water bodies and found no contaminant issues at the last available sampling in 2015.(Environment Agency, 2014) There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Black-tailed godwit (Limosa limosa islandica), Non-breeding	Supporting habitat: water quality - contaminants	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	Year round	Contaminants may have a range of biological effects on different species within the supporting habitat, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). This in turn can adversely affect the availability of bird breeding, rearing, feeding and roosting habitats, and potentially bird survival. Site-specifics: This target has been set based on data provided by the Environment Agency. Their assessment covers all Humber water bodies and found no contaminant issues at the last available sampling in 2015.(Environment Agency, 2014) There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Little tern (Sternula albifrons), Breeding	Supporting habitat: water quality - contaminants	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	Year round	Contaminants may have a range of biological effects on different species within the supporting habitat, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). This in turn can adversely affect the availability of bird breeding, rearing, feeding and roosting habitats, and potentially bird survival. Site-specifics: This target has been set based on data provided by the Environment Agency. Their assessment covers all Humber water bodies and found no contaminant issues at the last available sampling in 2015.(Environment Agency, 2014) There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Waterbird assemblage, Non-breeding	Supporting habitat: water quality - contaminants	Restrict aqueous contaminants to levels equating to High Status according to Annex VIII and Good Status according to Annex X of the Water Framework Directive, avoiding deterioration from existing levels.	Year round	Contaminants may have a range of biological effects on different species within the supporting habitat, depending on the nature of the contaminant (Joint Nature Conservation Committee (JNCC), 2004), (UK Technical Advisory Group on the Water Framework Directive (UKTAG), 2008), (Environment Agency, 2014). This in turn can adversely affect the availability of bird breeding, rearing, feeding and roosting habitats, and potentially bird survival. Site-specifics: This target has been set based on data provided by the Environment Agency. Their assessment covers all Humber water bodies and found no contaminant issues at the last available sampling in 2015.(Environment Agency, 2014) There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Bar-tailed godwit (Limosa lapponica), Non-breeding	Supporting habitat: water quality - dissolved oxygen	Maintain the dissolved oxygen (DO) concentration at levels equating to Good Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year), avoiding deterioration from existing levels.	Year round	Dissolved Oxygen (DO) levels affect the condition and health of supporting habitats. Excessive nutrients and/or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007) and hence can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. However, there is a significant amount of natural variation that should be considered. Site-specifics: The Humber Estuary SAC sits within four WFD water bodies: Humber Lower, Humber Middle, Humber Upper, Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the water column have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body (<10% of the site) failed for WFD due to a drop in DO levels. (Environment Agency, 2014) there is a dissolved oxygen (DO) sag that occurs annually in the tidal Ouse during the summer months. The sag normally occurs in June and July and is not thought to have an impact on avian features; it is a natural result of an increase in temperature combined with reduced flow. N.B anthropogenic impacts could push the sag out of this natural range and bring the DO levels even lower or extend the period during which it occurs naturally. E.g. abstraction from rivers could reduce flow further. Although the sag is natural its tolerance limits are low if there is any additional impact. This target has been set based on data provided by the EA, including their assessment of the Humber water bodies. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Shelduck (Tadorna tadorna), Non-breeding	Supporting habitat: water quality - dissolved	Maintain the dissolved oxygen (DO) concentration at levels equating to	Year round	Dissolved Oxygen (DO) levels affect the condition and health of supporting habitats. Excessive nutrients and/or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007) and hence can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats.

		Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year), avoiding deterioration from existing levels.		Site-specifics: The Humber Estuary SAC sits within four WFD water bodies: Humber Lower, Humber Middle, Humber Upper, Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the water column have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body (<10% of the site) failed for WFD due to a drop in DO levels. (Environment Agency, 2014) there is a dissolved oxygen (DO) sag that occurs annually in the tidal Ouse during the summer months. The sag normally occurs in June and July and is not thought to have an impact on avian features; it is a natural result of an increase in temperature combined with reduced flow. N.B anthropogenic impacts could push the sag out of this natural range and bring the DO levels even lower or extend the period during which it occurs naturally. E.g. abstraction from rivers could reduce flow further. Although the sag is natural its tolerance limits are low if there is any additional impact. This target has been set based on data provided by the EA, including their assessment of the Humber water bodies. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Marsh harrier (Circus aeruginosus), Breeding	Supporting habitat: water quality - dissolved oxygen	Maintain the dissolved oxygen (DO) concentration at levels equating to Good Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year)], avoiding deterioration from existing levels.	Year round	Dissolved Oxygen (DO) levels affect the condition and health of supporting habitats. Excessive nutrients and/or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007) and hence can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. However, there is a significant amount of natural variation that should be considered. Site-specifics: The Humber Estuary SAC sits within four WFD water bodies: Humber Lower, Humber Middle, Humber Upper, Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the water column have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body (<10% of the site) failed for WFD due to a drop in DO levels. (Environment Agency, 2014) there is a dissolved oxygen (DO) sag that occurs annually in the tidal Ouse during the summer months. The sag normally occurs in June and July and is not thought to have an impact on avian features; it is a natural result of an increase in temperature combined with reduced flow. N.B anthropogenic impacts could push the sag out of this natural range and bring the DO levels even lower or extend the period during which it occurs naturally. E.g. abstraction from rivers could reduce flow further. Although the sag is natural its tolerance limits are low if there is any additional impact. This target has been set based on data provided by the EA, including their assessment of the Humber water bodies. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Non-breeding	Supporting habitat: water quality - dissolved oxygen	Maintain the dissolved oxygen (DO) concentration at levels equating to Good Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year)], avoiding deterioration from existing levels.	Year round	Dissolved Oxygen (DO) levels affect the condition and health of supporting habitats. Excessive nutrients and/or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007) and hence can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. However, there is a significant amount of natural variation that should be considered. Site-specifics: The Humber Estuary SAC sits within four WFD water bodies: Humber Lower, Humber Middle, Humber Upper, Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the water column have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body (<10% of the site) failed for WFD due to a drop in DO levels. (Environment Agency, 2014) there is a dissolved oxygen (DO) sag that occurs annually in the tidal Ouse during the summer months. The sag normally occurs in June and July and is not thought to have an impact on avian features; it is a natural result of an increase in temperature combined with reduced flow. N.B anthropogenic impacts could push the sag out of this natural range and bring the DO levels even lower or extend the period during which it occurs naturally. E.g. abstraction from rivers could reduce flow further. Although the sag is natural its tolerance limits are low if there is any additional impact. This target has been set based on data provided by the EA, including their assessment of the Humber water bodies. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Breeding	Supporting habitat: water quality - dissolved oxygen	Maintain the dissolved oxygen (DO) concentration at levels equating to Good Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year)], avoiding deterioration from	Year round	Dissolved Oxygen (DO) levels affect the condition and health of supporting habitats. Excessive nutrients and/or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007) and hence can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. However, there is a significant amount of natural variation that should be considered. Site-specifics: The Humber Estuary SAC sits within four WFD water bodies: Humber Lower, Humber Middle, Humber

				From 2009 to 2012 the dissolved oxygen levels within the water column have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body (<10% of the site) failed for WFD due to a drop in DO levels. (Environment Agency, 2014) there is a dissolved oxygen (DO) sag that occurs annually in the tidal Ouse during the summer months. The sag normally occurs in June and July and is not thought to have an impact on avian features; it is a natural result of an increase in temperature combined with reduced flow. N.B anthropogenic impacts could push the sag out of this natural range and bring the DO levels even lower or extend the period during which it occurs naturally. E.g. abstraction from rivers could reduce flow further. Although the sag is natural its tolerance limits are low if there is any additional impact. This target has been set based on data provided by the EA, including their assessment of the Humber water bodies. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Avocet (Recurvirostra avosetta), Non-breeding	Supporting habitat: water quality - dissolved oxygen	Maintain the dissolved oxygen (DO) concentration at levels equating to Good Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year)], avoiding deterioration from existing levels.	Year round	Dissolved Oxygen (DO) levels affect the condition and health of supporting habitats. Excessive nutrients and/or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007) and hence can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. However, there is a significant amount of natural variation that should be considered. Site-specifics: The Humber Estuary SAC sits within four WFD water bodies: Humber Lower, Humber Middle, Humber Upper, Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the water column have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body (<10% of the site) failed for WFD due to a drop in DO levels. (Environment Agency, 2014) there is a dissolved oxygen (DO) sag that occurs annually in the tidal Ouse during the summer months. The sag normally occurs in June and July and is not thought to have an impact on avian features; it is a natural result of an increase in temperature combined with reduced flow. N.B anthropogenic impacts could push the sag out of this natural range and bring the DO levels even lower or extend the period during which it occurs naturally. E.g. abstraction from rivers could reduce flow further. Although the sag is natural its tolerance limits are low if there is any additional impact. This target has been set based on data provided by the EA, including their assessment of the Humber water bodies. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Golden plover (Pluvialis apricaria), Non-breeding	Supporting habitat: water quality - dissolved oxygen	Maintain the dissolved oxygen (DO) concentration at levels equating to Good Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year)], avoiding deterioration from existing levels.	Year round	Dissolved Oxygen (DO) levels affect the condition and health of supporting habitats. Excessive nutrients and/or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007) and hence can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. However, there is a significant amount of natural variation that should be considered. Site-specifics: The Humber Estuary SAC sits within four WFD water bodies: Humber Lower, Humber Middle, Humber Upper, Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the water column have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body (<10% of the site) failed for WFD due to a drop in DO levels. (Environment Agency, 2014) there is a dissolved oxygen (DO) sag that occurs annually in the tidal Ouse during the summer months. The sag normally occurs in June and July and is not thought to have an impact on avian features; it is a natural result of an increase in temperature combined with reduced flow. N.B anthropogenic impacts could push the sag out of this natural range and bring the DO levels even lower or extend the period during which it occurs naturally. E.g. abstraction from rivers could reduce flow further. Although the sag is natural its tolerance limits are low if there is any additional impact. This target has been set based on data provided by the EA, including their assessment of the Humber water bodies. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Knot (Calidris canutus), Non-breeding	Supporting habitat: water quality - dissolved oxygen	Maintain the dissolved oxygen (DO) concentration at levels equating to Good Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year)], avoiding deterioration from existing levels.	Year round	Dissolved Oxygen (DO) levels affect the condition and health of supporting habitats. Excessive nutrients and/or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007) and hence can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. However, there is a significant amount of natural variation that should be considered. Site-specifics: The Humber Estuary SAC sits within four WFD water bodies: Humber Lower, Humber Middle, Humber Upper, Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the water column have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body (<10% of the site) failed for WFD due to a drop in DO levels. (Environment Agency, 2014) there is a dissolved oxygen (DO) sag that occurs annually in the tidal Ouse during the summer months. The

				result of an increase in temperature combined with reduced flow. N.B anthropogenic impacts could push the sag out of this natural range and bring the DO levels even lower or extend the period during which it occurs naturally. E.g. abstraction from rivers could reduce flow further. Although the sag is natural its tolerance limits are low if there is any additional impact. This target has been set based on data provided by the EA, including their assessment of the Humber water bodies. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Hen harrier (Circus cyaneus), Non-breeding	Supporting habitat: water quality - dissolved oxygen	Maintain the dissolved oxygen (DO) concentration at levels equating to Good Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year)], avoiding deterioration from existing levels.	Year round	Dissolved Oxygen (DO) levels affect the condition and health of supporting habitats. Excessive nutrients and/or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007) and hence can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. However, there is a significant amount of natural variation that should be considered. Site-specifics: The Humber Estuary SAC sits within four WFD water bodies: Humber Lower, Humber Middle, Humber Upper, Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the water column have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body (<10% of the site) failed for WFD due to a drop in DO levels. (Environment Agency, 2014) there is a dissolved oxygen (DO) sag that occurs annually in the tidal Ouse during the summer months. The sag normally occurs in June and July and is not thought to have an impact on avian features; it is a natural result of an increase in temperature combined with reduced flow. N.B anthropogenic impacts could push the sag out of this natural range and bring the DO levels even lower or extend the period during which it occurs naturally. E.g. abstraction from rivers could reduce flow further. Although the sag is natural its tolerance limits are low if there is any additional impact. This target has been set based on data provided by the EA, including their assessment of the Humber water bodies. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Avocet (Recurvirostra avosetta), Breeding	Supporting habitat: water quality - dissolved oxygen	Maintain the dissolved oxygen (DO) concentration at levels equating to Good Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year)], avoiding deterioration from existing levels.	Year round	Dissolved Oxygen (DO) levels affect the condition and health of supporting habitats. Excessive nutrients and/or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007) and hence can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. However, there is a significant amount of natural variation that should be considered. Site-specifics: The Humber Estuary SAC sits within four WFD water bodies: Humber Lower, Humber Middle, Humber Upper, Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the water column have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body (<10% of the site) failed for WFD due to a drop in DO levels. (Environment Agency, 2014) there is a dissolved oxygen (DO) sag that occurs annually in the tidal Ouse during the summer months. The sag normally occurs in June and July and is not thought to have an impact on avian features; it is a natural result of an increase in temperature combined with reduced flow. N.B anthropogenic impacts could push the sag out of this natural range and bring the DO levels even lower or extend the period during which it occurs naturally. E.g. abstraction from rivers could reduce flow further. Although the sag is natural its tolerance limits are low if there is any additional impact. This target has been set based on data provided by the EA, including their assessment of the Humber water bodies. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Black-tailed godwit (Limosa limosa islandica), Non-breeding	Supporting habitat: water quality - dissolved oxygen	Maintain the dissolved oxygen (DO) concentration at levels equating to Good Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year)], avoiding deterioration from existing levels.	Year round	Dissolved Oxygen (DO) levels affect the condition and health of supporting habitats. Excessive nutrients and/or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007) and hence can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. However, there is a significant amount of natural variation that should be considered. Site-specifics: The Humber Estuary SAC sits within four WFD water bodies: Humber Lower, Humber Middle, Humber Upper, Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the water column have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body (<10% of the site) failed for WFD due to a drop in DO levels. (Environment Agency, 2014) there is a dissolved oxygen (DO) sag that occurs annually in the tidal Ouse during the summer months. The sag normally occurs in June and July and is not thought to have an impact on avian features; it is a natural result of an increase in temperature combined with reduced flow. N.B anthropogenic impacts could push the sag out of this natural range and bring the DO levels even lower or extend the period during which it occurs naturally. E.g. abstraction from rivers could reduce flow further. Although the sag is natural its tolerance limits are low if there is any additional impact.

				water bodies. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Redshank (Tringa totanus), Non-breeding	Supporting habitat: water quality - dissolved oxygen	Maintain the dissolved oxygen (DO) concentration at levels equating to Good Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year)], avoiding deterioration from existing levels.	Year round	Dissolved Oxygen (DO) levels affect the condition and health of supporting habitats. Excessive nutrients and/or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007) and hence can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. However, there is a significant amount of natural variation that should be considered. Site-specifics: The Humber Estuary SAC sits within four WFD water bodies: Humber Lower, Humber Middle, Humber Upper, Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the water column have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body (<10% of the site) failed for WFD due to a drop in DO levels. (Environment Agency, 2014) there is a dissolved oxygen (DO) sag that occurs annually in the tidal Ouse during the summer months. The sag normally occurs in June and July and is not thought to have an impact on avian features; it is a natural result of an increase in temperature combined with reduced flow. N.B anthropogenic impacts could push the sag out of this natural range and bring the DO levels even lower or extend the period during which it occurs naturally. E.g. abstraction from rivers could reduce flow further. Although the sag is natural its tolerance limits are low if there is any additional impact. This target has been set based on data provided by the EA, including their assessment of the Humber water bodies. The target has been set in accordance with the MCZ General Management Approach, based on application of the vulnerability assessment, from the time of designation. The GMA has been tailored to specific attributes according to the likely impacts.
Dunlin (Calidris alpina alpina), Non-breeding	Supporting habitat: water quality - dissolved oxygen	Maintain the dissolved oxygen (DO) concentration at levels equating to Good Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year)], avoiding deterioration from existing levels.	Year round	Dissolved Oxygen (DO) levels affect the condition and health of supporting habitats. Excessive nutrients and/or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007) and hence can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. However, there is a significant amount of natural variation that should be considered. Site-specifics: The Humber Estuary SAC sits within four WFD water bodies: Humber Lower, Humber Middle, Humber Upper, Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the water column have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body (<10% of the site) failed for WFD due to a drop in DO levels. (Environment Agency, 2014) there is a dissolved oxygen (DO) sag that occurs annually in the tidal Ouse during the summer months. The sag normally occurs in June and July and is not thought to have an impact on avian features; it is a natural result of an increase in temperature combined with reduced flow. N.B anthropogenic impacts could push the sag out of this natural range and bring the DO levels even lower or extend the period during which it occurs naturally. E.g. abstraction from rivers could reduce flow further. Although the sag is natural its tolerance limits are low if there is any additional impact. This target has been set based on data provided by the EA, including their assessment of the Humber water bodies. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Waterbird assemblage, Non-breeding	Supporting habitat: water quality - dissolved oxygen	Maintain the dissolved oxygen (DO) concentration at levels equating to Good Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year)], avoiding deterioration from existing levels.	Year round	Dissolved Oxygen (DO) levels affect the condition and health of supporting habitats. Excessive nutrients and/or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007) and hence can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. However, there is a significant amount of natural variation that should be considered. Site-specifics: The Humber Estuary SAC sits within four WFD water bodies: Humber Lower, Humber Middle, Humber Upper, Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the water column have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body (<10% of the site) failed for WFD due to a drop in DO levels. (Environment Agency, 2014) there is a dissolved oxygen (DO) sag that occurs annually in the tidal Ouse during the summer months. The sag normally occurs in June and July and is not thought to have an impact on avian features; it is a natural result of an increase in temperature combined with reduced flow. N.B anthropogenic impacts could push the sag out of this natural range and bring the DO levels even lower or extend the period during which it occurs naturally. E.g. abstraction from rivers could reduce flow further. Although the sag is natural its tolerance limits are low if there is any additional impact. This target has been set based on data provided by the EA, including their assessment of the Humber water bodies. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to

Little tern (Sternula albifrons), Breeding	Supporting habitat: water quality - dissolved oxygen	Maintain the dissolved oxygen (DO) concentration at levels equating to Good Ecological Status (specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year)], avoiding deterioration from existing levels.	Year round	Dissolved Oxygen (DO) levels affect the condition and health of supporting habitats. Excessive nutrients and/or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007) and hence can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. However, there is a significant amount of natural variation that should be considered. Site-specifics: The Humber Estuary SAC sits within four WFD water bodies: Humber Lower, Humber Middle, Humber Upper, Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the water column have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body (<10% of the site) failed for WFD due to a drop in DO levels. (Environment Agency, 2014) there is a dissolved oxygen (DO) sag that occurs annually in the tidal Ouse during the summer months. The sag normally occurs in June and July and is not thought to have an impact on avian features; it is a natural result of an increase in temperature combined with reduced flow. N.B anthropogenic impacts could push the sag out of this natural range and bring the DO levels even lower or extend the period during which it occurs naturally. E.g. abstraction from rivers could reduce flow further. Although the sag is natural its tolerance limits are low if there is any additional impact. This target has been set based on data provided by the EA, including their assessment of the Humber water bodies. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Ruff (Calidris pugnax), Non-breeding	Supporting habitat: water quality - dissolved oxygen	Maintain the dissolved oxygen (DO) concentration at levels equating to Good Ecological Status [(specifically ≥ 5.7 mg per litre (at 35 salinity) for 95 % of the year)], avoiding deterioration from existing levels.	Year round	Dissolved Oxygen (DO) levels affect the condition and health of supporting habitats. Excessive nutrients and/or high turbidity can lead to a drop in DO, especially in warmer months. Low DO can have sub-lethal and lethal impacts on fish and infauna and epifauna communities (Best et al., 2007) and hence can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. However, there is a significant amount of natural variation that should be considered. Site-specifics: The Humber Estuary SAC sits within four WFD water bodies: Humber Lower, Humber Middle, Humber Upper, Lincolnshire. From 2009 to 2012 the dissolved oxygen levels within the water column have been classified as achieving Good Ecological Potential. However, in 2013 and 2014 the Humber Upper water body (<10% of the site) failed for WFD due to a drop in DO levels. (Environment Agency, 2014) there is a dissolved oxygen (DO) sag that occurs annually in the tidal Ouse during the summer months. The sag normally occurs in June and July and is not thought to have an impact on avian features; it is a natural result of an increase in temperature combined with reduced flow. N.B anthropogenic impacts could push the sag out of this natural range and bring the DO levels even lower or extend the period during which it occurs naturally. E.g. abstraction from rivers could reduce flow further. Although the sag is natural its tolerance limits are low if there is any additional impact. This target has been set based on data provided by the EA, including their assessment of the Humber water bodies. The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Ruff (Calidris pugnax), Non-breeding	Supporting habitat: water quality - nutrients	Maintain water quality and specifically mean winter dissolved inorganic nitrogen (DIN) at a concentration equating to High Ecological Status (specifically mean winter DIN is < 12 µM for coastal waters), avoiding deterioration from existing levels.	Year round	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. This can impact sensitive fish, epifauna and infauna communities (Devlin et al., 2007), (Best, 2014) and hence adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. The aim is to seek no further deterioration or improve water quality. Site-specifics: This target has been set based on data provided by the EA, including their assessment of the Humber water bodies (Environment Agency, 2014). There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Dunlin (Calidris alpina alpina), Non-breeding	Supporting habitat: water quality - nutrients	Maintain water quality and specifically mean winter dissolved inorganic nitrogen (DIN) at a concentration equating to High Ecological Status (specifically mean winter DIN is < 12 µM for coastal waters), avoiding deterioration from existing levels.	Year round	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. This can impact sensitive fish, epifauna and infauna communities (Devlin et al., 2007), (Best, 2014) and hence adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. The aim is to seek no further deterioration or improve water quality. Site-specifics: This target has been set based on data provided by the EA, including their assessment of the Humber water bodies (Environment Agency, 2014). There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Redshank	Supporting	Maintain water quality	Year	

Non-breeding	quality - nutrients	winter dissolved inorganic nitrogen (DIN) at a concentration equating to High Ecological Status (specifically mean winter DIN is < 12 µM for coastal waters), avoiding deterioration from existing levels.		macroalgae blooms, leading to reduced dissolved oxygen availability. This can impact sensitive fish, epifauna and infauna communities (Devlin et al., 2007), (Best, 2014) and hence adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. The aim is to seek no further deterioration or improve water quality. Site-specifics: This target has been set based on data provided by the EA, including their assessment of the Humber water bodies (Environment Agency, 2014). There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Black-tailed godwit (Limosa limosa islandica), Non-breeding	Supporting habitat: water quality - nutrients	Maintain water quality and specifically mean winter dissolved inorganic nitrogen (DIN) at a concentration equating to High Ecological Status (specifically mean winter DIN is < 12 µM for coastal waters), avoiding deterioration from existing levels.	Year round	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. This can impact sensitive fish, epifauna and infauna communities (Devlin et al., 2007), (Best, 2014) and hence adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. The aim is to seek no further deterioration or improve water quality. Site-specifics: This target has been set based on data provided by the EA, including their assessment of the Humber water bodies (Environment Agency, 2014). There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Bar-tailed godwit (Limosa lapponica), Non-breeding	Supporting habitat: water quality - nutrients	Maintain water quality and specifically mean winter dissolved inorganic nitrogen (DIN) at a concentration equating to High Ecological Status (specifically mean winter DIN is < 12 µM for coastal waters), avoiding deterioration from existing levels.	Year round	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. This can impact sensitive fish, epifauna and infauna communities (Devlin et al., 2007), (Best, 2014) and hence adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. The aim is to seek no further deterioration or improve water quality. Site-specifics: This target has been set based on data provided by the EA, including their assessment of the Humber water bodies (Environment Agency, 2014). There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Little tern (Sternula albifrons), Breeding	Supporting habitat: water quality - nutrients	Maintain water quality and specifically mean winter dissolved inorganic nitrogen (DIN) at a concentration equating to High Ecological Status (specifically mean winter DIN is < 12 µM for coastal waters), avoiding deterioration from existing levels.	Year round	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. This can impact sensitive fish, epifauna and infauna communities (Devlin et al., 2007), (Best, 2014) and hence adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. The aim is to seek no further deterioration or improve water quality. Site-specifics: This target has been set based on data provided by the EA, including their assessment of the Humber water bodies (Environment Agency, 2014). There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Waterbird assemblage, Non-breeding	Supporting habitat: water quality - nutrients	Maintain water quality and specifically mean winter dissolved inorganic nitrogen (DIN) at a concentration equating to High Ecological Status (specifically mean winter DIN is < 12 µM for coastal waters), avoiding deterioration from existing levels.	Year round	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. This can impact sensitive fish, epifauna and infauna communities (Devlin et al., 2007), (Best, 2014) and hence adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. The aim is to seek no further deterioration or improve water quality. Site-specifics: This target has been set based on data provided by the EA, including their assessment of the Humber water bodies (Environment Agency, 2014). There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Avocet (Recurvirostra avosetta), Breeding	Supporting habitat: water quality - nutrients	Maintain water quality and specifically mean winter dissolved inorganic nitrogen (DIN) at a concentration equating to High Ecological Status (specifically mean winter DIN is < 12 µM for coastal waters), avoiding deterioration from	Year round	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. This can impact sensitive fish, epifauna and infauna communities (Devlin et al., 2007), (Best, 2014) and hence adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. The aim is to seek no further deterioration or improve water quality. Site-specifics: This target has been set based on data provided by the EA, including their assessment of the Humber water bodies (Environment Agency, 2014).

				currently un-impacted by anthropogenic activities.
Hen harrier (Circus cyaneus), Non-breeding	Supporting habitat: water quality - nutrients	Maintain water quality and specifically mean winter dissolved inorganic nitrogen (DIN) at a concentration equating to High Ecological Status (specifically mean winter DIN is < 12 µM for coastal waters), avoiding deterioration from existing levels.	Year round	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. This can impact sensitive fish, epifauna and infauna communities (Devlin et al., 2007), (Best, 2014) and hence adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. The aim is to seek no further deterioration or improve water quality. Site-specifics: This target has been set based on data provided by the EA, including their assessment of the Humber water bodies (Environment Agency, 2014). There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Knot (Calidris canutus), Non-breeding	Supporting habitat: water quality - nutrients	Maintain water quality and specifically mean winter dissolved inorganic nitrogen (DIN) at a concentration equating to High Ecological Status (specifically mean winter DIN is < 12 µM for coastal waters), avoiding deterioration from existing levels.	Year round	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. This can impact sensitive fish, epifauna and infauna communities (Devlin et al., 2007), (Best, 2014) and hence adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. The aim is to seek no further deterioration or improve water quality. Site-specifics: This target has been set based on data provided by the EA, including their assessment of the Humber water bodies (Environment Agency, 2014). There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Golden plover (Pluvialis apricaria), Non-breeding	Supporting habitat: water quality - nutrients	Maintain water quality and specifically mean winter dissolved inorganic nitrogen (DIN) at a concentration equating to High Ecological Status (specifically mean winter DIN is < 12 µM for coastal waters), avoiding deterioration from existing levels.	Year round	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. This can impact sensitive fish, epifauna and infauna communities (Devlin et al., 2007), (Best, 2014) and hence adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. The aim is to seek no further deterioration or improve water quality. Site-specifics: This target has been set based on data provided by the EA, including their assessment of the Humber water bodies (Environment Agency, 2014). There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Avocet (Recurvirostra avosetta), Non-breeding	Supporting habitat: water quality - nutrients	Maintain water quality and specifically mean winter dissolved inorganic nitrogen (DIN) at a concentration equating to High Ecological Status (specifically mean winter DIN is < 12 µM for coastal waters), avoiding deterioration from existing levels.	Year round	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. This can impact sensitive fish, epifauna and infauna communities (Devlin et al., 2007), (Best, 2014) and hence adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. The aim is to seek no further deterioration or improve water quality. Site-specifics: This target has been set based on data provided by the EA, including their assessment of the Humber water bodies (Environment Agency, 2014). There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Bittern (Botaurus stellaris), Breeding	Supporting habitat: water quality - nutrients	Maintain water quality and specifically mean winter dissolved inorganic nitrogen (DIN) at a concentration equating to High Ecological Status (specifically mean winter DIN is < 12 µM for coastal waters), avoiding deterioration from existing levels.	Year round	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. This can impact sensitive fish, epifauna and infauna communities (Devlin et al., 2007), (Best, 2014) and hence adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. The aim is to seek no further deterioration or improve water quality. Site-specifics: This target has been set based on data provided by the EA, including their assessment of the Humber water bodies (Environment Agency, 2014). There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Bittern (Botaurus stellaris), Non-breeding	Supporting habitat: water quality - nutrients	Maintain water quality and specifically mean winter dissolved inorganic nitrogen (DIN) at a concentration equating to High Ecological Status (specifically mean winter DIN is < 12 µM for coastal waters), avoiding deterioration from existing levels.	Year round	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. This can impact sensitive fish, epifauna and infauna communities (Devlin et al., 2007), (Best, 2014) and hence adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. The aim is to seek no further deterioration or improve water quality. Site-specifics: This target has been set based on data provided by the EA, including their assessment of the Humber

		for coastal waters), avoiding deterioration from existing levels.		There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Marsh harrier (Circus aeruginosus), Breeding	Supporting habitat: water quality - nutrients	Maintain water quality and specifically mean winter dissolved inorganic nitrogen (DIN) at a concentration equating to High Ecological Status (specifically mean winter DIN is < 12 µM for coastal waters), avoiding deterioration from existing levels.	Year round	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. This can impact sensitive fish, epifauna and infauna communities (Devlin et al., 2007), (Best, 2014) and hence adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. The aim is to seek no further deterioration or improve water quality. Site-specifics: This target has been set based on data provided by the EA, including their assessment of the Humber water bodies (Environment Agency, 2014). There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Shelduck (Tadorna tadorna), Non-breeding	Supporting habitat: water quality - nutrients	Maintain water quality and specifically mean winter dissolved inorganic nitrogen (DIN) at a concentration equating to High Ecological Status (specifically mean winter DIN is < 12 µM for coastal waters), avoiding deterioration from existing levels.	Year round	High concentrations of nutrients in the water column can cause phytoplankton and opportunistic macroalgae blooms, leading to reduced dissolved oxygen availability. This can impact sensitive fish, epifauna and infauna communities (Devlin et al., 2007), (Best, 2014) and hence adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. The aim is to seek no further deterioration or improve water quality. Site-specifics: This target has been set based on data provided by the EA, including their assessment of the Humber water bodies (Environment Agency, 2014). There is evidence from survey or monitoring that shows the feature to be in a good condition and/or currently un-impacted by anthropogenic activities.
Shelduck (Tadorna tadorna), Non-breeding	Supporting habitat: water quality - turbidity	Maintain natural levels of turbidity (e.g. concentrations of suspended sediment, plankton and other material) across the habitat.	Year round	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter from land sources. Turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg development) factors. Prolonged changes in turbidity may influence the amount of light reaching supporting habitats, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe. A prolonged increase in turbidity is indicative of an increase in suspended particulates. This has a number of implications for the aquatic / marine environment, such as affecting fish health, clogging the filtering organs of suspension feeding animals and affecting sedimentation rates. This in turn can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Marsh harrier (Circus aeruginosus), Breeding	Supporting habitat: water quality - turbidity	Maintain natural levels of turbidity (e.g. concentrations of suspended sediment, plankton and other material) across the habitat.	Year round	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter from land sources. Turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg development) factors. Prolonged changes in turbidity may influence the amount of light reaching supporting habitats, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe. A prolonged increase in turbidity is indicative of an increase in suspended particulates. This has a number of implications for the aquatic / marine environment, such as affecting fish health, clogging the filtering organs of suspension feeding animals and affecting sedimentation rates. This in turn can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Non-breeding	Supporting habitat: water quality - turbidity	Maintain natural levels of turbidity (e.g. concentrations of suspended sediment, plankton and other material) across the habitat.	Year round	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter from land sources. Turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg development) factors. Prolonged changes in turbidity may influence the amount of light reaching supporting habitats, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe. A prolonged increase in turbidity is indicative of an increase in suspended particulates. This has a number of implications for the aquatic / marine environment, such as affecting fish health, clogging the filtering organs of suspension feeding animals and affecting sedimentation rates. This in turn can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. Site-specifics:

				The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bittern (Botaurus stellaris), Breeding	Supporting habitat: water quality - turbidity	Maintain natural levels of turbidity (e.g. concentrations of suspended sediment, plankton and other material) across the habitat.	Year round	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter from land sources. Turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg development) factors. Prolonged changes in turbidity may influence the amount of light reaching supporting habitats, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe. A prolonged increase in turbidity is indicative of an increase in suspended particulates. This has a number of implications for the aquatic / marine environment, such as affecting fish health, clogging the filtering organs of suspension feeding animals and affecting sedimentation rates. This in turn can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Avocet (Recurvirostra avosetta), Non-breeding	Supporting habitat: water quality - turbidity	Maintain natural levels of turbidity (e.g. concentrations of suspended sediment, plankton and other material) across the habitat.	Year round	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter from land sources. Turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg development) factors. Prolonged changes in turbidity may influence the amount of light reaching supporting habitats, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe. A prolonged increase in turbidity is indicative of an increase in suspended particulates. This has a number of implications for the aquatic / marine environment, such as affecting fish health, clogging the filtering organs of suspension feeding animals and affecting sedimentation rates. This in turn can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Golden plover (Pluvialis apricaria), Non-breeding	Supporting habitat: water quality - turbidity	Maintain natural levels of turbidity (e.g. concentrations of suspended sediment, plankton and other material) across the habitat.	Year round	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter from land sources. Turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg development) factors. Prolonged changes in turbidity may influence the amount of light reaching supporting habitats, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe. A prolonged increase in turbidity is indicative of an increase in suspended particulates. This has a number of implications for the aquatic / marine environment, such as affecting fish health, clogging the filtering organs of suspension feeding animals and affecting sedimentation rates. This in turn can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Knot (Calidris canutus), Non-breeding	Supporting habitat: water quality - turbidity	Maintain natural levels of turbidity (e.g. concentrations of suspended sediment, plankton and other material) across the habitat.	Year round	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter from land sources. Turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg development) factors. Prolonged changes in turbidity may influence the amount of light reaching supporting habitats, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe. A prolonged increase in turbidity is indicative of an increase in suspended particulates. This has a number of implications for the aquatic / marine environment, such as affecting fish health, clogging the filtering organs of suspension feeding animals and affecting sedimentation rates. This in turn can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Hen harrier (Circus cyaneus), Non-breeding	Supporting habitat: water quality - turbidity	Maintain natural levels of turbidity (e.g. concentrations of suspended sediment, plankton and other material) across the habitat.	Year round	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter from land sources. Turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg development) factors. Prolonged changes in turbidity may influence the amount of light reaching supporting habitats, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe. A prolonged increase in turbidity is indicative of an increase in suspended particulates. This has a number of implications for the aquatic / marine environment, such as affecting fish health, clogging the filtering organs of suspension feeding animals and affecting sedimentation rates. This in turn can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats.

				The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Avocet (Recurvirostra avosetta), Breeding	Supporting habitat: water quality - turbidity	Maintain natural levels of turbidity (e.g. concentrations of suspended sediment, plankton and other material) across the habitat.	Year round	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter from land sources. Turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg development) factors. Prolonged changes in turbidity may influence the amount of light reaching supporting habitats, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe. A prolonged increase in turbidity is indicative of an increase in suspended particulates. This has a number of implications for the aquatic / marine environment, such as affecting fish health, clogging the filtering organs of suspension feeding animals and affecting sedimentation rates. This in turn can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Waterbird assemblage, Non-breeding	Supporting habitat: water quality - turbidity	Maintain natural levels of turbidity (e.g. concentrations of suspended sediment, plankton and other material) across the habitat.	Year round	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter from land sources. Turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg development) factors. Prolonged changes in turbidity may influence the amount of light reaching supporting habitats, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe. A prolonged increase in turbidity is indicative of an increase in suspended particulates. This has a number of implications for the aquatic / marine environment, such as affecting fish health, clogging the filtering organs of suspension feeding animals and affecting sedimentation rates. This in turn can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Little tern (Sternula albifrons), Breeding	Supporting habitat: water quality - turbidity	Maintain natural levels of turbidity (e.g. concentrations of suspended sediment, plankton and other material) across the habitat.	Year round	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter from land sources. Turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg development) factors. Prolonged changes in turbidity may influence the amount of light reaching supporting habitats, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe. A prolonged increase in turbidity is indicative of an increase in suspended particulates. This has a number of implications for the aquatic / marine environment, such as affecting fish health, clogging the filtering organs of suspension feeding animals and affecting sedimentation rates. This in turn can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Bar-tailed godwit (Limosa lapponica), Non-breeding	Supporting habitat: water quality - turbidity	Maintain natural levels of turbidity (e.g. concentrations of suspended sediment, plankton and other material) across the habitat.	Year round	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter from land sources. Turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg development) factors. Prolonged changes in turbidity may influence the amount of light reaching supporting habitats, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe. A prolonged increase in turbidity is indicative of an increase in suspended particulates. This has a number of implications for the aquatic / marine environment, such as affecting fish health, clogging the filtering organs of suspension feeding animals and affecting sedimentation rates. This in turn can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Black-tailed godwit (Limosa limosa islandica), Non-breeding	Supporting habitat: water quality - turbidity	Maintain natural levels of turbidity (e.g. concentrations of suspended sediment, plankton and other material) across the habitat.	Year round	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter from land sources. Turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg development) factors. Prolonged changes in turbidity may influence the amount of light reaching supporting habitats, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe. A prolonged increase in turbidity is indicative of an increase in suspended particulates. This has a number of implications for the aquatic / marine environment, such as affecting fish health, clogging the filtering

				the availability and suitability of bird breeding, rearing, feeding and roosting habitats. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Redshank (Tringa totanus), Non-breeding	Supporting habitat: water quality - turbidity	Maintain natural levels of turbidity (e.g. concentrations of suspended sediment, plankton and other material) across the habitat.	Year round	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter from land sources. Turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg development) factors. Prolonged changes in turbidity may influence the amount of light reaching supporting habitats, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe. A prolonged increase in turbidity is indicative of an increase in suspended particulates. This has a number of implications for the aquatic / marine environment, such as affecting fish health, clogging the filtering organs of suspension feeding animals and affecting sedimentation rates. This in turn can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Dunlin (Calidris alpina alpina), Non-breeding	Supporting habitat: water quality - turbidity	Maintain natural levels of turbidity (e.g. concentrations of suspended sediment, plankton and other material) across the habitat.	Year round	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter from land sources. Turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg development) factors. Prolonged changes in turbidity may influence the amount of light reaching supporting habitats, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe. A prolonged increase in turbidity is indicative of an increase in suspended particulates. This has a number of implications for the aquatic / marine environment, such as affecting fish health, clogging the filtering organs of suspension feeding animals and affecting sedimentation rates. This in turn can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.
Ruff (Calidris pugnax), Non-breeding	Supporting habitat: water quality - turbidity	Maintain natural levels of turbidity (e.g. concentrations of suspended sediment, plankton and other material) across the habitat.	Year round	Water turbidity is a result of material suspended in the water, including sediment, plankton, pollution or other matter from land sources. Turbidity levels can rise and fall rapidly as a result of biological (eg plankton blooms), physical (eg storm events) or human (eg development) factors. Prolonged changes in turbidity may influence the amount of light reaching supporting habitats, affecting the primary production and nutrient levels of the habitat's associated communities. Changes in turbidity may also have a range of biological effects on different species within the habitat, eg affecting their abilities to feed or breathe. A prolonged increase in turbidity is indicative of an increase in suspended particulates. This has a number of implications for the aquatic / marine environment, such as affecting fish health, clogging the filtering organs of suspension feeding animals and affecting sedimentation rates. This in turn can adversely affect the availability and suitability of bird breeding, rearing, feeding and roosting habitats. Site-specifics: The target has been set using expert judgement based on knowledge of the sensitivity of the feature to activities that are occurring / have occurred on the site.

See further guidance on how to undertake an HRA for a plan or project on a European site.

These tables bring together the findings of the best available scientific evidence which may be updated or supplemented in further publications from Natural England and other sources. You may decide to use other additional sources of information.

These tables do not give advice about SSSI features or other legally protected species which may also be present within the European site.

European Site Conservation Objectives for Lower Derwent Valley Special Area of Conservation
Site Code: UK0012844

With regard to the SAC and the natural habitats and/or species for which the site has been designated (the 'Qualifying Features' listed below), and subject to natural change;

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.**

This document should be read in conjunction with the accompanying *Supplementary Advice* document, which provides more detailed advice and information to enable the application and achievement of the Objectives set out above.

Qualifying Features:

H6510. Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*)

H91E0. Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*); Alder woodland on floodplains*

S1355*. Lutra lutra*; Otter

* denotes a priority natural habitat or species (supporting explanatory text on following page)

*** Priority natural habitats or species**

Some of the natural habitats and species for which UK SACs have been selected are considered to be particular priorities for conservation at a European scale and are subject to special provisions in the Habitats Regulations. These priority natural habitats and species are denoted by an asterisk (*) in Annex I and II of the Habitats Directive. The term 'priority' is also used in other contexts, for example with reference to particular habitats or species that are prioritised in UK Biodiversity Action Plans. It is important to note however that these are not necessarily the priority natural habitats or species within the meaning of the Habitats Regulations.

Explanatory Notes: European Site Conservation Objectives

These Conservation Objectives are those referred to in the Conservation of Habitats and Species Regulations 2017 as amended from time to time (the "Habitats Regulations"). They must be considered when a competent authority is required to make a 'Habitats Regulations Assessment', including an Appropriate Assessment, under the relevant parts of this legislation.

These Conservation Objectives and the accompanying Supplementary Advice (where available) will also provide a framework to inform the measures needed to conserve or restore the European Site and the prevention of deterioration or significant disturbance of its qualifying features.

These Conservation Objectives are set for each habitat or species of a Special Area of Conservation (SAC). Where the objectives are met, the site will be considered to exhibit a high degree of integrity and to be contributing to achieving Favourable Conservation Status for that species or habitat type at a UK level. The term 'favourable conservation status' is defined in regulation 3 of the Habitats Regulations.

Publication date: 27 November 2018 (version 3). This document updates and replaces an earlier version dated 30 June 2014 to reflect the consolidation of the Habitats Regulations in 2017.

European Site Conservation Objectives: Supplementary Advice on Conserving and Restoring Site Features

Lower Derwent Valley Special Area of Conservation (SAC)
Site code: UK0012844

Hay meadows, Lower Derwent Valley NNR© Natural England/Peter Roworth

Date of Publication: 18 March 2019

About this document

This document provides Natural England's supplementary advice about the European Site Conservation Objectives relating to Lower Derwent Valley SAC. This advice should therefore be read together with the SAC Conservation Objectives available here.

The site also overlaps with the Lower Derwent Valley Special Protection Area (SPA) and is contiguous with the River Derwent SAC. You should also refer to the separate advice on the European Site Conservation Objectives provided for those sites (see links on page 3 of this advice).

This advice replaces a draft version dated 29 June 2016 following the receipt of comments from the site's stakeholders.

You should use the Conservation Objectives, this Supplementary Advice and any case-specific advice given by Natural England, when developing, proposing or assessing an activity, plan or project that may affect this site. Any proposals or operations which may affect the site or its qualifying features should be designed so they do not adversely affect any of the attributes listed in the objectives and supplementary advice.

This supplementary advice to the Conservation Objectives describes in more detail the range of ecological attributes on which the qualifying features will depend and which are most likely to contribute to a site's overall integrity. It sets out minimum targets for each qualifying feature to achieve in order to meet the site's objectives.

The tables provided below bring together the findings of the best available scientific evidence relating to the site's qualifying features, which may be updated or supplemented in further publications from Natural England and other sources. The local evidence used in preparing this supplementary advice has been cited. The references to the national evidence used are available on request. Where evidence and references have not been indicated, Natural England has applied ecological knowledge and expert judgement. You may decide to use other additional sources of information.

In many cases, the attribute targets shown in the tables indicate whether the current objective is to 'maintain' or 'restore' the attribute. This is based on the best available information, including that gathered during monitoring of the feature's current condition. As new information on feature condition becomes available, this will be added so that the advice remains up to date.

The targets given for each attribute do not represent thresholds to assess the significance of any given impact in Habitats Regulations Assessments. You will need to assess this on a case-by-case basis using the most current information available.

Some, but not all, of these attributes can also be used for regular monitoring of the actual condition of the designated features. The attributes selected for monitoring the features, and the standards used to assess their condition, are listed in separate monitoring documents, which will be available from Natural England.

These tables do not give advice about SSSI features or other legally protected species which may also be present within the European Site.

If you have any comments or queries about this Supplementary Advice document please contact your local Natural England adviser or email HDIRConservationObjectivesNE@naturalengland.org.uk

About this site

European Site information

Name of European Site	Lower Derwent Valley Special Area of Conservation (SAC)
Location	North Yorkshire, East Riding of Yorkshire, City Of York
Site map	The designated boundary of this site can be viewed here on the MAGIC website
Designation Date	14 June 2005
Qualifying Features	See section below
Designation Area	915.91 hectares
Designation Changes	Not Applicable
Feature Condition Status	Details of the feature condition assessments made at this site can be found using Natural England's Designated Sites System
Names of component Sites of Special Scientific Interest (SSSIs)	Derwent Ings SSSI, Melbourne and Thornton Ings SSSI, Breighton Meadows SSSI, Newton Mask SSSI
Relationship with other European or International Site designations	The site also overlaps with the Lower Derwent Valley Special Protection Area (SPA) and is contiguous with the River Derwent SAC.

Site background and geography

Situated to the south of York, the Lower Derwent Valley is one of the largest areas of traditionally managed, agriculturally-unimproved flood plain meadows in England. The Valley running north-south along the course of the River Derwent for approximately 10 miles falls within both the Vale of York and Humberhead Levels National Character Areas.

The meadows are known locally as 'ings' (a word of Nordic origin referring to low lying wet meadow or pasture) and support a wealth of native wildflowers in the spring and early summer. They also support a rich breeding bird community together with important populations of dragonflies and other invertebrates and otter. During the winter months these same grasslands are partially flooded and support internationally important populations of waterfowl. In addition to the open grassland the Valley also supports several pockets of alder woodland of conservation importance.

Many of the meadows are divided into historic strip ownership and have been traditionally managed in the same way for centuries; they are cut for their hay in the summer once the majority of meadow plants have flowered and the subsequent re-growth of vegetation (the 'aftermath') is grazed by cattle or sheep. The open floodplain is recognised as an important landscape.

Just under half the site is managed as a National Nature Reserve by Natural England and partner organisations, the Carstairs Countryside Trust and Yorkshire Wildlife Trust.

About the qualifying features of the SAC

The following section gives you additional, site-specific information about this SAC's qualifying features. These are the natural habitats and/or species for which this SAC has been designated.

Qualifying habitats:

- **H6510 Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*)**

This Annex I habitat type comprises species-rich hay meadows on the moderately fertile soils of river and tributary floodplains. Most examples are cut annually for hay, with light aftermath grazing. Seasonal flooding maintains an input of nutrients.

In the UK, this habitat corresponds to the NVC type MG4 *Alopecurus pratensis – Sanguisorba officinalis* grassland. This community is characterised by species-rich swards containing frequent red fescue *Festuca rubra*, crested dog's-tail *Cynosurus cristatus*, meadow foxtail *Alopecurus pratensis*, great burnet *Sanguisorba officinalis*, meadowsweet *Filipendula ulmaria* and meadow buttercup *Ranunculus acris*.

The Lower Derwent Valley SAC in north-east England contains a greater area of high-quality examples of lowland hay meadows than any other UK site and encompasses the majority of this habitat type occurring in the Vale of York. The abundance of the rare narrow-leaved water-dropwort *Oenanthe silaifolia* is a notable feature. Traditional management has ensured that ecological variation is well-developed, particularly in the local transitions between this grassland type and other types of wet and dry grassland, swamp and fen vegetation.

The site supports a significant proportion of the national resource of the NVC type MG4 grassland community and many of the characteristic species associated with this grassland occur including; great burnet, meadow vetchling *Lathyrus pratensis*, pepper saxifrage *Silaum silaus* and autumn hawk-bit *Leontondon autumnalis*.

- **H91E0 Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) * Priority feature ('alder woodland on floodplains')**

Alluvial forests with alder *Alnus glutinosa* and ash *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) comprises woods dominated by alder and willow *Salix* spp. on flood plains in a range of situations from islands in river channels to low-lying wetlands alongside the channels. The habitat typically occurs on moderately base-rich, eutrophic soils subject to periodic inundation.

Typically, many such woods are dynamic, being part of a successional series of habitats. Their structure and function are best maintained within a larger unit that includes the open communities, mainly fen and swamp, of earlier successional stages. On the drier margins of these areas other tree species, notably ash *Fraxinus excelsior* and elm *Ulmus* spp., may become abundant. In other situations the alder woods occur as a stable component within transitions to surrounding dry-ground forest, sometimes including other Annex I woodland types. These transitions from wet to drier woodland and from open to more closed communities provide an important facet of ecological variation.

The only significant area of this vegetation community within this SAC is found at Thornton Ellers. Covering an estimated 6.59 ha of a c.9ha block of woodland, this wet woodland type comprises several component woodland NVC communities notably*;* W6a *Alnus glutinosa* alder - *Urtica dioica* nettle, W7 *Alnus glutinosa – Fraxinus excelsior* ash - *Lysimachia nemorum* yellow pimpernel woodland and small areas of W2a *Salix cinerea* grey willow - *Betula pubescens* downy birch – *Phragmites australis* common reed; alder-meadowsweet sub community.

The woodland is characterised by an almost continuous canopy of coppiced alder with occasional pedunculate oak *Quercus robur* and ash *Fraxinus excelsior* with an understorey of grey willow *Salix*

cinerea, hawthorn *Crataegus monogyna*, blackthorn *Prunus spinosa* and occasional holly *Ilex aquifolium*. Nettle *Urtica dioica* dominates the ground flora of the woodland areas classified as W6 whilst wood sorrel *Oxalis acetosella* and greater stitchwort *Stellaria holostea* are more prevalent in the W7 areas. The W2a woodland is characterised by the abundance of common reed within the ground flora.

Qualifying Species:

- **S1355 Otter *Lutra lutra***

Otters are semi aquatic, living mainly along rivers. They mainly eat fish, though crustaceans, frogs, voles and aquatic birds may also be taken. Being at the top of the food chain, an otter needs to eat up to 15% of its body weight in fish daily.

Otters are solitary shy animals, usually active at dusk and during the night. Otters can travel widely over large areas. Some are known to use 20 km or more of river habitat. Otters tend to live alone as they are very territorial. Otters deposit faeces in prominent places along a watercourse (known as spraints) which have a characteristic sweet musky odour. These mark their range which may help neighbouring animals keep in social contact with one another.

Within the Lower Derwent Valley SAC, otters utilise the systems of dykes and ditches linking the ings to the River Derwent (also an SAC for otters). These combined with the abundance of flood plain habitat which includes wet woodland, fen, wet grassland, and ponds provide excellent supporting habitat for the otters. There are many suitable undisturbed areas for shelter and holts and a good fish population available in the River Derwent and its tributaries provide a food source.

The Otter is also a 'European Protected Species' in the UK, and it is an offence to disturb, capture, injure or kill an otter (either on purpose or by not taking enough care), or to damage, destroy or obstruct access to its breeding or resting places, without first getting a Licence.

References

THE FLOODPLAIN MEADOWS PARTNERSHIP at http://www.floodplainmeadows.org.uk/
RODWELL, J.S. (ed.) 1991. *British Plant Communities. Volume 1. Woodlands and scrub*. Cambridge University Press.
RODWELL, J.S. (ed.) 1992. *British Plant Communities. Volume 3. Grasslands*. Cambridge University Press.

Table 1: Supplementary Advice for Qualifying Features: H6510. Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	Extent of the feature within the site	Maintain the total extent of the H6510 feature at 172.65 Ha	There should be no measurable net reduction (excluding any trivial loss) in the extent and area of this feature, and in some cases, the full extent of the feature may need to be restored. The baseline-value of extent given has been generated using data gathered from the listed site-based surveys. Area measurements given may be approximate depending on the methods, age and accuracy of data collection, and as a result this value may be updated in future to reflect more accurate information. The extent of an Annex I habitat feature covers the sum extent of all of the component vegetation communities present and may include transitions and mosaics with other closely-associated habitat features. Where a feature is susceptible to natural dynamic processes, there may be acceptable variations in its extent through natural fluctuations. Where a reduction in the extent of a feature is considered necessary to meet the Conservation Objective for another Annex I feature, Natural England will advise on this on a case-by-case basis. For this feature, there will be year to year fluctuations in climate resulting in variable flooding regimes. This may mean that there will need to be allowance made for reversible shifts in vegetation types between MG4 (the H6510 habitat) and wetter vegetation types such as inundation grasslands (e.g. MG13, MG7c) and MG8 and related vegetation depending on the flood cycle. These natural variations in the extent have been documented by Wallace and Prosser (2004[a]) The extent figure is largely based upon data presented in Prosser and Wallace (2004[b]), Additional historic surveys have also been reviewed and in a limited number of SSSI units a higher baseline has been adopted. A full list of historic sources referred to is listed opposite.	PRIEST, S. & STUTTARD, P. 1983. TRINDER, C. 1990. ADAS. 1994. BENYON, P. 1998. WALLACE H.L. AND PROSSER M. 2004[a]: PROSSER, M. V. AND WALLACE, H. L. 2004[b]:
Extent and distribution of the feature	Spatial distribution of the feature within the site	Maintain the distribution and configuration of the feature, including where applicable its component vegetation types, across the site	A contraction in the range, or geographic spread, of the feature (and its component vegetation and typical species, plus transitional communities) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes.	WALLACE H.L. AND PROSSER M. 2004[a]

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			This may also reduce and break up the continuity of a habitat within a site and how well its typical species are able to move around the site to occupy and use habitat. Such fragmentation can impact on their viability and the wider ecological composition of the Annex I habitat. Smaller fragments of habitat can typically support smaller and more isolated populations which are more vulnerable to extinction. These fragments also have a greater amount of open edge habitat which will differ in the amount of light, temperature, wind, and even noise that it receives compared to its interior. These conditions may not be suitable for some of the typical and more specialist species associated with the Annex I habitat feature. Distribution of the (*Alopecurus pratensis, Sanguisorba officinalis*) community correspond the NVC MG4 vegetation communities and its associates. Maps indicating distribution of relevant NVC communities across the site can be found in Wallace H.L. and Prosser M. (2004[a]). Information on an Ings by ings basis is available within the component Natural England SSSI Favourable Conservation Tables (in preparation).	
Structure and function (including its typical species)	Vegetation community composition	Ensure the component vegetation communities of the H6510 feature are referable to and characterised by the following National Vegetation Classification type (s); MG4 *Alopecurus pratensis - Sanguisorba officinalis* grassland	This habitat feature will comprise a number of associated semi-natural vegetation types and their transitional zones, reflecting the geographical location of the site, altitude, aspect, soil conditions (especially base-status and drainage) and vegetation management. In the UK these have been categorised by the National Vegetation Classification (NVC). Maintaining or restoring these characteristic and distinctive vegetation types, and the range of types as appropriate, will be important to sustaining the overall habitat feature. This will also help to conserve their typical plant species (i.e. the constant and preferential species of a community), and therefore that of the SAC feature, at appropriate levels (recognising natural fluctuations). In addition to the MG4 *Alopecurus pratensis - Sanguisorba officinalis* grassland community, reference should also be made to the MG7c *Lolium perenne-Alopecurus pratensis –Festuca pratensis* community. The expression of this community within the Lower Derwent Valley is particularly species rich and often grades imperceptibly into more typical MG4 type grassland. It has recently be suggested that this community be classified as a distinct vegetation type called *Alopecurus pratensis – Poa trivialis-Cardamine pratensis* (MG15) under the NVC (Wallace et al 2016 in prep & Rothero et al 2016)	WALLACE, H.L. 2016 ROTHERO, E, LAKE, S. & GOWING, D. 2016

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	Key structural, influential and distinctive species	Restore the abundance of the species listed below to enable each of them to be a viable component of the H6510 habitat; *Alopecurus pratensis* (meadow foxtail), *Filipendula ulmaria* (meadowsweet), *Leontodon autumnalis* (autumn hawkbit), *Oenanthe silaifolia* narrow-leaved water dropwort), *Sanguisorba officinalis* (great burnet), *Silaum silaus* (pepper saxifrage), *Succisa pratensis* (Devil's-bit scabious), *Thalictrum flavum* (common meadow-rue) *Centaurea nigra* (black knapweed), , *Galium verum* (lady's bedstraw), *Lathyrus pratensis* (meadow vetchling), *Leucanthemum vulgare* (oxeye daisy), *Lotus corniculatus* (common bird's-foot-trefoil) , *Primula veris* (cowslip), *Rhinanthus minor* (yellow rattle), *Serratula tinctoria* s(aw-wort), *Stachys officinalis* (betony), *Tragopogon pratensis* (goat's beard). Assemblage of birds including breeding waders (snipe, lapwing, redshank and curlew) and nationally important numbers of whimbrel on spring passage.	Some plant or animal species (or related groups of such species) make a particularly important contribution to the structure, function and/or quality of an Annex I habitat feature at a particular site. These species will include; – Structural species which form a key part of the habitat's structure or help to define an Annex I habitat on a site (see also the attribute for 'vegetation community composition'). – Influential species which are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of soil/sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat). – Site-distinctive species which are considered to be a particularly special and distinguishing component of an Annex I habitat on a particular site. There may be natural fluctuations in the frequency and cover of each of these species. The relative contribution made by them to the overall ecological integrity of a site may vary, and Natural England will provide bespoke advice on this as necessary. The list of species given here for this Annex I habitat feature at this SAC is not necessarily exhaustive. The list may evolve, and species may be added or deleted, as new information about this site becomes available. Not all species listed will occur at all locations. It is generally accepted for this community to be considered favourable if at least two species should be frequent plus three species occasional throughout the sward or locally abundant in more than 10% of the sward (Robertson, H.J. & Jefferson R.G. 2000). It is accepted that in some areas the MG4 present within the Lower Derwent Valley is a northern expression of the community and slightly less species rich.	ROBERTSON H.J. & JEFFERSON, R.J. 2000
Structure and function (including its	Vegetation: undesirable species	Maintain the frequency/cover of the following undesirable species to within acceptable levels (no	Undesirable non-woody and woody vascular plant species may require active management to avert an unwanted succession to a different and less desirable state.	NATURAL ENGLAND, 2017.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
typical species)		more than occasional throughout the sward or singly or together more than 5% cover) and prevent changes in surface condition, soils, nutrient levels or hydrology which may encourage their spread; *Anthriscus sylvestris* (cow parsley), *Cirsium arvense* (creeping thistle), *Cirsium vulgare* (spear thistle), *Rumex crispus* (curled dock), *Rumex obtusifolius* (broad-leaved dock), *Senecio jacobaea* (common ragwort), *Urtica dioica* (common nettle). *Juncus spp* (rushes), *Deschampsia cespitosa* (tufted hair-grass), large *Carex* spp. (sedges) large grasses i.e. *Glyceria maxima* (reed sweet-grass, *Phalaris arundinacea* (reed canary-grass), *Phragmites australis* (common reed). Tree and scrub species should be no more than occasional throughout the sward or more than 1% cover. Giant hogweed (*Heracleum mantegazzianum)* and Himalayan balsam (*Impatiens glandulifera*) should be absent from hay meadows communities.	Such species may be indicative of a negative trend relating to another aspect of a site's structure and function. These species will vary depending on the nature of the particular feature, and in some cases these species may be natural or acceptable components or even dominants. This feature is sensitive to prolonged waterlogging and some species listed here are indicative of this. Non-native species also constitute a major threat to many river systems. Impacts may be on the river and adjacent habitats. The UK Technical Advisory Group (UKTAG) of the Water Framework Directive produces a regularly updated classification of aquatic alien species (plants and animals) according to their level of impact. Further information on non-native species associated with the adjacent River Derwent SAC can be found within the supplementary advice relating to the River Derwent SAC (Natural England 2017) http://publications.naturalengland.org.uk/publication/4824082210095104 Within the Lower Derwent Valley SAC giant hogweed (*Heracleum mantegazzianum)* can be found on the edge of meadows adjacent to the River Derwent. Himalayan balsam (*Impatiens glandulifera*) is abundant within the River Derwent catchment and can be found in ditches and watercourses flowing into the River.	
Structure and function	Vegetation community	Maintain the pattern of naturally-occurring vegetation zonations	Transitions/zonations between adjacent but different vegetation communities are usually related to naturally-occurring changes in soil, aspect or slope. Such	WALLACE & PROSSER 2004a

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
(including its typical species)	transitions	and transitions within the H6510 feature	'ecotones' retain characteristics of each bordering community and can add value in often containing species not found in the adjacent communities. Retaining such transitions can provide further diversity to the habitat feature, and support additional flora and fauna. As stated above the component MG4 vegetation community grades imperceptibly into adjacent related vegetation communities, the exact location of these transitions can vary from year to year as result of prevailing conditions, particularly relating to flooding and soil moisture content	
Structure and function (including its typical species)	Soils, substrate and nutrient cycling	Maintain the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal: bacterial ratio, to within typical values for the H6150 habitat. For this feature soil P index should typically be between index 0 and 1 (<15 mg/l)	Soil is the foundation of basic ecosystem function and a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species which together form vegetation types, and therefore provides a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the ecological structure, function and processes associated with this Annex I feature. The *Alopecurus pratensis - Sanguisorba officinalis* community is particularly associated with the “Fladbury” soil series. It has been suggested that the location of this soil series could be used to target restoration projects for the community. A detailed analysis on the soils associated with much of the site was undertaken in 2002 (Palmer & Holman 2003).	PALMER, R.C. & HOLMAN, I P 2003
Structure and function (including its typical species)	Water quality	Where the feature is dependent on surface water and/or groundwater, maintain water quality and quantity to a standard which provides the necessary conditions to support the H6510 feature	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives. Reference should be made to water quality targets provided in the River Derwent SAC Conservation Objectives; supplementary advice and referenced in River Derwent Diffuse Water Pollution (Natural England & Environment Agency 2014).	NATURAL ENGLAND & THE ENVIRONMENT AGENCY 2014.
Structure and function (including its	Hydrology: Water table	Maintain a hydrological regime which provides a consistently near-surface water table which	Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature.	WALLACE, H. & PROSSER, M. 2014c.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
typical species)		typically averages depths of 35 cm (winter), 45cm (spring), 70cm (summer) and 60cm (autumn) below ground level	Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts. For this feature sub-surface water table levels during the year should be at levels consistent with published guidance. Investigations into hydrological conditions and vegetation at this site have been undertaken by the Floodplain Meadows Partnership (Wallace and Prosser 2004a & 2014c). For this feature, the timing, frequency, extent and duration of surface flooding should be commensurate with maintenance of the feature at this site. A non-optimal flooding regime can result in a shift from H6510 habitat to other vegetation types (such as inundation grassland, swamps). Too little flooding may compromise the necessary conservation/agricultural management due to reduced nutrient inputs which will reduce hay yields making hay management less viable and sustainable. Flooding is difficult to control within the site as it is largely a gravity fed system with few water control structures. The site is therefore largely at the vagaries of climatic and river conditions. Consequently factors in the wider River Derwent Catchment may have a significant influence on conditions within the SAC. At Wheldrake Ings water control structures do exist and a water management protocol has been established. However this can be compromised in extreme flood conditions when structures can be drowned out.	WALLACE & PROSSER 2004a.
Structure and function (including its typical species)	Hydrology: Flooding regime	Maintain a hydrological regime which provides a cumulative duration of annual surface flooding (typically less than 10 days between December-February and less than 3 days between September-November, with no inundations during March – August), subject to natural changes.		
Structure and function (including its typical species)	Hydrology	At a site and catchment level maintain natural hydrological processes to provide the conditions necessary to sustain the feature within the site	Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature. Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts. For this feature surface flooding regime and sub-surface irrigation via gravel aquifers can be affected by land use change, water abstraction, flood	CHALK, L. (2004)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			alleviation, development and mineral extraction in the catchment. One possible influence on water levels on the site is the operation of the Barmby Barrage where the River Derwent meets the River Ouse. Potential impacts of the Barmby Barrage were assessed by the Environment Agency in 2004 (Chalk 2004).	
Structure and function (including its typical species)	Adaptation and resilience	Maintain the H6150 feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either within or external to the site	This recognises the increasing need of natural habitat features to absorb or adapt to wider environmental changes. Resilience may be described as the ability of an ecological system to cope with, and adapt to environmental stress and change whilst retaining the same basic structure and ways of functioning. Such environmental changes may include changes in sea levels, precipitation and temperature, for example, which are likely to affect the extent, distribution, composition and functioning of a feature within a site. The vulnerability and response of features to such changes will vary. Using best available information, any necessary or likely adaptation or adjustment by the feature and its management in response to actual or expected climatic change should be allowed for, as far as practicable, in order to ensure the feature's long-term viability. The overall vulnerability of this particular SAC to climate change has been assessed by Natural England as being *high*, taking into account the sensitivity, fragmentation, topography and management of its habitats/supporting habitats. This means that action to address specific issues is highly likely, such as reducing habitat fragmentation, creating more habitat to buffer the site or expand the habitat into more varied landscapes and addressing particular management and condition issues. Individual species may be more or less vulnerable than their habitat itself. In many cases, change will be inevitable so appropriate monitoring would be required.	NATURAL ENGLAND, 2015.
Supporting processes (on which the feature relies)	Air quality	Restore the concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	This habitat type is considered sensitive to changes in air quality, especially nitrogen, acidity and ammonia. Exceedance of these critical values for air pollutants may modify the chemical status of its substrate, accelerating or damaging plant growth, altering its vegetation structure and composition and causing the loss of sensitive typical species associated with it. Critical Loads and Levels are recognised thresholds below which such harmful effects on sensitive UK habitats will not occur to a significant level, according to current levels of scientific understanding. There	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			are critical levels for ammonia (NH3), oxides of nitrogen (NOx) and sulphur dioxide (SO2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales.	Information System (www.apis.ac.uk .
Supporting processes (on which the feature relies)	Conservation measures	Maintain the management measures within and/or outside the site boundary) which are necessary to maintain the structure, functions and supporting processes associated with the H6510 feature	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement (VAM) for the underpinning SSSI and/or management agreements. Conservation measures for this feature will typically include grazing, hay cutting, scrub management, weed control, recreation/visitor management. Also covered is maintenance of surface drainage features such as grips, gutters and foot drains. Retention of suitable land use infrastructure/patterns to enable site management e.g. pastoral livestock farming. It should be noted that the Site Improvement Plan for the site identified a number of current pressures on the site, notably hydrological changes and under-grazing. Additional information relating to the management of the site can be found within; The Sustainable Management of the Lower Derwent Valley, Yorkshire. Lower Derwent Valley Management Plan 2005-2010 (Chalk, L. Leighton, E. & Bentley) and the Lower Derwent Valley National Nature Reserve Management Plan.	NATURAL ENGLAND, 2014. ENGLISH NATURE, 2005. CHALK, L. LEIGHTON, E. & BENTLEY, M 2005. NATURAL ENGLAND. Lower Derwent Valley NNR Management Plan (in prep.)
Version Control Advice last updated: **18 March 2019** following stakeholder feedback Additional explanatory text in **Spatial distribution of feature within site** attribute to clarify location of evidence. Further information provided on **Vegetation: undesirable species** attribute include key species and further sources of information; clarification in supporting notes of **Hydrology – flooding regime** attribute that factors in the wider catchment may impact on the feature within the SAC				
Variations from national feature-framework of integrity-guidance: The attribute relating to supporting off site habitat and functional connectivity with the wider				

Attributes	Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
landscape has been removed as it is considered not relevant. The community being restricted to the designated site only. Similarly that relating to the Functional connectivity with the wider landscape has also be removed			

Table 2: Supplementary Advice for Qualifying Features: H91E0. Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae); Alder woodland on floodplains *

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	Extent of the feature within the site	Maintain the total extent of the H91E0 feature at 6.59 hectares.	See the notes for this attribute in Table 1 above. For this feature tree roots (particularly of veteran trees) can extend a considerable distance beyond the boundary of the site - they can be impacted by soil compaction and chemical applications which get into the soil. Any loss of woodland area - whether at the edge or in the middle of a site will reduce the core woodland area where woodland conditions are found - these support significant assemblages of species dependent on woodland conditions (e.g. lichens and bryophytes - being one example). Loss of any woodland area which fragments a site into different parts will clearly disturb the movement of species between the remaining parts of the woodland. Vegetation surveys since designation show that relevant woodland communities actually cover a slightly lower area than that previously taken as the baseline at the time of designation which was estimated in the absence of NVC surveys.	PROSSER, M.V. & WALLACE, H.L. 2003 PROSSER, M. V. AND WALLACE, H. L. 2004[b] REILLY, J.2008
Extent and distribution of the feature	Spatial distribution of the feature within the site	Maintain the distribution and configuration of the H91E0 feature, including where applicable its component vegetation types, across the site	See the notes for this attribute in Table 1 above. This feature is restricted to one location within the site, this being at Thornton Ellers (SE729456). Although other small pockets of alder woodland do occur within the site these were deemed not to contribute towards the SAC feature. This decision was made in accordance with advice from English Nature Woodland specialist at the time of designation.	
Structure and function (including its typical species)	Vegetation community composition	Ensure the component vegetation communities of the feature are referable to and characterised by the following National Vegetation Classification type(s); W6a *Alnus glutinosa* (alder) - *Urtica dioica* (nettle) W7 *Alnus glutinosa* **(**alder) – Fraxinus excelsior (ash) -	This habitat feature will comprise a number of associated semi-natural vegetation types and their transitional zones, reflecting the geographical location of the site, altitude, aspect, soil conditions (especially base-status and drainage) and vegetation management. In the UK these have been categorised by the National Vegetation Classification (NVC). Maintaining or restoring these characteristic and distinctive vegetation types, and the range of types as appropriate, will be important to sustaining the overall habitat feature. This will also help to conserve their typical plant species (i.e. the constant and preferential species of a community), and therefore that of the SAC feature, at appropriate levels (recognising natural fluctuations).	PROSSER, M.V. & WALLACE, H.L. 2003 REILLY, J. 2008

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		Lysimachia nemorum (yellow pimpernel) and W2a *Salix cinerea* (grey willow) - *Betula pubescens* (downy birch) – *Phragmites australis* (common reed); alder-meadowsweet sub community.		
Structure and function (including its typical species)	Vegetation structure - canopy cover	Maintain an appropriate tree canopy cover across the H91E0 feature, which will typically be between 30-90% of the site	Canopy cover is the overall proportion of vegetative cover consisting of any woody layer ranging from established regeneration to mature and veteran stages. Woodland canopy density and structure is important because it affects ecosystem function and in particular microclimate, litterfall, soil moisture, nutrient turnover and shading; this in turn influences the composition of plants and animals in lower vegetation layers and soil. Open canopies with just scattered trees will have less of a woodland character and reduced diversity of woodland-dependent species (although they may be still be important as a form of woodland-pasture). Completely closed canopies across the whole woodland are not ideal either however, as they cast heavier shade and support fewer species associated with edges, glades and open grown trees, and have little space where tree regeneration could occur. In general, the woodland canopy of this feature should provide a core of woodland interior conditions with some open and edge habitat as well. Canopy cover will vary according to coppice cycle being undertaken.	
Structure and function (including its typical species)	Vegetation structure - open space	Maintain areas of permanent/temporary open space within the woodland feature, typically to cover approximately 10%of area	Woodland structure includes variations in age, tree form, layering, the distribution and abundance of open space and dead wood. It plays a critical role in woodland ecosystem functioning. Having some open, sunlit and largely tree-less areas as part of the woodland community is often important to facilitate natural tree and shrub regeneration and also to provide supporting habitat for specialist woodland invertebrates, birds, vascular and lower plants. Such open space can be permanent or temporary and may consist of managed grazed areas, linear rides and glades, or naturally-produced gaps caused by disturbance events such as windthrow/fire/tree falling over/snow damage.	
	Vegetation structure - old growth	Maintain the extent and continuity of undisturbed, mature/old growth stands	Good woodland structure includes variations in age, tree form, layering, the distribution and abundance of open space and dead wood. It plays a critical role in woodland ecosystem functioning.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		(typically comprising at least 10% of the H91E0 feature at any one time) and the assemblages of veteran and ancient trees (typically c.5 trees per hectare).	For this habitat type, old or over-mature elements of the woodland are particularly characteristic and important features, and their continuity should be a priority. The abundance of veteran and ancient trees is likely to be less than the 10% specified under targets given that the area of woodland has a long history of coppice management resulting in a lack of this age class. Figures given in targets are in line with JNCC Common Standards for monitoring.	
	Vegetation structure - dead wood	Maintain the continuity and abundance of standing or fallen dead and decaying wood, (typically between 30 - 50 m^3 per hectare of standing or fallen timber or 3 fallen trees >30cm per hectare, and 4 standing dead trees per hectare)	Woodland structure includes variations in age, tree form, layering, the distribution and abundance of open space and dead wood. It plays a critical role in woodland ecosystem functioning. Dead and actively decaying wood, either as part of a standing tree or as a fallen tree on the woodland floor, is an important component of woodland ecosystems, and supports a range of specialist invertebrates, fungi, lichens and bryophytes, and associated hole-nesting birds and roosting bats, all of which may be very typical of the feature.	
Structure and function (including its typical species)	Vegetation structure - age class distribution	Maintain at least 3 age classes (pole stage/ medium/ mature) spread across the average life expectancy of the commonest trees.	A distribution of size and age classes of the major site-native tree and shrub species that indicate the woodland will continue in perpetuity, and will provide a variety of the woodland habitats and niches expected for this type of woodland at the site in question.	
Structure and function (including its typical species)	Vegetation structure - shrub layer	Maintain an understorey of shrubs covering 10 - 60% of the stand area (this will vary with light levels and site objectives)	Woodland structure includes variations in age, tree form, layering, the distribution and abundance of open space and dead wood. It plays a critical role in woodland ecosystem functioning.	
	Vegetation structure - woodland edge	Maintain a graduated woodland edge into adjacent semi-natural open habitats, other woodland/wood-pasture types or scrub.	Woodland edge is defined as being the transitional zone between the forest feature and adjacent but different habitat types - the best woodland edges will have a varied structure in terms of height and cover. Many typical forest species make regular use of the edge habitats for feeding due to higher herb layer productivity and larger invertebrate populations. Grasslands / arable fields managed with high doses of agro-chemicals could potentially not allow this gradation of woodland edge and could have other impacts on the integrity of the site (pollution/ nutrient enrichment etc.).	
	Adaptation and resilience	Maintain the resilience of the feature by ensuring a diversity (at least 3 species) of site-native trees (e.g. alder, willow *Salix* spp,	See notes for this attribute in Table 1 above.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		ash, elm *Ulmus* spp, black poplar) across the site.		
	Browsing and grazing by herbivores	Maintain browsing at a (low) level that maintains a well-developed understorey with no obvious browse line and lush ground vegetation with some grazing sensitive species evident (bramble, ivy etc.), and tree seedlings and sapling common in gaps.	Herbivores, especially deer, are an integral part of woodland ecosystems. They are important in influencing woodland regeneration, composition and structure and therefore in shaping woodland wildlife communities. In general, both light grazing and browsing is desirable to promote both a diverse woodland structure and continuous seedling establishment. Short periods with no grazing at all can allow fresh natural regeneration of trees, but a long-term absence of herbivores can result in excessively dense thickets of young trees which shade out ground flora and lower plant species. However, heavy grazing by deer or sheep prevents woodland regeneration, and can cause excessive trampling and/or poaching damage, canopy fragmentation, heavy browsing, bark stripping and a heavily grazed sward.	
Structure and function (including its typical species)	Regeneration potential	Maintain the potential for sufficient natural regeneration of desirable trees and shrubs; typically tree seedlings of desirable species (measured by seedlings and <1.3m saplings - above grazing and browsing height) should be visible in sufficient numbers in gaps, at the wood edge and/or as regrowth from coppice stumps as appropriate ;	The regeneration potential of the woodland feature must be maintained if the wood is to be sustained and survive, both in terms of quantity of regeneration and in terms of appropriate species. This will Include regeneration of the trees and shrubs from saplings or suckers, regrowth from coppice stools or pollards, and where appropriate planting. Browsing and grazing levels must permit regeneration at least in intervals of 5 years every 20. The density of regeneration considered sufficient is less in parkland sites than in high forest. Regeneration from pollarding of veteran trees should be included where this is happening.	
	Tree and shrub species composition	Maintain a canopy and under-storey of which 95% is composed of site-native trees and shrubs e.g. *Alnus glutinosa* (alder) *Fraxinus excelsior* (ash) and to a lesser extent *Quercus robur* (Oak)	Native trees and shrubs in general support a greater diversity of associated species than non-native species, especially amongst groups of invertebrates which depend directly on trees for food and shelter. There are many plants and animals which use or co-exist with non-native trees, but many rare and threatened woodland species are specialists adapted to one or a few native trees or shrub species (birches, willows and oaks, are examples of trees that host many specialist insect species).	
	Key structural, influential and distinctive species	Restore the abundance of the species listed below to enable each of them to be a viable component of the H91E0 habitat;	See notes for this attribute in Table 1 above.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		Higher plants: alder *Alnus glutinosa,* ash *Fraxinus excelsior,* downy birch *Betula pubescens,* willows *Salix* spp., sedges *Carex* spp*.,* hawthorn *Crataegus monogyna*, blackthorn Prunus spinosa, holly *Ilex aquifolium*. Nettle *Urtica dioica,* wood sorrel *Oxalis acetosella*, greater stitchwort *Stellaria holostea* and localised common reed *Phragmites australis*.		
Structure and function (including its typical species)	Invasive, non-native and/or introduced species	Ensure invasive and introduced non-native species are either rare or absent, but if present are causing minimal damage to the H91E0 feature	Invasive or introduced non-native species are a serious potential threat to the biodiversity of native and ancient woods, because they are able to exclude, damage or suppress the growth of native tree, shrub and ground species (and their associated typical species), reduce structural diversity and prevent the natural regeneration of characteristic site-native species. Once established, the measures to control such species may also impact negatively on the features of interest (e.g. use of broad spectrum pesticides). Such species can include Rhododendrons, snowberry, Japanese knotweed, giant hogweed and Himalayan balsam, for example. Similarly, this would include pheasants, rabbits and non-native invertebrate 'pest' species. Himalayan Balsam is a particular potential threat to the site.	
	Soils, substrate and nutrient cycling	Maintain the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal: bacterial ratio, to within typical values for the H91E0 habitat.	Soil is the foundation of basic ecosystem function and a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species which together form vegetation types, and therefore provides a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the ecological structure, function and processes associated with this Annex I feature.	
Supporting processes (on which the feature relies)	Water quality/quantity	Where the feature is dependent on surface water and/or groundwater, maintain water quality and quantity to a standard	For many SAC features which are dependent on surface and/or ground water, such as the H91E0 habitat, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of	NATURAL ENGLAND & THE ENVIRONMENT

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		which provides the necessary conditions to support the H91E0 feature.	this habitat type. One critical aspect is that water levels should be consistently at or very close to surface level (subject to natural variation), Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases more stringent standards may be needed. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC. Reference should be made to water quality targets provided in the River Derwent SAC conservation Objectives; supplementary advice and referenced in the River Derwent Diffuse Water Pollution (Natural England & Environment Agency 2014).	AGENCY 2014.
	Hydrology	At a site, unit and/or catchment level (as necessary, maintain natural hydrological processes to provide the conditions necessary to sustain the H91E0 feature within the site	Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature. Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts. Alluvial forests can be dynamic in nature, being part of successional habitats and transitions to drier woodlands. Hydrological processes (including periodic inundation) are critical to how they function and must not be negatively impacted. It should be noted that extent of flooding is difficult to control within the site as it is largely a gravity fed system with few water control structures. The site is therefore largely at the vagaries of climatic and river conditions. Consequently factors in the wider River Derwent Catchment may have a significant influence on conditions within the SAC.	
Supporting processes (on which the feature relies)	Functional connectivity with wider landscape	Maintain the overall extent, quality and function of any supporting features within the local landscape which provide a critical functional connection with the site	This recognises the potential need at this site to maintain or restore the connectivity of the site to its wider landscape in order to meet the conservation objectives. These connections may take the form of landscape features, such as habitat patches, hedges, watercourses and verges, outside of the designated site	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			boundary which are either important for the migration, dispersal and genetic exchange of those typical species closely associated with qualifying Annex I habitat features of the site. These features may also be important to the operation of the supporting ecological processes on which the designated site and its features may rely. In most cases increasing actual and functional landscape-scale connectivity would be beneficial. Where there is a lack of detailed knowledge of the connectivity requirements of the qualifying feature, Natural England will advise as to whether these are applicable on a case by case basis.	
	Conservation measures	Maintain the management measures within and/or outside the site boundary) which are necessary to maintain the structure, functions and supporting processes associated with the H91E0 feature	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement (VAM) for the underpinning SSSI and/or management agreements.	NATURAL ENGLAND, 2014. ENGLISH NATURE, 2005. CHALK, L. LEIGHTON, E. & BENTLEY, M 2005. NATURAL ENGLAND. Lower Derwent Valley NNR Management Plan (in prep.)
Supporting processes (on which the feature relies)	Illumination	Ensure artificial light is maintained at a level which is unlikely to affect natural phenological cycles and processes to the detriment of the H91E0 feature and its typical species at this site.	Woodland biodiversity has naturally evolved with natural patterns of light and darkness, so disturbance or modification of those patterns can influence numerous aspects of plant and animal behaviour. For example, light pollution (from direct glare, chronically increased illumination and/or temporary, unexpected fluctuations in lighting) can affect animal navigation, competitive interactions, predator-prey relations, and animal physiology. Flowering and development of trees and plants can also be modified by un-natural illumination which can disrupt natural seasonal responses.	
Version Control Advice last updated: **18 March 2019** following stakeholder feedback. Additional explanatory notes for **Hydrology** attribute outlining influences of wider Derwent catchment on the SAC.				
Variations from national feature-framework of integrity-guidance: n/a				

Table 3: Supplementary Advice for Qualifying Features: S1355. *Lutra lutra*; Otter

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting processes (on which the feature and/or its supporting habitat relies)	Conservation measures	Maintain the management measures (either within and/or outside the site boundary as appropriate) which are necessary to Maintain the structure, functions and supporting processes associated with the otter feature and/or its supporting habitats.	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, site management strategies or plans, the Views about Management Statement for the underpinning SSSI and/or management agreements.	CHALK, L. LEIGHTON, E. & BENTLEY, M. 2005.
Supporting habitat: extent and distribution	Extent of supporting habitat	Maintain the total extent of the habitat(s) which support otter at approximately: 586.18ha wet grassland 274.77ha fens marsh and swamp 27.47ha standing open water 18ha deciduous woodland 9ha dry neutral grassland.	In order to contribute towards the objective of achieving an overall favourable conservation status of the feature at a UK level, it is important to maintain or if appropriate restore the extent of supporting habitats and their range within this SAC. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection, and may be subject to periodic review in light of improvements in data. Habitat figures are based on information on the SAC Natura 2000 standard data form which gives percentage cover for relevant habitats). http://jncc.defra.gov.uk/protectedsites/sacselection/n2kforms/UK0012844.pdf These were based on best available evidence at time of completion and provide an indication of relative extent of various habitats. A more accurate review of habitat extent by NVC community (excluding open water) is now provided by Prosser, M.V. and Wallace H.L. (2004)	PROSSER, M. V. AND WALLACE, H. L. 2004[b]
	Distribution of supporting habitat	Maintain the distribution and continuity of the feature's supporting habitat, including where applicable its component vegetation types and associated transitional vegetation types, across the site	A contraction in the range, or geographic spread, of the feature (and its component vegetation) across the site will reduce its overall area, the local diversity and variations in its structure and composition and may undermine its resilience to adapt to future environmental changes. Contraction may also reduce and break up the continuity of a habitat within a site and how well the species feature is able to occupy and use habitat within the site. Such fragmentation may have a greater amount of open edge habitat which will differ in the amount of light, temperature, wind, and even noise that it	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			receives compared to its interior. These conditions may not be suitable for this feature and this may affect its viability.	
Supporting processes (on which the feature and/or its supporting habitat relies)	Adaptation and resilience	Maintain the feature's ability, and that of its supporting habitat, to adapt or evolve to wider environmental change, either within or external to the site	See supporting notes for this attribute in Table 1 above.	
	Water quantity/quality	Where the feature or its supporting habitat is dependent on surface water, maintain water quality and quantity to a standard which provides the necessary conditions to support the feature.	See supporting notes for this attribute in Table 2 above.	
	Air quality	Maintain or, where necessary, restore concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk)	The supporting habitat of this feature is considered sensitive to changes in air quality, especially acidity. Exceedance of these critical values for air pollutants may modify the chemical status of its substrate, accelerating or damaging plant growth, altering its vegetation structure and composition (including food-plants) and reducing supporting habitat quality and population viability of this feature. No critical loads are available for this feature on APIS	
Supporting habitat: structure/ function	Habitat quality - river habitat	Maintain the quality of supporting river habitat features based on natural river function, which provides a characteristic river-habitat mosaic that caters for otters.	A combination of dense bank vegetation, marshes and reedbeds are important for otters. Dense bank vegetation and reedbeds are favoured as resting areas, but otters will often travel some distance to a preferred 'couch' and this will not necessarily be along the edge of the river. The structure and quality of bankside vegetation, reedbeds and other nearby habitats should be maintained, particularly where there is evidence of use by otters. However, it is thought that the most significant determinant of otter usage of a habitat is the abundance of prey (Kruuk et al 1998). Supplementary advice has been produced for the River Derwent SAC which should be cross referenced with this document	KRUUK, H. (1998) NATURAL ENGLAND, 2017.
Supporting habitat: structure/ function	Habitat quality - waterway habitat	Maintain the quality of supporting waterways habitat features used by the otter population	Smaller tributaries of larger river systems (streams, becks etc.) are extremely important for otters and have been shown to have been used more frequently by otters than larger rivers. This is thought to be in part due to differences in fish density and preference for hunting in shallow water with areas of riffles and boulders.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
	Food availability	Maintain fish biomass within expected natural levels for the supporting habitat (subject to natural fluctuations).	In freshwater, key fish prey sources for otters include eels, salmonids, roach and sticklebacks. Frogs can also form an important part of the diet, depending on the habitat and time of year. Crayfish and water beetles may also form part of the diet, as well as an occasional waterbird (young coots, moorhens, ducks) or mammal (rabbits, water voles - although this is uncommon). T The diet of otters varies depending on the availability of prey, which in turn varies with the time of year. There should be a diverse range of food sources available throughout the year, within the normal expectations of each particular water course. It should be noted that otters may take prey from adjacent fisheries which are stocked to an artificially high level, especially where there are numerous stocked gravel pits on a floodplain. This can lead to artificially high prey densities adjacent to European sites, which might be expected to, in turn, result in artificially high densities of otter on the designated sites. This highlights the importance of biosecurity around stocked fisheries, and if implemented at all artificial still water fisheries on a floodplain might result in a legitimate reduction in otter density.	
	Abundance of breeding and resting places	Maintain an abundance of natural breeding and resting sites for otter within the site	Otters are highly mobile and are likely to spend their time within wider territories, where designated sites only form a proportion of their range and make a contribution to their wider requirements. Otters will often use many holts at any one time. They may give birth in one, but raise their young in another. Important features of a successful breeding site are the availability of food, limited disturbance and safety from the risk of flooding. It is important to consider the whole site and not just the known holts as appropriate management will influence all of these factors. Some natal den structures have a limited lifespan (e.g. hollow tree trunks, piles of timber etc.) and if alternative opportunities for natal dens are limited, suitable replacements can be created or constructed. Maintaining dense bank vegetation, areas of reed etc. will ensure that there are suitable areas for resting couches.	
Supporting habitat: structure/ function	Availability of refugia	Maintain an abundance of dense bankside vegetation to limit significant disturbance to animals	For rivers, most of the floodplain is outside the boundary of the site, yet the integrity of the interest feature will often be dependent upon the quality of the adjacent habitat outwith the boundary of the site. This is likely to be the case where bankside vegetation may be an important barrier to disturbing activity but may lie adjacent to and outside the boundary. Nevertheless it will be important to maintain, or in some cases, to restore dense bankside cover.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting habitat: structure/ function	Water flow - rivers	Maintain the natural flow regime of the river to that close to what would be expected in the absence of abstractions and discharges (the 'naturalised' flow).	Permanent or long-lasting reductions in flow may affect the availability and diversity of prey. This could lead to otters moving into new areas, increasing the likelihood of conflict with other otters. This may also alter they prey targeted by otters as they may hunt for low-preference food such as birds, rabbits, fish carrion or for frogs, depending on the time of year which may affect their fitness and condition. It should be noted that flows with adjacent River Derwent are significantly affected by factors in the wider catchment. These in turn may have a significant influence on conditions for otter within the SAC.	NATURAL ENGLAND, 2016.
	Water quality/quantity	Maintain water quality and quantity to a standard which provides the necessary conditions to support the feature.	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year during key stages of their life cycle. Poor water quality and inadequate quantities of water can adversely affect the availability and suitability of breeding, rearing and feeding habitats. The main impact of water chemistry on this feature is its effect on the food supply. For example, moderate levels of levels of eutrophication may increase certain fish populations, but excessive eutrophication can be detrimental. Excessive acidity in watercourses may also affect fish populations. Impacts from toxic pollutants can be devastating and were the major cause of otter population declines in the 50s, 60s and 70s. Reference should be made to water quality targets provided in the River Derwent SAC conservation objectives; supplementary advice and referenced within the River Derwent Diffuse Water Pollution (Natural England & Environment Agency 2014).	NATURAL ENGLAND & THE ENVIRONMENT AGENCY 2014. NATURAL ENGLAND, 2016.
Supporting processes (on which the feature and/or its supporting habitat relies)	Water quality : Toxic chemicals	Avoid any increase in the level of pollutants affecting the site which are potentially toxic to otters.	The major cause of the decline in otter populations in the 60s and 70s was toxic chemicals such as dieldrin and related pesticides. Contaminants that might have an effect on otters may have an indirect effect (e.g. on food supply - organic pollution, eutrophication, acidification from mine waste and acid rain), a mainly direct effect (e.g. oil spillage, radioactivity) or effects of bioaccumulation (e.g. metals, especially mercury, cadmium and lead; pesticides and PCBs). PCBs, organochlorine pesticides and heavy metals all being seen as detrimental to otters, although the use of many of these is now banned.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting processes (on which the feature and/or its supporting habitat relies)	Connectivity within and to the site	Ensure there are no significant artificial barriers to the safe passage and movement of otters into, within and away from the site	Otter populations within the SAC are likely to be dependent upon the integrity of other sections of river channel, riparian areas, freshwater still-waters and floodplains that lie outside of the site boundary, particularly if the river channel is operating under natural processes and moves laterally over time within the floodplain. It is possible that holts of otters that form part of the population for a SAC may lie on the adjacent floodplain outwith the boundary of the SAC. Barriers to movement between such habitats, such as roads, weirs etc. can generally increase the risk of harm to animals as they traverse or avoid them. If these barriers are considered a problem then mitigating measures could be taken.	
Population (of the feature)	Population abundance	Maintain the continued presence of an actively-breeding otter population within the SAC, whilst avoiding deterioration from current levels as indicated by the latest mean peak count, estimate or equivalent.	This will ensure there is a viable population of the feature which is being maintained at or increased to a level that contributes as appropriate to its Favourable Conservation Status across its natural range in the UK. Due to the dynamic nature of population change, the target-value given for the population size or presence of this feature is considered to be the minimum standard for conservation/restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size or presence has significantly changed as a result of natural factors or management measures and has been stable at or above a new level over a considerable period. The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's otter population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is designated, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account in any assessment.	EA Review of Consents otter records (Appendix 26) CRAWFORD, A., 2012.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			For otters, it is difficult to estimate population size. It could be assumed that where there is a high frequency of positive signs in an area, such as a large number of spraints (of several ages), that otters are likely to be occupying the site. Breeding will be indicated by the presence of natal dens, cub sightings and intensive otter activity (e.g. feeding, sprainting, pathways through vegetation). DNA analysis of spraints is now being used as a technique for identifying otters. The National Otter Surveys undertaken by EA do not provide a population estimate but check for presence at designated 600m sections. The first survey in 1977/78 showed no sign of otter presence in sections associated with the site but positive signs have increased to 85% of sections in the last survey (2009/10). It is estimated that the carrying capacity will be reached when 80% positive signs have been recorded on two consecutive surveys.	
Population (of the feature)	Anthropogenic mortality	Reduce levels of mortality as a result of anthropogenic (man-made) factors so that they are not adversely affecting the overall abundance and viability of the population.	High numbers of otter casualties within or adjacent to SAC catchments will adversely affect the condition and viability of the population and mitigation measures should be initiated as quickly as possible. Causes of mortality may include roads, accidents with fishing equipment (nets, lobster creels), poisoning, pollutants, hunting and acidification/contamination of water courses (which reduces fish populations). It should be noted that otters are also a European protected species, and that it is an offence to deliberately disturb, capture, injure or kill an otter.	CRAWFORD, A., 2012.
Version Control. Advice last updated: **18 March 2019** following stakeholder feedback. Additional explanatory notes for **Water Flow – rivers** attribute outlining influences of wider Derwent catchment on the SAC.				
Variations from national feature-framework of integrity-guidance: Removal of attributes and references relating to coastal otters given Lower Derwent Valley SAC is entirely inland coastal attributes consequently not relevant.				

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European Site Conservation Objectives for Lower Derwent Valley Special Protection Area Site Code: UK9006092

With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified (the 'Qualifying Features' listed below), and subject to natural change;

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.**

This document should be read in conjunction with the accompanying *Supplementary Advice* document, which provides more detailed advice and information to enable the application and achievement of the Objectives set out above.

Qualifying Features:

A037 *Cygnus columbianus bewickii*; Bewick's swan (Non-breeding)
A050 *Anas penelope*; Eurasian wigeon (Non-breeding)
A052 *Anas crecca*; Eurasian teal (Non-breeding)
A056 *Anas clypeata*; Northern shoveler (Breeding)
A140 *Pluvialis apricaria*; European golden plover (Non-breeding)
A151 *Philomachus pugnax*; Ruff (Non-breeding)
Waterbird assemblage

Explanatory Notes: European Site Conservation Objectives

These Conservation Objectives are those referred to in the Conservation of Habitats and Species Regulations 2017 (as amended) ('the Habitats Regulations'). They must be considered when a competent authority is required to make a 'Habitats Regulations Assessment' including an Appropriate Assessment, under the relevant parts of this legislation.

These Conservation Objectives, and the accompanying Supplementary Advice (where this is available), will also provide a framework to inform the management of the European Site and the prevention of deterioration of habitats and significant disturbance of its qualifying features

These Conservation Objectives are set for each bird feature for a Special Protection Area (SPA).

Where these objectives are being met, the site will be considered to exhibit a high degree of integrity and to be contributing to achieving the aims of the Wild Birds Directive.

Publication date: 21 February 2019 (version 3). This document updates and replaces an earlier version dated 30 June 2014 to reflect the consolidation of the Habitats Regulations in 2017.

European Site Conservation Objectives: Supplementary advice on conserving and restoring site features

Lower Derwent Valley
Special Protection Area (SPA)
Site Code: UK9006092

Wheldrake ings (January 2014)

Date of Publication: 21 March 2019

About this document

This document provides Natural England's supplementary advice for the European Site Conservation Objectives relating to Lower Derwent Valley SPA. This advice should therefore be read together with the SPA Conservation Objectives available here.

The site also overlaps with the Lower Derwent Valley Special Area of Conservation (SAC) and the River Derwent SAC. Conservation Objectives and Supplementary Advice relating to these sites (where available) can be found here: Lower Derwent Valley SAC & River Derwent SAC

This advice replaces a draft version dated 25 January 2019 following the receipt of comments from the site's stakeholders.

You should use the Conservation Objectives, this Supplementary Advice and any case-specific advice given by Natural England when developing, proposing or assessing an activity, plan or project that may affect this site.

This Supplementary Advice to the Conservation Objectives presents attributes which are ecological characteristics of the designated species and habitats within a site. The listed attributes are considered to be those that best describe the site's ecological integrity and which, if safeguarded, will enable achievement of the Conservation Objectives. Each attribute has a target which is either quantified or qualitative depending on the available evidence. The target identifies as far as possible the desired state to be achieved for the attribute.

The tables provided below bring together the findings of the best available scientific evidence relating to the site's qualifying features, which may be updated or supplemented in further publications from Natural England and other sources. The local evidence used in preparing this supplementary advice has been cited. The references to the national evidence used are available on request. Where evidence and references have not been indicated, Natural England has applied ecological knowledge and expert judgement. You may decide to use other additional sources of information.

This Supplementary Advice to the Conservation Objectives presents attributes which are ecological characteristics of the designated species and habitats within a site. The listed attributes are considered to be those that best describe the site's ecological integrity and which, if safeguarded, will enable achievement of the Conservation Objectives. Each attribute has a target which is either quantified or qualitative depending on the available evidence. The target identifies as far as possible the desired state to be achieved for the attribute.

In many cases, the attribute targets shown in the tables indicate whether the current objective is to 'maintain' or 'restore' the attribute. This is based on the best available information, including that gathered during monitoring of the feature's current condition. As new information on feature condition becomes available, this will be added so that the advice remains up to date.

The targets given for each attribute do not represent thresholds to assess the significance of any given impact in Habitats Regulations Assessments. You will need to assess this on a case-by-case basis using the most current information available.

Some, but not all, of these attributes can also be used for regular monitoring of the actual condition of the designated features. The attributes selected for monitoring the features, and the standards used to assess their condition, are listed in separate monitoring documents, which will be available from Natural England. These tables do not give advice about SSSI features or other legally protected species which may also be present within the European Site.

If you have any comments or queries about this Supplementary Advice document please contact your local Natural England adviser or email HDIRConservationObjectivesNE@naturalengland.org.uk

About this site

European Site information

Name of European Site	Lower Derwent Valley Special Protection Area (SPA)
Location	North Yorkshire, East Riding of Yorkshire, City Of York
Site Map	The designated boundary of this site can be viewed here on the MAGIC website
Designation Date	January 1993
Qualifying Features	A037 *Cygnus columbianus bewickii*; Bewick's swan (Non-breeding). A140 *Pluvialis apricaria*; European golden plover (Non-breeding) A151 *Philomachus pugnax*; Ruff (Non-breeding) A056; *Anas clypeata* Northern Shoveler (breeding) A050 *Anas penelope*; Eurasian wigeon (Non-breeding) A052 *Anas crecca*; Eurasian teal (Non-breeding) Waterbird assemblage
Designation Area	1,089.4 ha
Designation Changes	*None*
Feature Condition Status	Details of the feature condition assessments made at this site can be found using Natural England's Designated Sites System
Names of component Sites of Special Scientific Interest (SSSIs)	Derwent Ings SSSI, Melbourne and Thornton Ings SSSI, Breighton Meadows SSSI, Newton Mask SSSI, River Derwent SSSI
Relationship with other European or International Site designations	The site overlaps with the Lower Derwent Valley SAC/Ramsar site and the River Derwent SAC

Site background and geography

Situated to the south of York, the Lower Derwent Valley is one of the largest areas of traditionally managed flood plain meadows in England. The Valley, running north-south along the course of the River Derwent for approximately 10 miles falls within both the Vale of York and Humberhead Levels National Character Areas.

The meadows are known locally as Ings (a word of Nordic origin referring to low lying wet meadow or pasture) and support a wealth of wildflowers in the spring and early summer. They also support a rich breeding bird community together with important populations of dragonflies and other invertebrates and otter. During the winter months these same grassland are partially flooded and support internationally important populations of waterfowl.

Many of the meadows are divided into historic strip ownership and have been cut for hay meadows for centuries, with the aftermath being grazed by cattle and/or sheep, and the open floodplain is recognised as an important landscape.

In addition to the open grassland the Valley also supports several pockets of alder woodland conservation importance.

The site includes both the River itself and adjacent floodplain habitat.

Just under half the site is managed as a National Nature Reserve by Natural England and partner organisations, (the Carstairs Countryside Trust and Yorkshire Wildlife Trust).

About the qualifying features of the SPA

The following section gives you additional, site-specific information about this SPA's qualifying features. These are the individual species of wild birds listed on Annex I of the European Wild Birds Directive, and/or the individual regularly-occurring migratory species, and/or the assemblages (groups of different species occurring together) of wild birds for which the SPA was classified for.

- **Qualifying individual species listed in Annex I of the Wild Birds Directive (Article 4.1)**

During the non-breeding season the SPA regularly supports:

A037 Bewick's swan *Cygnus columbianus bewickii*; (Non-breeding)

When the site was classified in 1993 the Lower Derwent Valley supported 70 birds (mean peak count 1986/87-1990/91). Since this time numbers have declined in line with national trends and the mean winter count for the period (2012/13-16/17) has been 2 birds. The Annual Report of the Wetland Bird Survey 2013/14 (Holt *et al.* 2015) reported that the Bewick's Swan index had fallen to its lowest point for 40 years. It is considered that part of this decline can be attributed to birds increasingly short stopping in the Low Countries and elsewhere in Europe (BTO 2013) partly as a result of climate change.

Historically birds were associated with Bubwith Ings, Aughton Ings and North Duffield Carrs where they were known to feed on soft meadow grasses of the ings meadows and adjacent farmland particularly around Aughton and North Duffield.

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

The Lower Derwent Valley has long been known to support large numbers of golden plover, and the species was described as "a regular winter visitor, sometimes arriving in large flocks" as long ago as 1912 (Smith 1912). A 5 year average of 4120 (1986/87-1990/91) is quoted in the SPA Departmental Brief (English Nature 1993). Counts of 4620 (1989), and 3000+ and 4000+ in 1990 were also reported by Ralston (2005). 5 year annual peak counts between 1992/93 (Year of designation) and 1996/97 ranged from-to 3000-8900 with 5 year average 5400.

Birds are found throughout the site and surrounding farmland. Birds will however leave the site for the Humber Estuary and other coastal sites in periods of severe (cold) weather.

A151 Ruff *Philomachus pugnax*; (Non-breeding)

The site supports nationally important of wintering and spring passage ruff. The SPA Departmental Brief quoted the mean peak wintering number for the period 1986/87-1990/91 as 50 birds representing 3.5% of the British population. At the time of designation the site also supported up to 100 birds during the spring migration. Five year annual peak winter counts between 1992/93 (Year of designation) and 1996/97 ranged from 81-189 with 5 year average 122. Recent numbers are slightly below this number, the five year average for the period 2012/13-2016/17 being 78. However numbers remain within known historic fluctuations for this species with a peak count of 131 reported in 2014/15 (Frost *et al.* 2018).

Birds are widely distributed across the area being found wherever flooding conditions are suitable. Spring passage of birds from African wintering grounds begins in late February with most movement in March and April (Goodall 2005). Consequently counts from this period may include both wintering and passage birds.

- **Qualifying individual species not listed in Annex I of the Wild Birds Directive (Article 4.2)**

During the breeding season the SPA regularly supports:

A056; Northern Shoveler *Anas clypeata;* (breeding)

The site supports nationally important numbers of breeding shoveler and when the site was classified in 1993 a mean figure of 50 pairs was provided for the 1981-1990 period, which at the time represented 3% of breeding British population. There is little information available as to the natural fluctuations in breeding numbers from this time. The population appears to have remained stable since this time with the latest 5 year mean (2014-18) being 47 breeding pairs (confirmed and probable) (Natural England 2014-18).

Birds tend to be concentrated around North Duffield Carrs, Bank Island and Wheldrake where winter flood water tends to remain into early spring. Here the mosaic of wet grassland and fen vegetation in close proximity to a network of dykes ditches and pools provide ideal habitat for the species.

A050 Eurasian wigeon *Anas penelope*; (Non-breeding)

As with golden plover the site has long been known to support significant numbers of wigeon with Smith (1912) describing them as a "*common winter visitor*" and describing "*vast flocks in the Derwent valley*". Today the site supports internationally important numbers of wintering wigeon**.** Annual peak counts between 1986/87-1990/91 ranged from 5,000 – 11,500 with 5 average of 7370 (Frost *et al.* 2018). The SPA Departmental Brief quoted a 5 year mean of 7790 representing 3% of the United Kingdom population and 1% of the north-west European population. Since its classification as a SPA numbers have steadily increased with the five year (2012-17) peak mean being 11,770 (Frost *et al.* 2018).

The birds are widely distributed across the site where they feed on the seasonally flooded grasslands. It has been suggested (Goodall 2005) that the distribution can be correlated with the extent of flooding. Birds also favour areas less likely to be disturbed. Certain sites are however important in all years, most notably Wheldrake Ings.

A052 Eurasian teal *Anas crecca*; (Non-breeding)

Again Smith (1912) refers to the presence of flocks of teal. The site supports internationally important numbers of wintering teal. Annual peak counts between 1986/87 – 1990/91 ranged from 3,300 - 5,700 with a five year average of 3,974 (Austin *et al.* 2014). The Departmental Brief at the time of SPA classification quoted a 5 year mean of 4040, representing 1% of the north-west European population. The peak figure of 5,700 during this period quoted in Departmental Brief occurred in 1990/91. Since is classification as a SPA numbers have increased with the five year (2012-17) peak mean being 7459 and a peak count of 10,000 in 2016/17. As with wigeon, birds are widely distributed across the site where they feed amongst vegetation such as reed canary grass, it has however been suggested by Goodall (2005) that Melbourne and Thornton Ings, Ellerton Ings and Bubwith Ings are particularly important.

- **Qualifying assemblage of species (Article 4.2)**

Waterbird assemblage

The site qualifies under Article 4.2 by regularly supporting over 20,000 wintering waterfowl. In the five year period 1986/87-1990/91 the site held a mean peak of 27,580 birds comprising 17,415 wildfowl and 10,165 waders (English Nature 1993). These large numbers of birds being supported by the rich food resources of the floodplain meadows associated with the site. Since designation wintering numbers have increased with mean peak counts for the period 2012/13-2016/17 being 33,885 (Frost *et al.* 2018). The site remains one of the most important inland sites for wintering waterfowl in the United Kingdom.

Birds are widely distributed across the site, the relative distribution of wildfowl and waders being dependent upon the flood conditions present in any given winter.

Site-specific seasonality of SPA features

The table below highlights in grey those months in which significant numbers of each mobile qualifying feature are most likely to be present at the SPA during a typical calendar year. This table is provided as a general guide only. Unless otherwise indicated, the months shown below are primarily based on information relating to the general months of occurrence of the feature in the UK. Where site-based evidence is available and has been used to indicate below that significant numbers of the feature are typically present at this SPA outside of the general period, the site-specific references have been added to indicate this.

Applicants considering projects and plans scheduled in the periods highlighted in grey would benefit from early consultation with Natural England given the greater scope for there to be likely significant effects that require consideration of mitigation to minimise impacts to qualifying bird features during the principal periods of site usage by those features. The months which are *not* highlighted in grey are not ones in which the features are necessarily absent, rather that features may be present in less significant numbers in typical years. Furthermore, in any given year, features may occur in significant numbers in months in which typically they do not. Thus, applicants should not conclude that projects or plans scheduled in months not highlighted in grey cannot have a significant effect on the features. There may be a lower likelihood of significant effects in those months which nonetheless will also require prior consideration.

Any assessment of potential impacts on the features must be based on up-to-date count data and take account of population trends evident from these data and any other available information. Additional site-based surveys may be required. Non-breeding water bird monthly maxima data gathered for this site through the Wetland Bird Survey ('WeBS') may be available upon request from the British Trust for Ornithology.

Feature	Season	Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Site-specific references where available
Bewick's Swan	*Non Breeding*	*Winter*													*Frost, T.M., Austin, G.E., Calbrade, N.A., Mellan, H.J., Hearn, R.D., Stroud, D.A., Wotton, S.R. and Balmer, D.E. 2018. Waterbirds in the UK 2016/17: The Wetland Bird Survey. BTO/RSPB/JNCC. Thetford.* *Ralston, C.S.(2005): Birds of the Lower Derwent valley; A historic review 1850-2002 (English Nature)*
Eurasian Wigeon	*Non Breeding*	*Winter*													
Eurasian teal	*Non Breeding*	*Winter*													
European Golden Plover	*Non Breeding*	*Winter*													
Northern Shoveler	*Breeding*	*Summer*													
Ruff	*Non Breeding/ passage*	*Winter/ Spring Passage*													
Waterbird Assemblage	*Non Breeding*														

Guide to terms:
Breeding – present on a site during the normal breeding period for that species
Non-breeding - present on a site outside of the normal breeding period for that species (includes passage and winter periods).
Summer – the period generally from April to July inclusive
Passage - the periods during the autumn and spring when migratory birds are moving between breeding areas and wintering areas. These periods are not strictly defined but generally include the months of July – October inclusive (autumn passage) and March – April inclusive (spring passage).
Winter - the period generally from November to February inclusive.

Table 1: Supplementary Advice for Qualifying Features: A037. *Cygnus columbianus bewickii*; Bewick's swan (Non-breeding)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Non-breeding population	**Population abundance**	Restore the size of the non-breeding population to a level which is at or above that present at designation **70 birds**: (English Nature 1993) in so far as natural fluctuations associated with changes in population distribution allow.	**General:** This will sustain the site's population and contribute to a viable local, national and bio-geographic population. Due to the mobility of birds and the dynamic nature of population change, the target-value given for the abundance of this feature is considered to be the minimum standard for conservation/ restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's abundance has significantly changed as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally at least 10 years). The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current abundance of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is classified, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account. Maintaining or restoring bird abundance depends on the suitability of the site. However, factors affecting suitability can also determine other demographic rates of birds using the site including survival (dependent on factors such as body condition which influences the ability to breed or make foraging and/or migration movements) and breeding productivity. Adverse anthropogenic impacts on either of these rates may precede	English Nature (1993): Departmental Brief, Lower Derwent Valley Proposed Special Protection Area and Ramsar Site 628A BTO/RSPB/JNCC (2013): Waterbirds in the UK 2011/12: The annual report of the Wetland Bird Survey Holt, C. A., Austin G.E., Calbrade, N.A., Mellan, H.J., Hearn, R.D., Stroud, D.A., Wotton, S.R. & Musgrove, A.J. (2015). Waterbirds in the UK 2013/14: The Wetland Bird Survey. BTO, RSPB and JNCC in association with WWT. British Trust for Ornithology, Thetford.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			changes in population abundance (e.g. by changing proportions of birds of different ages) but eventually may negatively affect abundance. These rates can be measured/ estimated to inform judgements of likely impacts on abundance targets. Unless otherwise stated, the population size will be that measured using standard methods such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of natural fluctuations and margins of error during data collection. Whilst we will endeavour to keep these values as up to date as possible, local Natural England staff can advise on whether the figures stated are the best available. Numbers of Bewick's Swans over wintering in the Lower Derwent Valley are now very small, and the decline in the species reflects national declines reported by BTO. The Annual Report of the Wetland Bird Survey 2013/14 (Holt *et al.* 2015) reported that the Bewick's Swan index had fallen to its lowest point for 40 years. It is considered that part of this decline can be attributed to birds increasingly short stopping in the Low Countries and elsewhere in Europe (BTO 2013) partly as a result of climate change. The objective should be to provide appropriate conditions for the birds should shifts in population size and distribution at a national and international level be reversed.	
Supporting habitat (both within and outside the SPA): extent and distribution	**Extent and distribution of supporting non-breeding habitat**	Maintain the extent and distribution of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) Wet grassland (which will be partially inundated during winter months) c.709ha Inland water bodies	Conserving or restoring the extent of supporting habitats and their range will be key to maintaining the site's ability and capacity to support the SPA population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending to the nature, age and accuracy of data collection. This target may apply to supporting habitat which also lies outside the site boundary. Birds are known to winter close to water on permanent pasture, winter cereal, root crops or flooded meadows. It is important that these habitats are present so that suitable conditions exist for the species should numbers increase to historic level.	Information on historic distribution of birds available in Ralston, C.S.(2005): Birds of the Lower Derwent valley; A historic review 1850-2002 (English Nature) Goodall (2005): review of the Importance of the Lower Derwent valley for Birds (Ecological services Ltd) - A report to the Environment Agency.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		(Standing/Running water) c. 109ha Fens & associated habitats c.262ha.	Appropriate habitat is particularly important at sites historically known to support birds, notably North Duffield Carrs and Ings, Aughton Ings and Bubwith Ings, together with surrounding arable farmland. The Lower Derwent Valley provides a mosaic of habitats; including; periodically flooded wet grassland, fens, marsh and swamp vegetation together with standing and flowing open water. The relative abundance of these communities will vary according to the season however estimated extent of communities based upon JNCC standard Natura 2000 Data form:	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Air quality**	Maintain concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	The structure and function of habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of nesting, feeding or roosting habitats. Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH3), oxides of nitrogen (NOx) and sulphur dioxide (SO2), and critical loads for nutrient nitrogen deposition and acid deposition. It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development.	More information about site-relevant Critical Loads and Levels for this SPA is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk).

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting habitat (both within and outside the SPA): function/ supporting process	**Connectivity with supporting habitats**	Maintain the safe passage of birds moving between roosting and feeding areas	The ability of the feature to safely and successfully move to and from feeding and roosting areas is critical to their breeding success and to the adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant.	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Conservation measures**	Maintain management or other measures (whether within and/or outside the site boundary as appropriate) necessary to maintain the structure, function and/or the supporting processes associated with the feature and its supporting habitats.	Active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Further details about the necessary conservation measures for this site will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans (including River Restoration Plan (Royal Haskoning 2010), the Views about Management Statement for the underpinning SSSI and/or management agreements. In order to provide appropriate habitat for Bewick's Swan it is essential that the historic, traditional management of the Ings meadows be continued. This should include the taking of an annual hay crop with aftermath grazing. Land adjacent to the designated site should remain within the arable farmed landscape, providing feeding opportunities for any visiting birds	Chalk, L. Leighton, E. & Bentley, M on behalf of Lower Derwent Valley Project Partners (2005). The Sustainable Management of the Lower Derwent Valley, Yorkshire. Lower Derwent Valley Management Plan 2005-2010 (*Available from Natural England on request*). Natural England NNR Management Plan (in prep.) available from Natural England on request Information on historic distribution of birds available in: Ralston, C.S.(2005): Birds of the Lower Derwent Valley; A historic review 1850-2002 (English Nature) and Goodall, A. (2005): Review of the Importance of the Lower Derwent valley for Birds (Ecological services Ltd) - A report for the Environment Agency. Royal Haskoning, (2010). River Derwent SSSI Restoration Plan

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
				and Technical Report for Natural England and the Environment Agency. Accessed at: http://www.therrc.co.uk/DesignatedRivers/Yorks_Derwent_Restoration_Plan.pdf http://www.therrc.co.uk/DesignatedRivers/Yorks_Derwent_Technical_Report.pdf
Supporting habitat (both within and outside the SPA): function/ supporting process	**Food availability within supporting habitat**	Maintain and Restore the availability of cereal grains, rape, potatoes and sugar beet, where these sources are locally important to feeding flocks,	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population. Adjacent farmland traditionally provided feeding areas particularly adjacent arable land. Historically a local farmer provided supplementary food in the form of potatoes.	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Food availability within supporting habitat**	Maintain cover/abundance of preferred food plants (e.g. *Lolium perenne, Glyceria fluitans, Phleum pratense, Rorippa amphibia, Alopecurus geniculatus*).	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population.	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Hydrology/flow**	Maintain hydrological processes to ensure water availability in feeding sites, with visible areas of standing shallow water.	Changes in source, depth, duration, frequency, magnitude and timing of water supply or flow can have important implications for this feature. Such changes may affect the quality and suitability of habitats used by birds for nesting, drinking, preening, rearing, feeding or roosting. Unless these have already been undertaken, further site-specific investigations may be required to fully inform conservation measures for this feature and/or the likelihood of impacts on this attribute.	.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Flooding within the SPA is difficult to control as it is largely a gravity fed system with few water control structures. The site is therefore largely at the vagaries of climatic and river conditions. Consequently factors in the wider River Derwent catchment may have a significant influence on conditions within the SPA. Proactive water level management is only possible on Wheldrake Ings and to a lesser extent North Duffield Carrs. At Wheldake Ings water is allowed to gradually drain from the site in accordance with agreed protocols. Further information form Natural England on request.	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Water area**	Maintain the number of large waterbodies of optimal size (typically >10 ha).	This feature depends on the presence and continuity of open water habitat; often requiring water bodies of a particular size to in order to successfully feed and roost. Changes in water area, and associated marginal habitat, can adversely affect the suitability of supporting open water habitat. Permanent large waterbodies are largely absent from the site. Birds historically being associated with the large expanse of open water provided by the flooded meadows and grasslands during the winter months. Flooding within the SPA is difficult to control as it is largely a gravity fed system with few water control structures. The site is therefore largely at the vagaries of climatic and river conditions. Consequently factors in the wider River Derwent catchment may have a significant influence on conditions within the SPA.	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Water depth**	Maintain the availability of standing water of <1 m deep, over at least 50% of the total standing water area.	This feature is known to require extensive areas of water in which to feed. Birds are visual predators, with some having the ability to dive or to feed from the surface. As they will rely on detecting their prey within the water to hunt, the depth of water at critical times of year may be paramount for successful feeding and therefore their fitness and survival. Permanent large waterbodies are largely absent from the site. Birds historically associated with the large expanse of open water provided by the flooded meadows and grasslands during the winter months.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Flooding within the SPA is difficult to control as it is largely a gravity fed system with few water control structures. The site is therefore largely at the vagaries of climatic and river conditions. Consequently factors in the wider River Derwent catchment may have a significant influence on conditions within the SPA.	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Water quality/quantity**	Where the supporting habitats of the SPA feature are dependent on surface water ensure water quality and quantity is maintained and restored to a standard which provides the necessary conditions to support the feature.	For many SPA features which are dependent on wetland habitats supported by surface water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year during key stages of their life cycle. Poor water quality and inadequate quantities of water can adversely affect the availability and suitability of breeding, rearing, feeding and roosting habitats. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the SPA Conservation Objectives but in some cases more stringent standards may be needed to support the SPA feature. Further site-specific investigations may be required to establish appropriate standards for the SPA. Flooding within the SPA is difficult to control as it is largely a gravity fed system with few water control structures. The site is therefore largely at the vagaries of climatic and river conditions. Consequently factors in the wider River Derwent catchment may have a significant influence on conditions within the SPA. Reference should be made to water quality targets provided in the River Derwent Conservation Objectives: Supplementary Advice and referenced in the River Derwent SSSI and Pocklington Canal SSSI Diffuse Water Pollution Plan (DWP) Natural England and Environment Agency 2014).	European Site Conservation Objectives: Supplementary Advice on Conserving and Restoring Site Features River Derwent Special Area of Conservation (SAC) Site Code: UK0030253 http://publications.naturalengland.org.uk/publication/4824082210095104 NATURAL ENGLAND & THE ENVIRONMENT AGENCY 2014. Diffuse Water Pollution Plan for River Derwent SSSI and Pocklington Canal SSSI.
Supporting habitat (both within and outside the SPA): minimising disturbance	**Minimising disturbance caused by human activity**	Restrict the frequency, duration and/or intensity of disturbance within close proximity or affecting historic roosting, foraging, feeding, moulting and/or loafing sites so that the feature is not significantly	The nature, scale, timing and duration of some human activities can result in the disturbance of birds at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, and desertion of supporting habitat (both within or outside the	Natural England (2014) Site Improvement Plan: Lower Derwent Valley (SIP058). http://publications.naturalengland.org.uk/publication/5916047525806080

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		disturbed should birds return.	designated site boundary where appropriate). This may undermine successful feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, presence of people, animals and structures. The Lower Derwent Valley Site Improvement Plan highlights that public access along public and non-public rights of way (particularly flood banks) is causing increasing disturbance to birds. It is thought that much of this originates from adjacent villages as opposed to visitors from further afield. Seasonal flooding can restrict some access by recreational users on foot however it can increase other activities e.g. canoeing and kite surfing.	
Supporting habitat (both within and outside the SPA): structure	**Landscape**	Maintain open and unobstructed terrain within and around roosting and feeding areas, with no overall decrease in field sizes	This feature is known to favour large areas of open terrain, largely free of obstructions, in and around its roosting and feeding areas. Often there is a need to maintain an unobstructed line of sight within feeding and roosting habitat to detect approaching predators, or to ensure visibility of displaying behaviour. An open landscape may also be required to facilitate movement of birds between the SPA and any off-site supporting habitat. Planning proposals coming forward will need to take into account these landscape requirements. Supplementary Planning Guidance has been produced by the East Riding of Yorkshire Council in collaboration with other Local Authorities in relation to the Lower Derwent Valley (ERYC 2017).	East Riding of Yorkshire Council (2017) Lower Derwent Valley Supplementary Planning Document. https://www.eastriding.gov.uk/environment/planning-and-building-control/planning-policy/supplementary-planning-documents/
Supporting habitat (both within and outside the SPA): structure	**Vegetation characteristics**	Maintain The extent and distribution of predominantly short (<10 cm) grassland swards in areas used for feeding	The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enable successful foraging. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			In order to provide appropriate habitat for Bewick's Swan it is essential that the historic, traditional management of the ings meadows be continued. This should include the taking of an annual hay crop with aftermath grazing resulting in a relative short sward at the start of the winter period.	
Version Control Advice last updated: **21 March 2019** following stakeholder feedback. Additional information added to explanatory notes for **Hydrology/ flow, water depth, water quality/ quantity** and **Water area** attributes highlighting how factors within wider Derwent basin may affect the SPA. Clarification in explanatory notes for **Minimising disturbance caused by human activity** attribute around impacts on seasonal flooding on recreational use of the SPA.				
Variations from national feature-framework of integrity-guidance: Removal of **food availability requirements** attribute as considered not relevant to habitats present.				

Table 2: Supplementary Advice for Qualifying Features: A050. *Anas penelope*; Eurasian wigeon (Non-breeding)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Non-breeding population	**Population abundance**	Maintain the size of the non-breeding population at a level which is above **7790 individuals** (population at time of designation (English Nature 1993), whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	See general explanatory notes for this attribute in Table 1. The Departmental Brief at the time of SPA classification quoted a 5 year mean of 7790 representing 3% of the United Kingdom population and 1% of the north-west European population. Since is classification as a SPA numbers have steadily increased with the five year (2012-17) peak mean being 11,770 (Frost *et al.* 2018).	English Nature (1993): Departmental Brief, Lower Derwent Valley Proposed Special Protection Area and Ramsar Site 628A Frost, T.M., Austin, G.E., Calbrade, N.A., Mellan, H.J., Hearn, R.D., Stroud, D.A., Wotton, S.R. and Balmer, D.E. 2018. Waterbirds in the UK 2016/17: The Wetland Bird Survey. BTO/RSPB/JNCC. Thetford.
Supporting habitat (both within and outside the SPA): extent and distribution	**Extent and distribution of supporting non-breeding habitat**	Maintain the extent and distribution of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) Estimated extent of communities based upon JNCC standard Natura 2000 Data form: Wet grassland (which will be partially inundated during winter months) c.709ha Inland water bodies (Standing/Running water) c. 109ha Fens & associated habitats c.262ha	Conserving or restoring the extent of supporting habitats and their range will be key to maintaining the site's ability and capacity to support the SPA population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending to the nature, age and accuracy of data collection. This target may apply to supporting habitat which also lies outside the site boundary. Wigeon are widely distributed across the site during the winter months. Goodall (2005) suggests that bird distribution correlates with the extent of flooding with certain ings becoming more important in dryer years e.g. Bank Island. Extent areas are estimates made at the time the Natura 2000 data form was being complied in the late 1990s. Although more detailed NVC surveys exist for the parts of the SPA these do not cover areas within the River Derwent SSSI. Consequently Natura 2000 data form data http://jncc.defra.gov.uk/pdf/SPA/UK9006092.pdf should be used until more detailed information is available.	Goodall, A. (2005): Review of the Importance of the Lower Derwent valley for Birds (Ecological services Ltd) - A report the Environment Agency.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting habitat (both within and outside the SPA): function/ supporting process	**Air quality**	Maintain concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	See explanatory text for this attribute in Table 1.	More information about site-relevant Critical Loads and Levels for this SPA is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk).
Supporting habitat (both within and outside the SPA): function/ supporting process	**Connectivity with supporting habitats**	Maintain the availability of grasslands in close proximity (typically <50 m) to open water bodies.	The ability of the feature to safely and successfully move to and from feeding and roosting areas is critical to their breeding success and to the adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant.	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Connectivity with supporting habitats**	Maintain the safe passage of birds moving between roosting and feeding areas	The ability of the feature to safely and successfully move to and from feeding and roosting areas is critical to their breeding success and to the adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant.	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Conservation measures**	Maintain management or other measures (whether within and/or outside the site boundary as appropriate) necessary to the structure, function and/or the supporting processes associated with the feature and its supporting habitats.	Active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Further details about the necessary conservation measures for this site will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans including River Restoration Plan (Royal Haskoning 2010), the Views about Management Statement for the underpinning SSSI and/or management agreements. Conservation measures and management for this feature will	Natural England "Views about Management" can be found at http://www.sssi.naturalengland.org.uk/Special/sssi/vam/VAM%201002114.pdf Additional information relating to the management of the site can be found within; Chalk, L. Leighton, E. & Bentley, M on behalf of Lower Derwent Valley Project Partners (2005). The Sustainable Management of the Lower Derwent Valley,

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			typically include hay cutting and grazing, scrub management, weed control and recreational access/vegetation management. Also covered is maintenance of surface drainage features such as grips gutters and foot drains. Retention of suitable land use infrastructure patterns to enable site management e.g. pastoral livestock farming.	Yorkshire. Lower Derwent Valley Management Plan 2005-2010 (*available from Natural England on request*). Natural England NNR Management Plan (in prep.) available from Natural England on request.
Supporting habitat (both within and outside the SPA): function/ supporting process	**Food availability within supporting habitat**	Maintain high cover/abundance of preferred food plants (e.g. *Polygonum, Eleocharis, Rumex, Ranunculus*).	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population.	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Food availability within supporting habitat**	Maintain the cover/abundance of preferred food plants (e.g. *Agrostis stolonifera*).	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population.	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Water depth**	Maintain the availability of standing water of optimal depth, typically <0.3 m deep, over at least 50% of the total standing water area.	This feature is known to require extensive areas of water in which to feed. Birds are visual predators, with some having the ability to dive or to feed from the surface. As they will rely on detecting their prey within the water to hunt, the depth of water at critical times of year may be paramount for successful feeding and therefore their fitness and survival. Deep water surrounding nesting sites may also be important to deterring predators. Permanent large waterbodies are largely absent from the site. Birds historically associated with the large expanse of open water provided by the flooded meadows and grasslands. The largest permanent waterbody is associated with Wheldrake Ings.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Flooding within the SPA is difficult to control as it is largely a gravity fed system with few water control structures. The site is therefore largely at the vagaries of climatic and river conditions. Consequently factors in the wider River Derwent catchment may have a significant influence on conditions within the SPA.	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Water quality/ quantity**	Where the supporting habitats of the SPA feature are dependent on surface water ensure water quality and quantity is maintained to a standard which provides the necessary conditions to support the feature.	For many SPA features which are dependent on wetland habitats supported by surface water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year during key stages of their life cycle. Poor water quality and inadequate quantities of water can adversely affect the availability and suitability of breeding, rearing, feeding and roosting habitats. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the SPA Conservation Objectives but in some cases more stringent standards may be needed to support the SPA feature. Further site-specific investigations may be required to establish appropriate standards for the SPA. Flooding within the SPA is difficult to control as it is largely a gravity fed system with few water control structures. The site is therefore largely at the vagaries of climatic and river conditions. Consequently factors in the wider River Derwent catchment may have a significant influence on conditions within the SPA. Reference should be made to water quality targets provided in the River Derwent Conservation Objectives: Supplementary Advice and referenced in the River Derwent SSSI and Pocklington Canal SSSI Diffuse Water Pollution Plan (DWP) Natural England and Environment Agency 2014).	European Site Conservation Objectives: Supplementary Advice on Conserving and Restoring Site Features River Derwent Special Area of Conservation (SAC) Site Code: UK0030253 http://publications.naturalengland.org.uk/publication/4824082210095104 NATURAL ENGLAND & THE ENVIRONMENT AGENCY 2014. Diffuse Water Pollution Plan for River Derwent SSSI and Pocklington Canal SSSI.
Supporting habitat (both within and outside the SPA): minimising disturbance	**Minimising disturbance caused by human activity**	Reduce the frequency, duration and/or intensity of disturbance affecting, roosting, foraging, feeding, birds so that the feature is not significantly disturbed	The nature, scale, timing and duration of some human activities can result in the disturbance of birds at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat	Natural England (2014) Site Improvement Plan: Lower Derwent Valley (SIP058). http://publications.naturalengland.org.uk/publication/5916047525806080

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			(both within or outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, and presence of people, animals and structures. The Lower Derwent Valley Site Improvement Plan highlights that recreational activities, public access along public and non-public rights of way (particularly flood banks) is causing increasing disturbance to birds. It is thought that much of this originates from adjacent villages as opposed to visitors from further afield. Seasonal flooding can restrict some access by recreational users on foot however it can increase other activities e.g. canoeing and kite surfing.	
Supporting habitat (both within and outside the SPA): structure	**Landscape**	Maintain open and unobstructed terrain within and around feeding and roosting areas.	This feature is known to favour large areas of open terrain, largely free of obstructions, in and around its roosting and feeding areas. Often there is a need to maintain an unobstructed line of sight within feeding and roosting habitat to detect approaching predators, or to ensure visibility of displaying behaviour. An open landscape may also be required to facilitate movement of birds between the SPA and any off-site supporting habitat. Planning proposals coming forward will need to take into account these landscape requirements. Supplementary Planning Guidance has been produced by the East Riding of Yorkshire Council in collaboration with other Local Authorities in relation to the Lower Derwent Valley (ERYC 2017).	East Riding of Yorkshire Council (2017) Lower Derwent Valley Supplementary Planning Document. https://www.eastriding.gov.uk/environment/planning-and-building-control/planning-policy/supplementary-planning-documents/
Supporting habitat (both within and outside the SPA): structure	**Vegetation characteristics**	Maintain the extent and distribution of predominantly short (<5 cm) swards in areas used for feeding.	The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enable successful nesting/ rearing/ concealment/ roosting. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			modify these characteristics may adversely affect the feature. In order to provide appropriate habitat for wigeon it is essential that the historic, traditional management of the ings meadows be continued. This should include the taking of an annual hay crop with aftermath grazing resulting in a relative short sward at the start of the winter period. Short grassland on River Derwent flood banks is also important.	
Version Control Advice last updated: **21 March 2019** following stakeholder feedback. Additional information added to explanatory notes for **Water depth** and **water quality/ quantity** attributes highlighting how factors within wider Derwent basin may affect the SPA. Clarification in explanatory notes for **Minimising disturbance caused by human activity** attribute around impacts on seasonal flooding on recreational use of the SPA.				
Variations from national feature-framework of integrity-guidance: Removal of **habitat references** attribute as not present within site and reference to **breeding populations.**				

Table 3: Supplementary Advice for Qualifying Features: A052. *Anas crecca*; Eurasian teal (Non-breeding)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting habitat (both within and outside the SPA): extent and distribution	**Extent and distribution of supporting non-breeding habitat**	Maintain the extent and distribution of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, and feeding). Estimated extent of habitats based upon JNCC standard Natura 2000 Data form: Wet grassland (which will be partially inundated during winter months) c.709ha Inland water bodies (Standing/Running water) c. 109ha Fens & associated habitats c.262ha	Conserving or restoring the extent of supporting habitats and their range will be key to maintaining the site's ability and capacity to support the SPA population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending to the nature, age and accuracy of data collection. This target may apply to supporting habitat which also lies outside the site boundary As with wigeon, birds are widely distributed across the site where they feed amongst vegetation such as reed canary grass. It has been suggested by Goodall (2005) that Melbourne and Thornton Ings, Ellerton Ings and Bubwith Ings are particularly important, where shallow flooding and dense stands of emergent vegetation provide ideal wintering conditions.	Goodall (2005): review of the Importance of the Lower Derwent Valley for Birds (Ecological services Ltd) - A report to the Environment Agency.
Supporting habitat (both within and outside the SPA): function/ supporting process	**Water quality/ quantity**	Where the supporting habitats of the SPA feature are dependent on surface water ensure water quality and quantity is maintained to a standard which provides the necessary conditions to support the feature	For many SPA features which are dependent on wetland habitats supported by surface water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year during key stages of their life cycle. Poor water quality and inadequate quantities of water can adversely affect the availability and suitability of breeding, rearing, feeding and roosting habitats. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the SPA Conservation Objectives but in some cases more stringent standards may be needed to support the SPA feature. Further site-specific investigations may be required to establish appropriate standards for the SPA.	European Site Conservation Objectives: Supplementary Advice on Conserving and Restoring Site Features River Derwent Special Area of Conservation (SAC) Site Code: UK0030253 http://publications.naturalengland.org.uk/publication/4824082210095104 NATURAL ENGLAND & THE ENVIRONMENT AGENCY 2014. Diffuse Water Pollution Plan for

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Flooding within the SPA is difficult to control as it is largely a gravity fed system with few water control structures. The site is therefore largely at the vagaries of climatic and river conditions. Consequently factors in the wider River Derwent catchment may have a significant influence on conditions within the SPA. Reference should be made to water quality targets provided in the River Derwent Conservation Objectives: Supplementary Advice and referenced in the River Derwent SSSI and Pocklington Canal SSSI Diffuse Water Pollution Plan (DWP) Natural England and Environment Agency 2014).	River Derwent SSSI and Pocklington Canal SSSI.
Supporting habitat (both within and outside the SPA): function/ supporting process	**Conservation measures**	Maintain management or other measures (whether within and/or outside the site boundary as appropriate) necessary to Maintain the structure, function and/or the supporting processes associated with the feature and its supporting habitats.	Active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Conservation measures and management for this feature will typically include hay cutting and grazing, scrub management, weed control and recreational access/vegetation management. Also covered is maintenance of surface drainage features such as grips gutters and foot drains. Retention of suitable land use infrastructure patterns to enable site management e.g. pastoral livestock farming. Further details about the necessary conservation measures for this site will can be found within, where applicable, supporting documents such as Lower Derwent Valley Natura 2000 Site Improvement Plan, and Lower Derwent Valley Management Plan 2005-2010. NNR Plan reference. Considerable areas of the site are managed under agri-environment scheme agreement between Natural England and individual private owners.	NATURAL ENGLAND (2014), Site Improvement Plan: Lower Derwent Valley (SIP058) Natural England “Views about Management” can be found at http://www.sssi.naturalengland.org.uk/Special/sssi/vam/VAM%201002114.pdf Additional information relating to the management of the site can be found within; Chalk, L. Leighton, E. & Bentley, M on behalf of Lower Derwent Valley Project Partners (2005). The Sustainable Management of the Lower Derwent Valley, Yorkshire. Lower Derwent Valley Management Plan 2005-2010 (*Available from Natural England on request*). Natural England NNR Management Plan (in prep.)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting habitat (both within and outside the SPA): function/ supporting process	Air quality	Maintain concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	See explanatory notes for this attribute in Table 1.	More information about site-relevant Critical Loads and Levels for this SPA is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk).
Non-breeding population	**Population abundance**	Maintain the size of the non-breeding population at a level which is above **4040 individuals** (population at time of designation English Nature 1993) whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	See general explanatory notes for this attribute in Table 1. **Teal** The Departmental Brief at the time of SPA classification quoted a 5 year mean of 4040, representing 1% of the north-west European population. The peak figure of 5,700 during this period quoted in Departmental Brief occurring in 1990/91. Since is classification as a SPA numbers have increased with the five year (2012-17) peak mean being 7459 and a peak count of 10,000 in 2016/17 (Frost *et al.* 2018).	English Nature (1993): Departmental Brief, Lower Derwent Valley Proposed Special Protection Area and Ramsar Site 628A Frost, T.M., Austin, G.E., Calbrade, N.A., Mellan, H.J., Hearn, R.D., Stroud, D.A., Wotton, S.R. and Balmer, D.E. 2018. Waterbirds in the UK 2016/17: The Wetland Bird Survey. BTO/RSPB/JNCC. Thetford.
Supporting habitat (both within and outside the SPA): minimising disturbance	**Minimising disturbance caused by human activity**	Reduce the frequency, duration and/or intensity of disturbance affecting, roosting, foraging, feeding, birds so that the feature is not significantly disturbed	The nature, scale, timing and duration of some human activities can result in the disturbance of birds at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, and presence of people, animals and structures.	Natural England (2014) Site Improvement Plan: Lower Derwent Valley (SIP058). http://publications.naturalengland.org.uk/publication/5916047525806080

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			The Lower Derwent Valley Site Improvement Plan highlights that recreational activities, public access along public and non-public rights of way (particularly flood banks) is causing increasing disturbance to birds. It is thought that much of this originates from adjacent villages as opposed to visitors from further afield. Seasonal flooding can restrict some access by recreational users on foot however it can increase other activities e.g. canoeing and kite surfing.	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Water depth**	Maintain the availability of standing water of optimal depth, typically <0.1 m deep, over at least 50% of the total standing water area.	This feature is known to require extensive areas of water in which to feed. Birds are visual predators, with some having the ability to dive or to feed from the surface. As they will rely on detecting their prey within the water to hunt, the depth of water at critical times of year may be paramount for successful feeding and therefore their fitness and survival. Deep water surrounding nesting sites may also be important to deterring predators. Permanent large waterbodies are largely absent from the site. Birds historically associated with the large expanse of open, shallow water provided by the flooded meadows and grasslands during the winter months. Flooding within the SPA is difficult to control as it is largely a gravity fed system with few water control structures. The site is therefore largely at the vagaries of climatic and river conditions. Consequently factors in the wider River Derwent catchment may have a significant influence on conditions within the SPA.	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Connectivity with supporting habitats**	Maintain the safe passage of birds moving between roosting and feeding areas	The ability of the feature to safely and successfully move to and from feeding and roosting areas is critical to their breeding success and to the adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant.	
Supporting habitat (both within and outside the SPA):	**Food availability within supporting habitat**	Maintain the availability of cereal grains, where these sources are locally important to feeding flocks.	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
function/ supporting process			may adversely affect the population.	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Food availability within supporting habitat**	Maintain the cover/abundance of preferred food plants (e.g. *Polygonum, Eleocharis, Rumex, Ranunculus*).	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population.	
Version Control Advice last updated: **21 March 2019** following stakeholder feedback. Additional information added to explanatory notes for **Water depth** and **water quality/ quantity** attributes highlighting how factors within wider Derwent basin may affect the SPA. Clarification in explanatory notes for **Minimising disturbance caused by human activity** attribute around impacts on seasonal flooding on recreational use of the SPA.				
Variations from national feature-framework of integrity-guidance: Removal of some **food availability** attributes considered not relevant to site.				

Table 4: Supplementary Advice for Qualifying Features: A056. *Anas clypeata*; Northern Shoveler (Breeding)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Breeding population	**Population abundance**	Maintain the size of the breeding population at a level which is above **50 pairs** (English nature 1993), whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	See general text in explanatory notes for this attribute in Table 1. **Northern Shoveler** The Departmental Brief at the time of SPA classification 1993 quoted a mean figure of 50 pairs for the 1981-1990 period, which at the time represented 3% of breeding British population. There is little information available as to the natural fluctuations in breeding numbers from this time. The population however appears to have remained stable over this period and the latest 5 year mean (2012-17) was 47 breeding pairs (confirmed and probable) Ralston 2013-17).	English Nature (1993): Departmental Brief, Lower Derwent Valley Proposed Special Protection Area and Ramsar Site 628A Ralston, C. (2012-2017) Rare Breeding Bird Panel Records Natural England files Tate, D. (2009-2014) Breeding Bird surveys of Lower Derwent Valley conducted 2009-2014
Supporting habitat (both within and outside the SPA): extent and distribution	**Extent and distribution of supporting breeding habitat**	Maintain the extent, distribution and availability of suitable breeding habitat which supports the feature for all necessary stages of its breeding cycle (courtship, nesting, feeding): Estimated extent of habitats within SPA based upon JNCC standard Natura 2000 Data form: Wet grassland (which will be partially inundated during winter months) c.709ha Inland water bodies (Standing/Running water) c. 109ha Fens & associated habitats c.262ha	Conserving or restoring the extent of supporting habitats and their range will be key to maintaining the site's ability and capacity to support the SPA population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending to the nature, age and accuracy of data collection. This target will apply to any supporting habitat which is known to occur outside the site boundary. Breeding birds are found on “wetter” ings, with Wheldrake Ings and North Duffield Carrs being key sites. Here the extensive network of ditches and pools associated with “marshy grassland provides ideal habitat.	
Supporting habitat (both within and outside	**Air quality**	Maintain concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values	See explanatory notes for this attribute in Table 1.	More information about site-relevant Critical Loads and Levels for this SPA is available by using the ‘search by site’ tool on the Air

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
the SPA): function/ supporting process		given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).		Pollution Information System (www.apis.ac.uk).
Supporting habitat (both within and outside the SPA): function/ supporting process	**Conservation measures**	Maintain management or other measures (whether within and/or outside the site boundary as appropriate) necessary to Maintain the structure, function and/or the supporting processes associated with the feature and its supporting habitats.	Active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Conservation measures and management for this feature will typically include hay cutting and grazing, scrub management, weed control and recreational access/vegetation management. Also covered is maintenance of surface drainage features such as grips gutters and foot drains. Retention of suitable land use infrastructure patterns to enable site management e.g. pastoral livestock farming. Further details about the necessary conservation measures for this site will can be found within, where applicable, supporting documents such as Lower Derwent Valley Natura 2000 Site Improvement Plan, and Lower Derwent Valley Management Plan 2005-2010. NNR Plan reference. Considerable areas of the site are managed under agri-environment scheme agreement between Natural England and individual private owners.	NATURAL ENGLAND (2014), Site Improvement Plan: Lower Derwent Valley (SIP058) Natural England "Views about Management" can be found at http://www.sssi.naturalengland.org.uk/Special/sssi/vam/VAM%201002114.pdf Additional information relating to the management of the site can be found within; Chalk, L. Leighton, E. & Bentley, M on behalf of Lower Derwent Valley Project Partners (2005). The Sustainable Management of the Lower Derwent Valley, Yorkshire. Lower Derwent Valley Management Plan 2005-2010 (*Available from Natural England on request*). Natural England NNR Management Plan (in prep.)
Supporting habitat (both within and outside the SPA): function/ supporting process	**Food availability within supporting habitat**	Maintain the distribution, abundance and availability of key prey items (e.g. hatching midges) at preferred prey sizes.	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting habitat (both within and outside the SPA): function/ supporting process	**Food availability within supporting habitat**	Maintain high cover/abundance of preferred food plants (e.g. *Scirpus, Eleocharis, Carex, Potamogeton, Glyceria*, surface plankton).	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population.	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Food availability within supporting habitat**	Maintain the distribution, abundance and availability of key prey items (e.g. *Hydrobia, crustaceans, caddisflies, diptera, beetles*) at preferred prey sizes.	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population.	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Hydrology/ flow**	Maintain water availability in feeding sites to provide shallow surface water and damp field conditions.	Changes in source, depth, duration, frequency, magnitude and timing of water supply or flow can have important implications for this feature. Such changes may affect the quality and suitability of habitats used by birds for nesting, drinking, preening, rearing, feeding or roosting. Unless these have already been undertaken, further site-specific investigations may be required to fully inform conservation measures for this feature and/or the likelihood of impacts on this attribute. Flooding within the SPA is difficult to control as it is largely a gravity fed system with few water control structures. The site is therefore largely at the vagaries of climatic and river conditions. Consequently factors in the wider River Derwent catchment may have a significant influence on conditions within the SPA. Proactive water level management is only possible on Wheldrake Ings and to a lesser extent North Duffield Carrs. At Wheldrake Ings water is allowed to gradually drain from the site in accordance with agreed protocols. Further information from Natural England on request.	
Supporting habitat (both within and outside	**Hydrology/ flow**	Maintain the hydrology of a waterbody used as a feeding site such that water levels reduce (or are reduced) from	Changes in source, depth, duration, frequency, magnitude and timing of water supply or flow can have important implications for this feature. Such changes may affect the quality and suitability of habitats used by birds for nesting, drinking,	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
the SPA): function/ supporting process		the time of mean hatch date to the end of the breeding season.	preening, rearing, feeding or roosting. Unless these have already been undertaken, further site-specific investigations may be required to fully inform conservation measures for this feature and/or the likelihood of impacts on this attribute. Flooding within the SPA is difficult to control as it is largely a gravity fed system with few water control structures. The site is therefore largely at the vagaries of climatic and river conditions. Consequently factors in the wider River Derwent catchment may have a significant influence on conditions within the SPA. Proactive water level management is only possible on Wheldrake Ings and to a lesser extent North Duffield Carrs. At Wheldrake Ings water is allowed to gradually drain from the site in accordance with agreed protocols. Further information from Natural England on request.	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Water depth**	Maintain the availability of standing water at optimal depth, typically <0.3 m deep, over at least 50% of the total standing water area.	This feature is known to require extensive areas of water in which to feed. Birds are visual predators, with some having the ability to dive or to feed from the surface. As they will rely on detecting their prey within the water to hunt, the depth of water at critical times of year may be paramount for successful feeding and therefore their fitness and survival. Deep water surrounding nesting sites may also be important to deterring predators. Flooding within the SPA is difficult to control as it is largely a gravity fed system with few water control structures. The site is therefore largely at the vagaries of climatic and river conditions. Consequently factors in the wider River Derwent catchment may have a significant influence on conditions within the SPA. Permanent large waterbodies are largely absent from the site, with Wheldrake Ings providing the largest single expanse of permanent water.	
Supporting habitat (both within and outside the SPA): function/ supporting	**Water quality/ quantity**	Where the supporting habitats of the SPA feature are dependent on surface water, maintain water quality and quantity at a standard which provides the necessary conditions to support the feature	For many SPA features which are dependent on wetland habitats supported by surface water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year during key stages of their life cycle. Poor water quality and inadequate quantities of water can adversely affect the availability and suitability of breeding, rearing, feeding and roosting habitats.	European Site Conservation Objectives: Supplementary Advice on Conserving and Restoring Site Features River Derwent Special Area of Conservation (SAC)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
process			Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the SPA Conservation Objectives but in some cases more stringent standards may be needed to support the SPA feature. Further site-specific investigations may be required to establish appropriate standards for the SPA. Flooding within the SPA is difficult to control as it is largely a gravity fed system with few water control structures. The site is therefore largely at the vagaries of climatic and river conditions. Consequently factors in the wider River Derwent catchment may have a significant influence on conditions within the SPA. Reference should be made to water quality targets provided in the River Derwent Conservation Objectives: Supplementary Advice and referenced in the River Derwent SSSI and Pocklington Canal SSSI Diffuse Water Pollution Plan (DWP) Natural England and Environment Agency 2014).	Site Code: UK0030253 http://publications.naturalengland.org.uk/publication/4824082210095104 NATURAL ENGLAND & THE ENVIRONMENT AGENCY 2014. Diffuse Water Pollution Plan for River Derwent SSSI and Pocklington Canal SSSI.
Supporting habitat (both within and outside the SPA): minimising disturbance	**Minimising disturbance caused by human activity**	Restrict the frequency, duration and/or intensity of disturbance affecting nesting, roosting, foraging, feeding, birds so that the feature is not significantly disturbed	The nature, scale, timing and duration of some human activities can result in the disturbance of birds at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, and presence of people, animals and structures. The Lower Derwent Valley Site Improvement Plan highlights that recreational activities, public access along public and non-public rights of way (particularly flood banks) is causing	Natural England (2014) Site Improvement Plan: Lower Derwent Valley (SIP058). http://publications.naturalengland.org.uk/publication/5916047525806080

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			increasing disturbance to birds. It is thought that much of this originates from adjacent villages as opposed to visitors from further afield. Seasonal flooding can restrict some access by recreational users on foot however it can increase other activities e.g. canoeing and kite surfing.	
Supporting habitat (both within and outside the SPA): predation	**Predation**	Reduce predation and disturbance caused by native and non-native predators.	This will ensure that breeding productivity (number of chicks per pair) and survival are sustained at rates that maintain or restore the abundance of the feature. Impacts to breeding productivity can result directly from predation of eggs, chicks, juveniles and adults, and also from significant disturbance. The presence of predators can influence bird behaviours, such as abandonment of nest sites or reduction of effective feeding. Where evidence suggests predator management is required, measures can include their exclusion through fencing and scaring or by direct control. Any such measures must consider the legal protection of some predators, as well as the likely effects of such control on other qualifying features. A review of the effect of predation on breeding waders was undertaken by Tate (2017)	Tate, D, D. Tect (2017) A Review of the Breeding Waders in the Lower Derwent Valley
Supporting habitat (both within and outside the SPA): structure	**Vegetation characteristics**	Maintain the overall heights of vegetation patches (20-60 cm) within nesting areas.	The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enable successful nesting/ rearing/ concealment/ roosting. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature. In order to provide appropriate habitat for shoveler it is essential that the historic, traditional management of the ings meadows be continued. This should include the taking of an annual hay crop with aftermath grazing and sympathetic ditch management.	
Version Control Advice last updated: **21 March 2019** following stakeholder feedback. Additional information added to explanatory notes for **Hydrology/ flow, water depth, water quality/ quantity** and **Water area** attributes highlighting how factors within wider Derwent basin may affect the SPA. Clarification in explanatory notes for **Minimising disturbance caused by human activity** attribute around impacts on seasonal flooding on recreational use of the SPA.				
Variations from national feature-framework of integrity-guidance: N/A				

Table 5: Supplementary Advice for Qualifying Features: A140. *Pluvialis apricaria*; European golden plover (Non-breeding)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Non-breeding population	**Population abundance**	Maintain the size of the non-breeding population at a level which is above **4,120 individuals** (population at time of designation - English Nature 1993), whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	See general explanatory notes for this attribute in Table 1. **Golden Plover** The Departmental Brief at the time of SPA classification 1993 quoted a mean figure of 4,120 for the 1986/87-1990/91 period, which at the time represented 2% of British population. Peak mean for this period being 6050. Counts of 4620 (1989), and 3000+ and 4000+ in 1990 were also reported by Ralston (2005). 5 year annual peak counts between 1992/93 (Year of designation) and 1996/97 ranged from to 3000-8900 with 5 year average 5400.	English Nature (1993): Departmental Brief, Lower Derwent Valley Proposed Special Protection Area and Ramsar Site 628A Ralston, C.S. (2005): Birds of the Lower Derwent valley; A historic review 1850-2002 (English Nature)
Supporting habitat (both within and outside the SPA): extent and distribution	**Extent and distribution of supporting non-breeding habitat**	Maintain the extent and distribution of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) Estimated extent of habitats based upon JNCC standard Natura 2000 Data form: Wet grassland (which will be partially inundated during winter months) c.709ha Inland water bodies (Standing/Running water) c. 109ha Fens & associated habitats c.262ha	Conserving or restoring the extent of supporting habitats and their range will be key to maintaining the site's ability and capacity to support the SPA population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending to the nature, age and accuracy of data collection. This target may apply to supporting habitat which also lies outside the site boundary Birds are known use arable land adjacent to the SPA both for roosting and feeding and it is important that these habitats are maintained.	Goodall (2005): review of the Importance of the Lower Derwent Valley for Birds (Ecological services Ltd) - A report to the Environment Agency.
Supporting habitat (both within and outside the SPA):	**Air quality**	Maintain concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site	See explanatory notes for this attribute in Table 1.	More information about site-relevant Critical Loads and Levels for this SPA is available by using the 'search by site' tool on the Air Pollution Information System

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
function/ supporting process		on the Air Pollution Information System (www.apis.ac.uk).		(www.apis.ac.uk).
Supporting habitat (both within and outside the SPA): function/ supporting process	**Connectivity with supporting habitats**	Maintain the safe passage of birds moving between roosting and feeding areas	The ability of the feature to safely and successfully move to and from feeding and roosting areas is critical to their breeding success and to the adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant.	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Conservation measures**	Maintain management or other measures (whether within and/or outside the site boundary as appropriate) necessary to maintain the structure, function and/or the supporting processes associated with the feature and its supporting habitats.	Active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Conservation measures and management for this feature will typically include hay cutting and grazing, scrub management, weed control and recreational access/vegetation management. Also covered is maintenance of surface drainage features such as grips gutters and foot drains. Retention of suitable land use infrastructure patterns to enable site management e.g. pastoral livestock farming. Further details about the necessary conservation measures for this site will can be found within, where applicable, supporting documents such as Lower Derwent Valley Natura 2000 Site Improvement Plan, and Lower Derwent Valley Management Plan 2005-2010 and National Nature Reserve Management Plan. Considerable areas of the site are managed under agri-environment scheme agreement between Natural England and individual private owners.	Natural England (2014), Site Improvement Plan: Lower Derwent Valley (SIP058) Natural England "Views about Management" can be found at http://www.sssi.naturalengland.org.uk/Special/sssi/vam/VAM%201002114.pdf Additional information relating to the management of the site can be found within; Chalk, L. Leighton, E. & Bentley, M on behalf of Lower Derwent Valley Project Partners (2005). The Sustainable Management of the Lower Derwent Valley, Yorkshire. Lower Derwent Valley Management Plan 2005-2010 (*Available from Natural England on request*). Natural England NNR Management Plan (in prep.)
Supporting habitat	**Food availability**	Maintain availability of key prey items (e.g. earthworm,	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
(both within and outside the SPA): function/ supporting process	**within supporting habitat**	leatherjackets, beetles, spiders) at preferred prey sizes.	and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population.	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Hydrology/ flow**	Maintain water availability in feeding sites and Maintain the area of soggy or flooded land overall.	Changes in source, depth, duration, frequency, magnitude and timing of water supply or flow can have important implications for this feature. Such changes may affect the quality and suitability of habitats used by birds for nesting, drinking, preening, rearing, feeding or roosting. Unless these have already been undertaken, further site-specific investigations may be required to fully inform conservation measures for this feature and/or the likelihood of impacts on this attribute. Flooding within the SPA is difficult to control as it is largely a gravity fed system with few water control structures. The site is therefore largely at the vagaries of climatic and river conditions. Consequently factors in the wider River Derwent catchment may have a significant influence on conditions within the SPA. Proactive water level management is only possible on Wheldrake Ings and to a lesser extent North Duffield Carrs. At Wheldrake Ings water is allowed to gradually drain from the site in accordance with agreed protocols. Further information from Natural England on request.	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Water quality/ quantity**	Where the supporting habitats of the SPA feature are dependent on surface water ensure water quality and quantity is maintained to a standard which provides the necessary conditions to support the feature.	For many SPA features which are dependent on wetland habitats supported by surface water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year during key stages of their life cycle. Poor water quality and inadequate quantities of water can adversely affect the availability and suitability of breeding, rearing, feeding and roosting habitats. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the SPA Conservation Objectives but in some cases more stringent standards may be needed to support the SPA feature. Further site-specific investigations may be required to establish	European Site Conservation Objectives: Supplementary Advice on Conserving and Restoring Site Features River Derwent Special Area of Conservation (SAC) Site Code: UK0030253 http://publications.naturalengland.org.uk/publication/4824082210095104 NATURAL ENGLAND & THE ENVIRONMENT AGENCY 2014.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			appropriate standards for the SPA. Flooding within the SPA is difficult to control as it is largely a gravity fed system with few water control structures. The site is therefore largely at the vagaries of climatic and river conditions. Consequently factors in the wider River Derwent catchment may have a significant influence on conditions within the SPA. Reference should be made to water quality targets provided in the River Derwent Conservation Objectives: Supplementary Advice and referenced in the River Derwent SSSI and Pocklington Canal SSSI Diffuse Water Pollution Plan (DWP) Natural England and Environment Agency 2014).	Diffuse Water Pollution Plan for River Derwent SSSI and Pocklington Canal SSSI.
Supporting habitat (both within and outside the SPA): minimising disturbance	**Minimising disturbance caused by human activity**	Restrict the frequency, duration and/or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that the feature is not significantly disturbed	The nature, scale, timing and duration of some human activities can result in the disturbance of birds at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, and presence of people, animals and structures. The Lower Derwent Valley Site Improvement Plan highlights that recreational activities, public access along public and non-public rights of way (particularly flood banks) is causing increasing disturbance to birds. It is thought that much of this originates from adjacent villages as opposed to visitors from further afield. Seasonal flooding can restrict some access by recreational users on foot however it can increase other activities e.g. canoeing and kite surfing.	Natural England (2014) Site Improvement Plan: Lower Derwent Valley (SIP058). http://publications.naturalengland.org.uk/publication/5916047525806080

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting habitat (both within and outside the SPA): structure	**Landscape**	Maintain open and unobstructed terrain within and around, roosting and feeding sites, and no overall reduction in field size.	This feature is known to favour large areas of open terrain, largely free of obstructions, in and around its nesting, roosting and feeding areas. Often there is a need to maintain an unobstructed line of sight within nesting, feeding or roosting habitat to detect approaching predators, or to ensure visibility of displaying behaviour. An open landscape may also be required to facilitate movement of birds between the SPA and any off-site supporting habitat. Surrounding arable farmland will be particularly important for this species. Planning proposals coming forward will need to take into account these landscape requirements. Supplementary Planning Guidance has been produced by the East Riding of Yorkshire Council in collaboration with other Local Authorities in relation to the Lower Derwent Valley (ERYC 2017).	East Riding of Yorkshire Council (2017) Lower Derwent Valley Supplementary Planning Document. https://www.eastriding.gov.uk/environment/planning-and-building-control/planning-policy/supplementary-planning-documents/
Supporting habitat (both within and outside the SPA): structure	**Vegetation characteristics**	Maintain the extent and distribution of predominantly short (<10 cm) grassland swards or adjacent arable fields in areas used for feeding is ed.	The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enable successful nesting/rearing/concealment/roosting. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature. Birds are known use arable land adjacent to the SPA both for roosting and feeding and it is important that these habitats are maintained.	
Supporting habitat (both within and outside the SPA): structure	**Vegetation characteristics**	Maintain the vegetation structure of key roost sites to that dominated by bare ground or a short sparsely-vegetated sward.	The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enable successful nesting/rearing/concealment/roosting. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Birds are known use arable land adjacent to the SPA both for roosting and feeding and it is important that these habitats are maintained.	
Version Control Advice last updated: **21 March 2019** following stakeholder feedback. Additional information added to explanatory notes for **Hydrology/ flow** and **water quality/ quantity** attributes highlighting how factors within wider Derwent basin may affect the SPA. Clarification in explanatory notes for **Minimising disturbance caused by human activity** attribute around impacts on seasonal flooding on recreational use of the SPA.				
Variations from national feature-framework of integrity-guidance: N/A				

Table 6: Supplementary Advice for Qualifying Features: A151. *Philomachus pugnax*; Ruff (Non-breeding)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Non-breeding population	**Population abundance**	Maintain the size of the non-breeding population at a level which is above **50 individuals (wintering)/100 (passage)** [population at time of designation English Nature 1993] which is above whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	See general explanatory notes for this attribute in Table 1 **Ruff** The Departmental Brief at the time of SPA classification 1993 quoted a winter mean figure 50 for the 1986/87-1990/91 period, which at the time represented 3.5% of British population. Peak mean for this period being 86. A figure 100 passage birds is stated on the SPA citation. Five year annual peak winter counts between 1992/93 (Year of designation) and 1996/97 ranged from to 81-189 with 5 year average 122 (Frost *et al.* 2018). Birds are widely distributed across the area being found wherever flooding conditions are suitable. Spring passage of birds from African wintering grounds begins in late February with most movement in March and April (Goodall 2005). Consequently counts from this period may include both wintering and passage birds.	English Nature 1993: Departmental Brief, Lower Derwent Valley Proposed Special Protection Area and Ramsar Site 628A. Goodall (2005): review of the Importance of the Lower Derwent Valley for Birds (Ecological services Ltd) - A report the Environment Agency Frost, T.M., Austin, G.E., Calbrade, N.A., Mellan, H.J., Hearn, R.D., Stroud, D.A., Wotton, S.R. and Balmer, D.E. 2018. Waterbirds in the UK 2016/17: The Wetland Bird Survey. BTO/RSPB/JNCC. Thetford.
Supporting habitat (both within and outside the SPA): extent and distribution	**Extent and distribution of supporting non-breeding habitat**	Maintain the extent and distribution of suitable habitat (either within or outside the site boundary) which supports the feature for all necessary stages of the non-breeding/wintering period (moulting, roosting, loafing, feeding) Wet grassland (which will be partially inundated during winter months) c.709ha Inland water bodies (Standing/Running water) c. 109ha Fens & associated habitats	Conserving or restoring the extent of supporting habitats and their range will be key to maintaining the site's ability and capacity to support the SPA population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending to the nature, age and accuracy of data collection. This target may apply to supporting habitat which also lies outside the site boundary. The Lower Derwent Valley provides a mosaic of habitats; including; periodically flooded wet grassland, fens, marsh and swamp vegetation together with standing and flowing open water. The relative abundance of these communities will vary according to the season however estimated extent of communities based upon JNCC standard Natura 2000 Data form.	Goodall (2005): review of the Importance of the Lower Derwent Valley for Birds (Ecological services Ltd) - A report the Environment Agency

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		c.262ha	Goodall (2005) states that wintering ruff are widely distributed across the site wherever flooding and consequently feeding conditions are suitable. Like golden plover, during cold weather birds will leave the area in preference for coastal areas.	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Air quality**	Maintain concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	See explanatory notes for this attribute in Table 1	More information about site-relevant Critical Loads and Levels for this SPA is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk).
Supporting habitat (both within and outside the SPA): function/ supporting process	**Connectivity with supporting habitats**	Maintain the safe passage of birds moving between roosting and feeding areas	The ability of the feature to safely and successfully move to and from feeding and roosting areas is critical to their breeding success and to the adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant.	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Conservation measures**	Maintain management or other measures (whether within and/or outside the site boundary as appropriate) necessary to the structure, function and/or the supporting processes associated with the feature and its supporting habitats.	Active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Conservation measures and management for this feature will typically include hay cutting and grazing, scrub management, weed control and recreational access/vegetation management. Also covered is maintenance of surface drainage features such as grips gutters and foot drains. Retention of suitable land use infrastructure patterns to enable site management e.g. pastoral livestock farming. Further details about the necessary conservation measures for this site will can be found within, where applicable, supporting documents such as Lower Derwent Valley Natura 2000 Site Improvement Plan, and Lower Derwent Valley Management	NATURAL ENGLAND, 2014. Site Improvement Plan: Lower Derwent Valley (SIP058) Natural England "Views about Management" can be found at http://www.sssi.naturalengland.org.uk/Special/sssi/vam/VAM%201002114.pdf Additional information relating to the management of the site can be found within; Chalk, L. Leighton, E. & Bentley, M on behalf of Lower Derwent Valley Project Partners (2005). The Sustainable Management of

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Plan 2005-2010 and National Nature Reserve Management Plan. Considerable areas of the site are managed under agri-environment scheme agreement between Natural England and individual private owners.	the Lower Derwent Valley, Yorkshire. Lower Derwent Valley Management Plan 2005-2010 (*Available from Natural England on request*). Natural England NNR Management Plan (in prep.)
Supporting habitat (both within and outside the SPA): function/ supporting process	**Food availability within supporting habitat**	Maintain availability of key prey species (e.g. dipteran flies, beetles, earthworms) at preferred prey sizes.	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population.	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Food availability within supporting habitat**	Maintain the availability of key prey species (e.g. Caddis flies, crustaceans, molluscs and worms) of preferred prey sizes.	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population.	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Water depth**	Maintain the availability of water at optimal depths, typically 1-3 cm deep, over at least 50% of the total water area.	This feature is known to require extensive areas of water in which to feed. Birds are visual predators, with some having the ability to dive or to feed from the surface. As they will rely on detecting their prey within the water to hunt, the depth of water at critical times of year may be paramount for successful feeding and therefore their fitness and survival. Deep water surrounding nesting sites may also be important to deterring predators. Flooding within the SPA is difficult to control as it is largely a gravity fed system with few water control structures. The site is therefore largely at the vagaries of climatic and river conditions. Consequently factors in the wider River Derwent catchment may have a significant influence on conditions within the SPA. Proactive water level management is only possible on	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Wheldrake Ings and to a lesser extent North Duffield Carrs. At Wheldrake Ings water is allowed to gradually drain from the site in accordance with agreed protocols. Further information from Natural England on request.	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Water quality/ quantity**	Where the supporting habitats of the SPA feature are dependent on surface water ensure water quality and quantity is maintained to a standard which provides the necessary conditions to support the feature.	For many SPA features which are dependent on wetland habitats supported by surface water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year during key stages of their life cycle. Poor water quality and inadequate quantities of water can adversely affect the availability and suitability of breeding, rearing, feeding and roosting habitats. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the SPA Conservation Objectives but in some cases more stringent standards may be needed to support the SPA feature. Further site-specific investigations may be required to establish appropriate standards for the SPA. Flooding within the SPA is difficult to control as it is largely a gravity fed system with few water control structures. The site is therefore largely at the vagaries of climatic and river conditions. Consequently factors in the Wider River Derwent Catchments may have a significant influence on conditions within the SPA. Reference should be made to water quality targets provided in the River Derwent SAC Conservation Objectives supplementary advice and referenced in the River Derwent SSSI and Pocklington Canal SSSI Diffuse Water Pollution Plan (DWP) Natural England and Environment Agency 2014).	European Site Conservation Objectives: Supplementary Advice on Conserving and Restoring Site Features River Derwent Special Area of Conservation (SAC) Site Code: UK0030253 http://publications.naturalengland.org.uk/publication/4824082210095104 NATURAL ENGLAND & THE ENVIRONMENT AGENCY 2014. Diffuse Water Pollution Plan for River Derwent SSSI and Pocklington Canal SSSI.
Supporting habitat (both within and outside the SPA): minimising disturbance	**Minimising disturbance caused by human activity**	Restrict the frequency, duration and/or intensity of disturbance affecting roosting, foraging, feeding, moulting and/or loafing birds so that the feature is not significantly disturbed	The nature, scale, timing and duration of some human activities can result in the disturbance of birds at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful feeding and/or roosting, and/or may	Natural England (2014) Site Improvement Plan: Lower Derwent Valley (SIP058). http://publications.naturalengland.org.uk/publication/5916047525806080

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, and presence of people, animals and structures. Recreational disturbance is thought to be an issue. Although seasonal flooding can restrict some access by recreational users on foot it can increase other activities e.g. canoeing and kite surfing. Walking (particularly with dogs) along footpaths associated with river flood banks and on ings meadows can also result in disturbance. It is thought that much of this originates from adjacent villages as opposed to visitors from further afield. Although seasonal flooding can restrict some access by recreational users on foot it can increase other activities e.g. canoeing and kite surfing.	
Supporting habitat (both within and outside the SPA): structure	**Landscape**	Maintain open and unobstructed terrain within and around nesting, roosting and feeding areas	This feature is known to favour large areas of open terrain, largely free of obstructions, in and around its nesting, roosting and feeding areas. Often there is a need to maintain an unobstructed line of sight within nesting, feeding or roosting habitat to detect approaching predators, or to ensure visibility of displaying behaviour. An open landscape may also be required to facilitate movement of birds between the SPA and any off-site supporting habitat. Planning proposals coming forward will need to take into account these landscape requirements. Supplementary Planning Guidance has been produced by the East Riding of Yorkshire Council in collaboration with other Local Authorities in relation to the Lower Derwent Valley (ERYC 2017).	East Riding of Yorkshire Council (2017) Lower Derwent Valley Supplementary Planning Document. https://www.eastriding.gov.uk/environment/planning-and-building-control/planning-policy/supplementary-planning-documents/
Supporting habitat (both within and outside the SPA): structure	**Vegetation characteristics**	Maintain a vegetation structure of key roost sites dominated by bare ground or a short sparsely-vegetated sward.	The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enable successful nesting/ rearing/ concealment/ roosting. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature.	
Version Control Advice last updated: **21 March 2019** following stakeholder feedback. Additional information added to explanatory notes for **Water depth** and **Water**				

Attributes	Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
quality/ quantity attributes highlighting how factors within wider Derwent basin may affect the SPA. Clarification in explanatory notes for **Minimising disturbance caused by human activity** attribute around impacts on seasonal flooding on recreational use of the SPA.			
Variations from national feature-framework of integrity-guidance: N/A			

Table 7: Supplementary Advice for Qualifying Features: Waterbird assemblage

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Assemblage of species	**Assemblage abundance**	Maintain the overall abundance of the non-breeding assemblage at a level which is above 27,580 individuals (5 year peak mean at time of designation – English Nature 1993)whilst avoiding deterioration from its current level as indicated by the latest mean peak count of 33,885 (Frost *et al.* 2018) .	See general explanatory notes for this attribute in Table 1. Target figure derived from SPA citation and 1993 Departmental Brief (English nature 1993) At time of drafting this advice wintering numbers are higher than at time of designation with mean peak counts for the period 2012/13-2016/17 being 33,885 (Frost *et al.* 2018). The site remains one of the most important inland sites for wintering waterfowl in the United Kingdom.	The most recent data about this feature on this SPA can be found at. BTO WeBS data at Frost, T.M., Austin, G.E., Calbrade, N.A., Mellan, H.J., Hearn, R.D., Stroud, D.A., Wotton, S.R. and Balmer, D.E. 2018. Waterbirds in the UK 2016/17: The Wetland Bird Survey. BTO/RSPB/JNCC. Thetford. English Nature (1993) Departmental Brief: Lower Derwent Valley; Proposed Special Protection Area and Ramsar Site
Assemblage of species	**Diversity of species**	Maintain the species diversity of the bird assemblage.	This will ensure the bird assemblage reflects the diversity of species the SPA supports. Assemblage diversity is a product of species richness (the number of different species present), abundance (population size of each assemblage component species) and relative 'importance' (an assessment of the conservation status of each assemblage component, described below). Each component makes a different contribution to the diversity of the assemblage, and changes to some components may be considered to affect diversity more than others. Negative changes to small numbers of relatively important assemblage components may have a similar overall effect to negative changes in larger numbers of less important components. To meet the target, the populations of each of the 'main component' assemblage species to be maintained or restored are i) those present in nationally important numbers (≥1% GB population); ii) migratory species present in internationally important numbers (≥1% biogeographic population); iii) those species comprising ≥2,000 individuals (≥10% of the minimum	Goodall (2005): review of the Importance of the Lower Derwent Valley for Birds (Ecological services Ltd) - A report the Environment Agency Frost, T.M., Austin, G.E., Calbrade, N.A., Mellan, H.J., Hearn, R.D., Stroud, D.A., Wotton, S.R. and Balmer, D.E. 2018. Waterbirds in the UK 2016/17: The Wetland Bird Survey. BTO/RSPB/JNCC. Thetford.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			qualifying threshold for an internationally-important assemblage); and iv) 'named components' otherwise listed on the SPA citation. In addition to the main components, other components should be considered as these contribute collectively to the assemblage diversity, in particular proportionally abundant populations of species of conservation importance. Examples are those 'red-listed' as Birds of Conservation Concern and/or those listed on Sections 41/42 of the Natural Environment and Rural Communities Act 2006. The species composition of an assemblage may change over time. However, to meet this target, the total number of all native waterbird species contributing to the assemblage species richness should not decline significantly.	
Supporting habitat (both within and outside the SPA): extent and distribution	**Extent and distribution of supporting non-breeding habitat**	Maintain the extent and distribution of habitats which support the assemblage feature during all necessary stages (moulting, roosting, loafing, and feeding) of the non-breeding period. Wet grassland (which will be partially inundated during winter months) c.709ha Inland water bodies (Standing/Running water) c. 109ha Fens & associated habitats c.262ha	Conserving or restoring the extent of supporting habitats and their range will be key to maintaining the site's ability and capacity to support the SPA population. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending to the nature, age and accuracy of data collection. This target will apply to any supporting habitat which is known to occur outside the site boundary .The principal habitats known or likely to support the assemblage feature at this SPA are as outlined on the JNCC standard Natura 2000 data form. The Lower Derwent Valley provides a mosaic of habitats; including; periodically flooded wet grassland, fens, marsh and swamp vegetation together with standing and flowing open water. The relative abundance of these communities will vary according to the season, however estimated extent of communities based upon JNCC standard Natura 2000 Data form	JNCC Natura 2000 data form at: http://jncc.defra.gov.uk/pdf/SPA/UK9006092.pdf
Supporting habitat (both within and outside the	Air quality	Maintain concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for	See explanatory notes for this attribute in Table 1.	More information about site-relevant Critical Loads and Levels for this SPA is available by using the 'search by site' tool on the Air

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
SPA): function/ supporting process		this feature of the site on the Air Pollution Information System (www.apis.ac.uk).		Pollution Information System (www.apis.ac.uk).
Supporting habitat (both within and outside the SPA): function/ supporting process	Conservation measures	Maintain management or other measures (whether within and/or outside the site boundary as appropriate) necessary to maintain the structure, function and/or the supporting processes associated with the feature and its supporting habitats.	Active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Conservation measures and management for this feature will typically include hay cutting and grazing, scrub management, weed control and recreational access/vegetation management. Also covered is maintenance of surface drainage features such as grips gutters and foot drains. Retention of suitable land use infrastructure patterns to enable site management e.g. pastoral livestock farming. Further details about the necessary conservation measures for this site can be found within, where applicable, supporting documents such as Lower Derwent Valley Natura 2000 Site Improvement Plan, Lower Derwent Valley Management Plan 2005-2010 and National Nature Reserve Management Plan. Considerable areas of the site are managed under agri-environment scheme agreement between Natural England and individual private owners.	NATURAL ENGLAND, 2014. Site Improvement Plan: Lower Derwent Valley (SIP058) Natural England "Views about Management" can be found at http://www.sssi.naturalengland.org.uk/Special/sssi/vam/VAM%201002114.pdf Additional information relating to the management of the site can be found within; Chalk, L. Leighton, E. & Bentley, M on behalf of Lower Derwent Valley Project Partners (2005). The Sustainable Management of the Lower Derwent Valley, Yorkshire. Lower Derwent Valley Management Plan 2005-2010 (*Available from Natural England on request*). Natural England NNR Management Plan (in prep.)
Supporting habitat (both within and outside the SPA): function/ supporting process	**Water quality/ quantity**	Where the supporting habitats of the SPA feature are dependent on surface water ensure water quality and quantity is maintained to a standard which provides the necessary conditions to support the feature.	For many SPA features which are dependent on wetland habitats supported by surface water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year during key stages of their life cycle. Poor water quality and inadequate quantities of water can adversely affect the availability and suitability of breeding, rearing, feeding and roosting habitats. Typically, meeting the surface water and groundwater	European Site Conservation Objectives: Supplementary Advice on Conserving and Restoring Site Features River Derwent Special Area of Conservation (SAC) Site Code: UK0030253 http://publications.naturalengland.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the SPA Conservation Objectives but in some cases more stringent standards may be needed to support the SPA feature. Further site-specific investigations may be required to establish appropriate standards for the SPA. Apart for the River Derwent, permanent waterbodies are largely absent from the site. Birds are however associated with the large expanses of open water provided by the flooded meadows and grasslands. The largest permanent waterbody (other than the river) is found at Wheldrake Ings. Flooding within the SPA is difficult to control as it is largely a gravity fed system with few water control structures. The site is therefore largely at the vagaries of climatic and river conditions. Consequently factors in the wider River Derwent catchment may have a significant influence on conditions within the SPA. Reference should be made to water quality targets provided in the River Derwent SAC Conservation Objectives; Supplementary Advice and referenced in the River Derwent SSSI and Pocklington Canal SSSI Diffuse Water Pollution Plan (DWP) Natural England and Environment Agency 2014).	org.uk/publication/4824082210095104 NATURAL ENGLAND & THE ENVIRONMENT AGENCY 2014. Diffuse Water Pollution Plan for River Derwent SSSI and Pocklington Canal SSSI.
Supporting habitat (both within and outside the SPA): minimising disturbance	**Minimising disturbance caused by human activity**	Restrict the frequency, duration and/or intensity of disturbance affecting moulting, loafing, feeding and/or roosting birds so that the assemblage feature is not significantly disturbed	The nature, scale, timing and duration of some human activities can result in the disturbance of birds at a level which may significantly affect their behaviour, and consequently impact on the long-term viability of their population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increased energy expenditure due to more frequent flights, disrupted incubation of eggs and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). Anthropogenic disturbance of birds may in effect reduce the availability to the birds of suitable habitat through temporary or long-lasting displacement of birds from affected areas and may result in their redistribution within the site or displacement from it.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, and presence of people, animals and structures. The Lower Derwent Valley Site Improvement Plan highlights that recreational activities, public access along public and non-public rights of way (particularly flood banks) is causing increasing disturbance to birds. It is thought that much of this originates from adjacent villages as opposed to visitors from further afield. Seasonal flooding can restrict some access by recreational users on foot however it can increase other activities e.g. canoeing and kite surfing.	
Supporting habitat (both within and outside the SPA): structure/function	**Quality of supporting non-breeding habitat**	Maintain the structure, function and availability of the following habitats which support the main component species of the assemblage feature for all stages (moulting, roosting, loafing, feeding) of the non-breeding period Wet grassland (which will be partially inundated during winter months) c.709ha Inland water bodies (Standing/Running water) c. 109ha Fens & associated habitats c.262ha	The site's ability to support and sustain an assemblage comprising a very large number of birds (in excess of 20,000) made up of a diverse mix of species will be reliant on the overall quality and diversity of the habitats that support them. The feeding and roosting habitats which support the assemblage will occur within, and in some cases outside, the site boundary. This target is applicable to both circumstances. Due to the large number of species and natural fluctuations in the overall composition of an assemblage, it is not practical to provide specific targets relating to each supporting habitat relevant to the assemblage. Generally speaking, the specific attributes of each supporting habitat may include vegetation characteristics and structure, water depth, food availability, connectivity between nesting, roosting and feeding areas both within and outside the SPA. Further advice will be provided by Natural England on a case by case basis. In addition to habitats within the site boundary it is recognised that the surrounding farmed landscape is vital for many birds using the SPA, which use surrounding fields for feeding and roosting. The Lower Derwent Valley provides a mosaic of habitats; including; periodically flooded wet grassland, fens, marsh and	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			swamp vegetation together with standing and flowing open water. The relative abundance of these communities will vary according to the season however estimated extent of communities based upon JNCC standard Natura 2000 Data form.	
Version Control Advice last updated: **21 March 2019** following stakeholder feedback. Additional information added to explanatory notes for **Water quality/ quantity** attributes highlighting how factors within wider Derwent basin may affect the SPA. Clarification in explanatory notes for **Minimising disturbance caused by human activity** attribute around impacts on seasonal flooding on recreational use of the SPA.				
Variations from national feature-framework of integrity-guidance: N/A				

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European Site Conservation Objectives: Supplementary Advice on Conserving and Restoring Site Features

River Derwent Special Area of Conservation (SAC)
Site Code: UK0030253

Photo: the River Derwent at Kirkham Bridge

Date of Publication: 27 March 2017 (version 2)

About this document

This document provides Natural England's supplementary advice about the European Site Conservation Objectives relating to the River Derwent SAC. This advice should therefore be read together with the SAC Conservation Objectives which are available here.

You should use the Conservation Objectives, this Supplementary Advice and any case-specific advice given by Natural England, when developing, proposing or assessing an activity, plan or project that may affect this site. Any proposals or operations which may affect the site or its qualifying features should be designed so they do not adversely affect any of the attributes listed in the objectives and supplementary advice.

This supplementary advice to the Conservation Objectives describes in more detail the range of ecological attributes on which the qualifying features will depend and which are most likely to contribute to a site's overall integrity. It sets out minimum targets for each qualifying feature to achieve in order to meet the site's objectives.

The tables provided below bring together the findings of the best available scientific evidence relating to the site's qualifying features, which may be updated or supplemented in further publications from Natural England and other sources. The local evidence used in preparing this supplementary advice has been cited. The references to the national evidence used are available on request. Where evidence and references have not been indicated, Natural England has applied ecological knowledge and expert judgement. You may decide to use other additional sources of information.

In many cases, the attribute targets shown in the tables indicate whether the current objective is to 'maintain' or 'restore' the attribute. This is based on the best available information, including that gathered during monitoring of the feature's current condition. As new information on feature condition becomes available, this will be added so that the advice remains up to date.

The targets given for each attribute do not represent thresholds to assess the significance of any given impact in Habitats Regulations Assessments. You will need to assess this on a case-by-case basis using the most current information available.

Some, but not all, of these attributes can also be used for regular monitoring of the actual condition of the designated features. The attributes selected for monitoring the features, and the standards used to assess their condition, are listed in separate monitoring documents, which will be available from Natural England.

These tables do not give advice about SSSI features or other legally protected species which may also be present within the European Site.

If you have any comments or queries about this Supplementary Advice document please contact your local Natural England adviser or email HDIRConservationObjectivesNE@naturalengland.org.uk

About this Site

Name of European Site	River Derwent Special Area of Conservation (SAC)
Location	East Riding of Yorkshire, North Yorkshire, York
Site Maps	The designated boundary of this site can be viewed here on the MAGIC website
EU Site Code	UK0030253
Designation Date	April 2005
Qualifying Features	See section below
Designation Area	411.23 hectares
Designation Changes	n/a
Feature Condition Status	Condition assessment information relating to this site can be found using Natural England's Designated Sites search tool.
Names of component Sites of Special Scientific Interest (SSSIs)	River Derwent SSSI
Relationship with other European or International Site designations	The boundary of this SAC runs through, but is not included within, the boundary of the Lower Derwent Valley SAC and Ramsar Site between its northern boundary at Newton Mask SSSI and its southern boundary at Breighton Meadows SSSI The boundary of this SAC is included within the Lower Derwent Valley SPA between its northern boundary at Newton Mask SSSI and its southern boundary at Breighton Meadows SSSI.

Site background and geography

Covering approximately 411.23 hectares, the 86.2 km length of the River Derwent SAC passes through four National Character Areas (NCAs) within Yorkshire, stretching from Ryemouth in the Vale of Pickering NCA to the north, downstream through the Howardian Hills, Vale of York and Humberhead Levels NCAs until its southern boundary at the confluence of the River Ouse.

The River Derwent SAC represents one of the best British examples of the classic river profile, with its source in the high-energy upland valleys of the North York Moors whose energy dissipates as the channel becomes wider and deeper as it passes through the flat and wide lowland floodplain valleys to its confluence with the Ouse and out into the Humber Estuary. Only the lower reaches of the river are however designated SAC.

The river supports an aquatic flora now uncommon in northern Britain. Several plant species, such as river water-dropwort *Oenanthe fluviatilis*, flowering rush *Botumus umbellatus*, shining pondweed *Potamogeton lucens*, arrowhead *Sagittaria sagittifolia*, opposite-leaved pondweed *Groenlandia densa* and narrow-leaved water-parsnip *Berula erecta,* are more typically found in lowland rivers in southern England.

The ‘Yorkshire Derwent’ is also noted for the rich diversity of its native fish communities, which include the Annex II species river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* populations that spawn in the lower reaches, and bullhead *Cottus gobio*.

The diversity of riparian habitats including wet woodland and fen also support a healthy population of otter *Lutra lutra*.

About the qualifying features of the SAC

The following section gives you additional, site-specific information about this SAC’s qualifying features. These are the natural habitats and/or species for which this SAC has been designated.

Qualifying Habitats:

- **H3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion vegetation* (‘Rivers with floating vegetation often dominated by water-crowfoot’)**

This habitat type is generally characterised by the abundance of water-crowfoots *Ranunculus* spp. Floating mats of these white-flowered species are characteristic of river channels in early to mid-summer. They may modify water flow, promote fine sediment deposition, and provide shelter and food for fish and invertebrate animals.

Watercourses of this habitat type have a high degree of naturalness and are governed by dynamic processes which result in a mosaic of characteristic physical biotypes, including a range of substrate types, variations in flow, channel width and depth, in-channel and side-channel sedimentation features, bank profiles, erosion features and both in-channel and bankside vegetation cover.

There are several variants of this habitat in the UK, depending on geology and river type, and at each site, the *Ranunculus* species will be associated with a different assemblage of other aquatic plants. The River Derwent SAC supports examples of water plants from the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (Rivers with floating vegetation often dominated by water-crowfoot). Submerged aquatic vegetation is varied and characterised by unbranched bur-reed (*Sparganium emersum*), fennel leaved pondweed (*Potamogeton pectinatus*), flowering rush (*Butomus umbellatus*), yellow water-lily (*Nuphar lutea*), and shining pondweed (*Potamogeton lucens*) with occasional arrowhead (*Sagittaria sagittifolia*), perfoliate pondweed (*Potamogeton perfoliatus*) and water crowfoot species (Batrachian *Ranunculus* spp.)

Qualifying Species:

- **S1095 Sea lamprey *Petromyzon marinus***

The sea lamprey *Petromyzon marinus* is a primitive, jawless fish resembling an eel. It occurs in estuaries and easily accessible rivers, and is an anadromous species (i.e. spawning in freshwater but completing its life cycle in the sea). The sea lamprey is the largest of the three species, reaching a size of approximately one metre in length.

After spending 18-24 months feeding at sea, adult sea lampreys migrate into rivers during the spring and early summer. Like other species of lamprey, sea lampreys need clean gravel for spawning, and marginal silt or sand for the burrowing larvae following egg-hatching. They spawn between the months of May-July in areas of pebble and cobble substrate

The River Derwent SAC is characteristic of the sea lamprey populations which inhabit the many rivers flowing into the Humber estuary in eastern England. The lower reaches of the Derwent provide the clean stable gravels needed for spawning and the stable silts with low flow and organic detritus for nursery habitat.

- **S1099 River lamprey *Lampetra fluviatilis***

The river lamprey *Lampetra fluviatilis* is found in coastal waters, estuaries and accessible rivers. The species is normally anadromous (i.e. spawning in freshwater but completing part of its life cycle in the sea), and pollution or artificial obstacles such as weirs or dams impede migration.

The River Derwent SAC is one example of river lamprey populations which inhabit the many rivers flowing into the Humber estuary in eastern England. The lower reaches of the Derwent provide suitable areas of gravels, silt or sand for spawning.

- **S1163 Bullhead *Cottus gobio***

The bullhead is a small bottom-living fish that inhabits a variety of rivers, streams and stony lakes. It appears to favour fast-flowing, clear shallow water with a hard substrate (gravel/cobble/pebble) and is frequently found in the headwaters of upland streams. However, it also occurs in lowland situations on softer substrates so long as the water is well-oxygenated and there is sufficient cover. It is not found in badly polluted rivers.

Bullheads spawn from February to June and up to four times. The male excavates a nest under a suitable large stone to attract a female. Part of this may be achieved by emission of acoustic 'knocking' sounds by the males. The female lays a batch of up to 400 eggs (2–2.5 mm in diameter), which adhere to the underside of the stone. In situations without suitable stones, bullheads may use other media, such as woody debris or tree roots. The male then defends the brood against egg predators such as caddis larvae and manages the nest by fanning the eggs with his pectoral fins. The eggs hatch after 20 to 30 days, depending on water temperature. The newly hatched larvae (6–7mm in length) are supplied by a large yolk sac, which is absorbed after 10 days, after this time they leave the nest.

Generally, bullheads attain a length of 40–50 mm after their first year, 60 mm after their second and 70–90 mm after their third. They do not generally live for more than three or four years, although fish of over 10 years old have been recorded.

Within the River Derwent SAC, bullhead is present in low numbers at most of the sites where fish are monitored and are most abundant in between Kirkham Abbey and Sutton on the Derwent.

- **S1355 Otter *Lutra lutra***

The otter is a semi-aquatic mammal, which occurs in a wide range of ecological conditions, including inland freshwater and coastal areas (particularly in Scotland). Otters mainly eat fish, though crustaceans, frogs, voles and aquatic birds may also be eaten. Being at the top of the food chain, an otter needs to eat up to 15% of its body weight in fish daily.

Otters are solitary shy animals, usually active at dusk and during the night. Otters can travel widely over large areas. Some are known to use 20 km or more of river habitat. Otters tend to live alone as they are very territorial. Otters deposit faeces in prominent places along a watercourse (known as spraints) which haveith a characteristic sweet musky odour. These mark their range which may help neighbouring animals keep in social contact with one another.

Inland populations of otter utilise a range of running and standing freshwaters. These must have an abundant supply of food (normally associated with high water quality), together with well-connected suitable habitat, such as vegetated river banks, islands, reed-beds and woodland, which are used for foraging, breeding and resting.

On the River Derwent SAC, undisturbed areas of riparian and adjacent floodplain habitat which includes

wet woodland, fen, wet grassland, ponds and many tributaries provide excellent supporting habitat for the population of otter on the river. There are many suitable undisturbed areas for shelter and holts and a good fish population providing an abundant food source.

The Otter is also a European Protected Species in the UK, and it is an offence to disturb, capture, injure or kill an otter (either on purpose or by not taking enough care), or to damage, destroy or obstruct access to its breeding or resting places, without first getting a Licence.

Table 1: Supplementary Advice for Qualifying Features: H3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation ('rivers with floating vegetation dominated by water-crowfoot')

Attributes		Targets	Supporting and/or Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	Extent of the feature within the site	Restore the full extent of the H3260 habitat to that characteristic of the natural fluvial processes associated with the river type.	There should be no measurable net reduction (excluding any trivial loss) in the extent and area of this feature, and in some cases, the full extent of the feature may need to be restored. The baseline-value of extent given below has been generated using data gathered from the listed site-based surveys. Area measurements given may be approximate depending on the methods, age and accuracy of data collection, and as a result this value may be updated in future to reflect more accurate information. The extent of an Annex I habitat feature covers the sum extent of all of the component vegetation communities present and may include transitions and mosaics with other closely-associated habitat features. Where a feature is susceptible to natural dynamic processes, there may be acceptable variations in its extent through natural fluctuations. Where a reduction in the extent of a feature is considered necessary to meet the Conservation Objective for another Annex I feature, Natural England will advise on this on a case-by-case basis.	JNCC, 2001. ROYAL HASKONING, 2010. HOBBS, SAMSON, & WOOD, 1977-78 SCOTT WILSON CONSULTANTS, 1998 ENVIRONMENT AGENCY, 1999. HAMMOND, M. 2001 ECUS LTD, 2009
Structure and function (including its typical species)	River (habitat) mosaic	Restore the extent and pattern of in-channel and riparian habitats to that characteristic of natural fluvial processes.	Watercourses with a high degree of naturalness are governed by dynamic processes which result in a mosaic of characteristic physical habitats which reflect a range of substrate types, variations in flow, channel width and depth, in-channel and side-channel sedimentation features (including transiently-exposed sediments), bank profiles (including shallow and steep slopes), erosion features (such as cliffs) and both in-channel and bankside (woody and herbaceous) vegetation cover. All of these distinct river habitats, and their characteristic patterns within the river corridor, are important to the full expression of the biological community and the H3260 feature. Modification or disruption of these processes can adversely affect this range of river habitat, resulting in declines of the characteristic wildlife dependent upon them. The River Derwent has been heavily modified in the past and has been subject to being deepened, widened and embanked resulting in the loss of dynamic processes and	ROYAL HASKONING, 2010.

Attributes		Targets	Supporting and/or Explanatory Notes	Sources of site-based evidence (where available)
			subsequent loss of a range of biotopes which would be associated with an unmodified river. Implementation of the River Restoration Plan aims to restore naturally-functioning geomorphological processes wherever possible.	
Structure and function (including its typical species)	Riparian zone	Maintain a mosaic of natural woody and herbaceous (tall and short swards) riparian vegetation to the riparian zone, which should be sufficiently wide to act as a healthy and functional habitat zone within the river corridor.	A mosaic of natural and semi-natural riparian vegetation types provides conditions for all characteristic in-channel and riparian biota to thrive, creating patches of tall and short riparian swards, a mixture of light and shade on the river channel, and tree root systems and a supply of large woody debris that add channel complexity. Patchy tree cover provides shade protection against rising water temperatures caused by climate change. Between 30-50% riparian tree cover is generally considered optimal for in-channel and riparian habitats. Intensive cutting across significant proportions of the riparian zone is not appropriate. Also see above comments on livestock grazing.	ROYAL HASKONING, 2010. NATURAL ENGLAND, 2014.
	Woody debris	Maintain the presence of coarse woody debris within the structure of the channel. In smaller watercourses, temporary debris dams should be a feature of channel dynamics.	Dead woody material that falls into streams ('woody debris') plays an important role in increasing habitat diversity, providing shelter for fish, supplying a food source for aquatic invertebrates, and for slowing the passage of nutrients downstream. Woody debris is therefore a key feature of healthy rivers. Woody debris should be left in situ, unless there are overriding reasons of public safety (for example to prevent flooding or bridge collapse). Woody debris is well represented throughout the reaches of the River Derwent and this should be maintained where possible.	
	Water course flow	Restore the natural flow regime of the river, with daily flows as close to what would be expected in the absence of abstractions and discharges (the naturalised flow).	The natural flow regime both shapes and sustains characteristic biotope mosaics, affecting factors such as current velocities and bed hydraulics, water levels and depths, wetted area, temperature regime and dissolved oxygen regime, All parts of the natural flow regime are important, including flushing flows, seasonal base flows and natural low flows. Natural seasonal flow recession is critical in supporting the full expression of ephemeral habitats (marginal and riparian vegetation, exposed riverine sediments, ephemeral headwaters). Any significant impacts on the natural flow regime should be rectified sustainably by reducing flow modifications, not by artificial augmentation, or by altering channel form to fit reduced levels of flow. There should be no increase in the existing level of impact on the natural flow regime, and any significant impacts should be controlled to acceptable levels.	

Attributes		Targets	Supporting and/or Explanatory Notes	Sources of site-based evidence (where available)
			Water Framework Directive flow targets used in defining high ecological status should be used to avoid deterioration and for restoration where this is technically feasible. As a minimum, the flow regime should be restored to the values given by Natural England (2014). Where multiple natural channels exist, flow targets should apply across all of these channels - any artificial channels should not create non-compliances in natural channels. The natural flow regime of the River Derwent has been altered by several in-channel structures which have an impoundment affect thereby changing the natural flow regime. There is also a large unrestricted drinking water abstraction point at Elvington which can have implications for the natural flow regime. The implementation of the River Restoration Plan and continued work towards agreed flow targets aims to restore the natural flow regime where possible and avoid further deterioration.	
Structure and function (including its typical species)	Sediment regime	Restore the natural supply of coarse and fine sediment to the river	Coarse sediment supply is essential for the stability of the river channel and for creating and sustaining key biotopes including riffles and exposed shingle banks. This can be interrupted by weirs and other impounding structures, and by dredging or extraction, and can result in channel incision and heavy bankside erosion that have consequences for both biodiversity and river management (e.g. flood risk). Excessive fine sediment supply can lead to the smothering of coarse substrates and the loss of flora and fauna dependent on them. Where fine sediment delivery is a problem, control measures need to be planned in the catchment. Coarse and fine sediment supply should reflect natural supply levels. Fine sediment delivery should not be enhanced by catchment or riparian management practices in ways that lead to siltation problems in the channel or unnaturally high levels of turbidity. It should be noted that this is not a whole river SAC and a significant proportion of the upper catchment is outside of the SAC boundary. This area is known to generate a significant amount of sediment which in turn impacts upon and adds to that generated within the SAC. The natural sediment regime therefore needs to be restored throughout the whole catchment through Diffuse Water Pollution Plans and actions of the Derwent Catchment Partnership.	ROYAL HASKONING, 2010. NATURAL ENGLAND & ENVIRONMENT AGENCY. 2014.
	Thermal regime	Maintain a natural thermal regime to the river (subject to a changing climate), ensuring that water temperatures should	Climate change is driving increases in river temperatures which will create stress for a range of characteristic riverine species, particularly those on the southern limit of their range. Catchment-based activities such as impoundment, abstraction, discharges, excessive tree removal or maintenance, may exacerbate this and raise water temperatures further.	

Attributes		Targets	Supporting and/or Explanatory Notes	Sources of site-based evidence (where available)
		not be significantly artificially elevated	Restoration of riparian tree cover to suitable levels will be needed in those cases, particularly in headwater streams, particularly where river reaches have been affected by tree disease such as alder phytophthora.	
Structure and function (including its typical species)	Biological connectivity	Ensure the movement of river wildlife characteristic of the H3260 feature at this site is not significantly artificially constrained.	Many species, including fish and invertebrates, require natural freedom of movement to complete their life cycle in rivers and maximise their population size and genetic diversity. Longitudinal connectivity within the river channel and lateral connectivity between the channel and the floodplain are both critical to a healthy river ecosystem. Constraints to longitudinal movement such as waterfalls and debris dams are a natural feature of rivers and add to the complexity and diversity of the habitat. Natural waterfalls in headwater areas can create unique (often fishless) communities of conservation importance. New artificial constraints to movement should be avoided and existing artificial constraints should be addressed through strategic river restoration as outlined above. Barriers should be removed wherever possible to restore all aspects of habitat integrity - fish passes constitute a partial mitigation measure for longitudinal biological movement and should only be considered where it is not possible to remove the barrier. Where established, they should allow for the passage of as many characteristic species as possible, including Annexe II fish species such as lamprey species. The River Derwent has a number of in-channel structures which form barriers to longitudinal connectivity and can restrict migratory species such as lamprey to certain poor quality spawning areas when a large amount of suitable spawning habitat occurs upstream of the structures. The river is also embanked for long sections which has removed the lateral connectivity of the river and its floodplain and removed access to tributaries and ditch networks for a range of species. Implementation of the River Restoration Plan will restore biological connectivity where possible. Barriers to biological connectivity also occur in the upper catchment outside of the SAC boundary. Connectivity will be restored where possible through Water Framework Directive objectives and the actions of the Derwent Catchment Partnership.	ROYAL HASKONING, 2010.
Supporting processes (on which the	Water chemistry - alkalinity	Maintain natural levels of alkalinity	Natural alkalinity levels are critical to characteristic biological communities, with many species adapted to certain parts of the alkalinity range. Mass transfers of water, for example, can disrupt the natural alkalinity regime.	

<table>
<tr><th colspan="2">Attributes</th><th>Targets</th><th>Supporting and/or Explanatory Notes</th><th>Sources of site-based evidence (where available)</th></tr>
<tr><td>feature relies)</td><td>Water quality - nutrients</td><td>Restore the natural nutrient regime of the river, with any anthropogenic enrichment above natural/background concentrations limited to levels at which adverse effects on the H3260 feature's characteristic biodiversity are unlikely.</td><td>Elevated nutrient levels interfere with competitive interactions between higher plant species and between higher plants and algae, leading to dominance by attached forms of algae and a loss of characteristic plant species (which may include lower plants such as mosses and liverworts). Through changes to plant growth and plant community composition and structure, they also affect the wider food web, altering the balance between species with different feeding and behavioural strategies.

The respiration of artificially large growths of benthic or floating algae may generate large diurnal sags in dissolved oxygen and poor substrate conditions (increased siltation) for fish and invertebrate species. The management focus is typically on phosphorus in rivers, on the assumption that it can be more easily controlled at levels that limit the growth of plant species. However, nitrogen may also be important in river eutrophication and ideally co-limitation would be the management aim.</td><td></td></tr>
<tr><td></td><td>Water quality - organic pollution</td><td>Restore organic pollution levels to the following levels that have minimal impact on the characteristic biota;

<table><tr><td>10%ile Dissolved Oxygen (% saturation)</td><td></td></tr><tr><td>Mean Biological oxygen Demand (BOD) (mg L^{-1})</td><td></td></tr><tr><td>90%ile total ammonia (NH_3-N, mg L^{-1})</td><td></td></tr><tr><td>95%ile un-ionised ammonia (NH_3-N, mg L^{-1})</td><td></td></tr></table></td><td>Organic pollution can affect the river biota of the SAC in a number of ways, including direct toxicity (from ammonia and nitrite), reduced dissolved oxygen levels (from microbial breakdown of organic material), and nutrient enrichment. Reducing organic pollution levels reduces toxic effects but unmasks enrichment effects.

Controlling the continuous input of low levels of organic material is critical to controlling the enrichment effect. The values given apply throughout the site not just at routine sampling points - assessment can be made by modelling (assuming full mixing of effluents at the point of discharge).

Environment Agency monitoring data 2011 – 2013 (inclusive) shows that the dissolved oxygen target is being failed at 3 out of 5 of the routine monitoring points within the SSSI/SAC.

Implementation of the River Restoration Plan, Diffuse Water Pollution Plan and the Catchment Sensitive Farming Initiative will reduce inputs into the river and reduce levels of organic pollution.

The Catchment Pollution Risk Assessment & Source Apportionment Project (Rivers Trust, 2015) will assist in targeting further action to reduce organic pollution in the wider catchment which should have a beneficial effect upon meeting this target within the SAC.</td><td>NATURAL ENGLAND 2014. NATURAL ENGLAND & ENVIRONMENT AGENCY. 2014. THE RIVERS TRUST 2015 (in draft).</td></tr>
<tr><td>Supporting processes (on which the feature relies)</td><td>Water quality - other pollutants</td><td>Achieve at least 'Good' chemical status (i.e. compliance with relevant</td><td>A wide range of pollutants may impact on habitat integrity depending on local circumstance. Good chemical status includes a list of Environmental Quality Standards (EQS) for individual pollutants that are designed to protect aquatic biota with high levels of precaution. These values should be applied throughout the site, not just at routine</td><td></td></tr>
</table>

Attributes		Targets	Supporting and/or Explanatory Notes	Sources of site-based evidence (where available)
		Environmental Quality Standards).	sampling points.	
Structure and function (including its typical species)	Invasive, non-native and/or introduced species	Ensure non-native species categorised as 'high-impact' in the UK under the Water Framework Directive are either rare or absent but if present are causing minimal damage to the H3260 feature. The species on the high-impact list known to be present include: Japanese knotweed, giant hogweed, Himalayan balsam, signal crayfish (some tributaries), Chinese mitten crab (lower reaches)	Non-native species constitute a major threat to many river systems. Impacts may be on the river habitat itself (e.g. damage to banks and consequent siltation) or directly on characteristic biota (through predation, competition and disease), or a combination of these. For example, species such as signal crayfish have been responsible for much of the decline of native crayfish through competition, habitat damage and the introduction of crayfish plague. The UK Technical Advisory Group (UKTAG) of the Water Framework Directive produces a regularly updated classification of aquatic alien species (plants and animals) according to their level of impact. In general, high impact species are of greatest concern but low or unknown impact species may be included in the target on a site-specific basis where there is evidence that they are causing a negative impact (for example high cover values or abundances). Those taxa considered likely to colonise lakes, are indicated by an 'L' in the UKTAG guidance. Examples of such high-impact species may include Water Fern, New Zealand pygmyweed and the zebra mussel. At this SAC, Chinese mitten crab has been recorded at Loftsome Bridge and Bubwith. Signal crayfish has been recorded at Settrington Beck, Priorpot Beck (Malton) and the main river at Malton/Norton. Giant hogweed and Japenese knotweed are sporadic and Himalayan balsam is abundant within the SAC and wider catchment. Terrapin has been recorded just downstream of Kirkham.	ROYAL HASKONING, 2010. EA Biodiversity Technical Specialist (*pers. comm*.)
Structure and function (including its typical species)	Key structural, influential and distinctive species	Maintain the abundance of the species listed below to enable each of them to be a viable component of the H3260 Annex 1 habitat; Flora; Water crowfoots - all	Some plant or animal species (or related groups of such species) make a particularly important contribution to the necessary structure, function and quality of an Annex I habitat feature at a particular site. These species will include; - *Structural* species which define or are critical to the structure and therefore the health of an Annex I feature on a site (see also attribute for 'vegetation community composition'). - *Influential* species which have an important positive impact on the structure and function of an Annex I feature on a site (such as bioturbators (mixers of soil/sediment), grazers, borers or predators) - *Site-distinctive* species which are considered to be a particularly special and	ROYAL HASKONING, 2010. ECUS LTD. 2009.

Attributes		Targets	Supporting and/or Explanatory Notes	Sources of site-based evidence (where available)
		Ranunculus spp. Starworts – all *Callitriche* spp. Pondweeds – all *Potamogeton* spp., plus *Groenlandia & Zannichellia* spp. Milfoils – *Myriophyllum* spp; lesser water parsnip *Berula erecta,* flowering rush *Botumus umbellatus* Fauna A rich invertebrate assemblage including mayflies (*Baetis buceratus, Heptagenia fusogrisea and Brachtcerus harisella*) and stoneflies (*Taeniopteryx nebulosi)* and 11 species of dragonfly. Diverse assemblage of native fish species (including gudgeon, pike, roach, dace, barbell, grayling, chub, brown trout, perch, ruffe, bleak, bullhead, minnow, stone loach, river lamprey, sea lamprey, flounder, eel) Otter *Lutra lutra*	distinguishing component of an Annex I feature on a particular site. There may be natural fluctuations in the frequency and cover of each of these species. The relative contribution made by them to the overall ecological integrity of a site may vary, and Natural England will provide bespoke advice on this as necessary. The list of species given here for this Annex I habitat feature at this SAC is not necessarily exhaustive. The list may evolve, and species may be added or deleted, as new information about this site becomes available.	
Structure and	Fisheries	Maintain fish densities	Fish stocking can cause elevated levels of competition and predation that may damage	EA Fisheries

Attributes		Targets	Supporting and/or Explanatory Notes	Sources of site-based evidence (where available)
function (including its typical species)		at or below the natural environmental carrying capacity of the river, and no higher than historical levels (this means no stocking to previously un-stocked rivers or river sections). Trout stocking should not elevate densities of adult trout (stocked plus natural) to more than 1-3 fish 100m², this being the estimated range of natural trout densities in SAC rivers.	the characteristic biological community. Ideally, fishery management should be based on natural recruitment, with an emphasis on restoring characteristic river habitat in ways that promote natural recruitment. Exploitation should be controlled to suitable levels, and net limitations and catch-and-release techniques used where necessary to avoid population impacts. Fish introductions, exploitation and other removals should not interfere with the ability of the river to support self-sustaining populations of characteristic species. Stocking should be undertaken so as to avoid risks of disease transfer, including crayfish plague where white-clawed crayfish populations are at risk. Exploitation and removals should not cause significant suppression of characteristic fish species (e.g. Atlantic salmon, eel, pike) or affect the balance of the fish or wider biological community. The stocking of carp to still waters immediately adjacent to SAC rivers is undesirable if there is continuity between river and still water during periods of flood and no effective biosecurity measures are in place. Stocking for population conservation purposes should only be considered as an interim measure whilst underlying environmental problems are addressed, and should not be undertaken if natural recovery can be achieved in reasonable timescales. Fish should be sourced to avoid impacts on the genetic integrity of local populations (including sub-catchment genetics where appropriate, e.g. for salmon). There is no history of trout stocking in the River Derwent SAC although stocking does occur in the upstream tributaries outside the SAC. Current densities of trout within the SAC are estimated to be <1-3 fish 100m².	Technical Specialist (*pers. comm*)
Structure and function (including its typical species)	Vegetation structure: riparian zone	Maintain a structurally-diverse riparian zone by livestock grazing at suitably low levels.	Grazing animals with waterside access can, if carefully managed, be important to the structure of riparian vegetation and the full expression of river channel habitat, benefiting the range of SAC features. Ideally, grazing levels should be managed at low levels across whole riparian fields. Where this is not feasible, set-back fencing may be established with access provision for limited grazing within the riparian zone. Particularly sensitive areas (e.g. exposed riverine sediments likely to support good invertebrate communities) may need to be fenced off to avoid any concentration of livestock activity, even if only present in low numbers. Close bankside fencing that excludes the development of a functional river corridor is not appropriate.	ROYAL HASKONING, 2010.
Supporting processes (on which the	Air quality	Maintain the concentrations and deposition of air	This habitat type is considered sensitive to changes in air quality. Exceedance of these critical values for air pollutants may modify the chemical status of its substrate, accelerating or damaging plant growth, altering its vegetation structure and composition	More information about site-relevant Critical

Attributes		Targets	Supporting and/or Explanatory Notes	Sources of site-based evidence (where available)
feature relies)		pollutants to at or below the site-relevant Critical Load or Level values given for this H3260 feature of the site on the Air Pollution Information System (www.apis.ac.uk).	and causing the loss of sensitive typical species associated with it. Critical Loads and Levels are recognised thresholds below which such harmful effects on sensitive UK habitats will not occur to a significant level, according to current levels of scientific understanding. There are critical levels for ammonia (NH3), oxides of nitrogen (NOx) and sulphur dioxide (SO2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. No critical loads currently available on APIS for the features of interest.	Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.co.uk).
Structure and function (including its typical species)	Cover of submerged macrophytes	Maintain a sufficient proportion of all aquatic macrophytes to enable them to reproduce in suitable habitat,	Removal of submerged aquatic vegetation (often called 'weed-cutting') might be undertaken for flood risk management or fishery purposes. Except in situations of extreme flood risk, best practice is for cutting to leave a mosaic of submerged and marginal vegetation, and should promote a characteristic diversity of plant species. It is recommended that where appropriate a weed management plan is developed for the site, allowing for higher levels of cutting at flood risk pinch-points, balanced by lower levels of cutting in other stretches. Any weed-cutting operations should be undertaken to leave a sufficient proportion of in-channel and marginal vegetation in the river to support characteristic river wildlife (in terms of cover, food supply and spawning substrate). Weed-cutting should not interfere with the ability of the river channel to downsize through encroachment of marginal vegetation during the summer flow recession. Weed cutting is currently not undertaken in the designated section of the river.	
	Screening of intakes and discharges	Ensure adequate screening of any intakes and discharges likely to trap a significant	Intakes and discharges can be responsible for significant mortalities of fish, especially those which need to move through estuaries and rivers to complete their life cycle. This puts them at risk of being accidentally drawn into water intakes and outfalls, and in significant numbers.	

Attributes		Targets	Supporting and/or Explanatory Notes	Sources of site-based evidence (where available)
		number of individuals of species characteristic of the H3260 feature	Long-distance migratory species such as Atlantic salmon, lamprey, sea trout and European eel can be particularly susceptible.	
	Supporting off-site habitat	Maintain any habitats beyond the SAC boundary upon which characteristic biological communities associated with the H3260 feature of the site depend	The characteristic biological communities of the site are dependent on the overall integrity of sections of river channel, riparian areas, and transitional and marine waters that lie outside of the site boundary. For example, headwater areas and tributaries may not fall within the site boundary, yet a range of species typical and characteristic of the site may use these areas for spawning and juvenile development and be critical for sustaining their populations within the site. Fully-developed riparian zones are essential to site integrity, yet part of this zone may lie outside of the site boundary, particularly if the river channel is operating under natural processes and moves laterally over time within the floodplain.	ROYAL HASKONING, 2010.
Supporting processes (on which the feature relies)	Adaptation and resilience	Maintain (or restore where resilience is degraded) the H3260 feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either within or external to the site	This recognises the increasing requirement for natural habitat features to absorb or adapt to wider environmental changes. Resilience may be described as the ability of an ecological system to cope with, and adapt to environmental stress and change whilst retaining the same basic structure and ways of functioning. Such environmental changes may include changes in precipitation and temperature, which are likely to affect the extent, distribution, composition and functioning of a feature within a site. Climate change modelling predicts significant changes in rainfall patterns, including increased frequency of prolonged droughts and more frequent storm events. These effects are likely to impose significant stress on mire systems through drying out, increased risk of fire, threat of erosion and increased variation in water levels. The vulnerability and response of features to such changes will vary. Using best available information, any necessary or likely adaptation or adjustment by the feature and its management in response to actual or expected climatic change should be allowed for, as far as practicable, in order to ensure the feature's long-term viability. The overall vulnerability of this particular SAC to climate change has been assessed by Natural England as being *high*, taking into account the sensitivity, fragmentation, topography and management of its habitats and supporting habitats. This means that action to address specific issues is urgent, such as reducing habitat fragmentation, creating more habitat to buffer the site or expand the habitat into more varied landscapes and addressing particular management and condition issues. Individual species may be	NATURAL ENGLAND, 2015.

Attributes		Targets	Supporting and/or Explanatory Notes	Sources of site-based evidence (where available)
			more or less vulnerable than their habitat itself. In many cases, change will be inevitable so appropriate monitoring would be required. A site based assessment should be carried out as a priority.	
Version Control Advice last updated: Explanatory notes updated in light of comments on draft advice dated 11 March 2016.				
Variations from national feature-framework of integrity-guidance: None				

Table 2: Supplementary Advice for Qualifying Features: S1095 Sea lamprey *Petromyzon marinus*; S1099 River lamprey *Lampetra fluviatilis*; S1163 Bullhead *Cottus gobio*

Attributes		Targets	Supporting and/or Explanatory Notes	Sources of site-based evidence (where available)
Supporting processes (on which the feature and/or its supporting habitat relies)	Conservation measures	Restore management or other measures (within and/or outside the site boundary as appropriate) necessary to restore the structure, functions and supporting processes associated with these features and their supporting habitats	Active and ongoing conservation management is needed to protect, maintain or restore the Annex II features of this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, site management strategies or plans, the Views about Management Statement for the underpinning SSSI and/or management agreements.	NATURAL ENGLAND, 2015. ENGLISH NATURE, 2005. ROYAL HASKONING, 2010.
Supporting habitat: extent and distribution	Extent of supporting habitat	Maintain the extent of river and stream habitat which supports the features at the baseline value of 368.8 hectares	In order to contribute towards the objective of achieving an overall favourable conservation status of the feature at a UK level, it is important to maintain or if appropriate restore the extent of supporting habitats and their range within this SAC. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection, and may be subject to periodic review in light of improvements in data. The habitats known or likely to support the feature at this SAC are: rivers and streams. The baseline value is derived from the area of the SAC which is 'rivers and streams' which does not include associated riparian habitats for this feature. A further large area of supporting habitat is provided in numerous tributaries outside the boundary of the SAC. The ones which have been identified as having suitable lamprey spawning habitat occur upstream of the SAC boundary to the East at Thornton Beck and the River Derwent at East/West Ayton and to the west Pickering Beck, River Severn, River Dove, River Riccall and River Rye.	
Supporting habitat: extent and distribution	Distribution of supporting habitat	Restore the distribution and continuity of the features and its supporting habitat, including where applicable its component vegetation types and associated transitional vegetation types, across	A contraction in the range, or geographic spread, of these features across the site will reduce its overall abundance, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. Contraction may also reduce and break up the continuity of supporting habitat within a site and how well the species feature is able to occupy and use habitat within the site.	

Attributes		Targets	Supporting and/or Explanatory Notes	Sources of site-based evidence (where available)
		the site	Such fragmentation may have a greater amount of open edge habitat which will differ in the amount of light, temperature, wind, and even noise that it receives compared to its interior. These conditions may not be suitable for these features and this may affect its viability.	
Supporting processes (on which the feature and/or its supporting habitat relies)	Adaptation and resilience	Maintain the features' ability, and that of their supporting habitats, to adapt or evolve to wider environmental change, either within or external to the site	As above in Table 1	ROYAL HASKONING, 2010.
Supporting habitat: structure/ function	Biotope mosaic	See the target above for the H3260 habitat feature	Habitat conditions for lamprey species vary naturally in rivers. Some river sections may provide optimal habitat for some or all life stages whilst others may be largely unsuitable. Adult lamprey require spawning substrates of coarse material in which to deposit eggs in shallow scrapes ('redds'). Larval lamprey ('ammocoetes') live in silt beds, which are often in channel margins but in relation to sea lamprey are known to occur in deep water in main river reaches. Habitat conditions for bullhead vary naturally in rivers. Optimal conditions typically occur in relatively shallow, fast flowing reaches with coarse substrates (used for egg-laying and juvenile/adult cover). A characteristically diverse mosaic of habitat allows the bullhead and other species to move within the channel to locate optimal habitat conditions in the face of a fluctuating flow regime. Pools, exposed tree root systems and marginal shallows are important high-flow refugia for the species. The advice for the H3260 habitat feature is based on natural river function, which provides a characteristic river habitat mosaic that can cater for both bullhead and lamprey life stages to a degree.	
	Riparian zone	See the target above for the H3260 habitat feature	Active marginal vegetation including riparian trees provides important habitat for lamprey ammocoetes, as it encourages and stabilises the formation of silt beds in which ammocoetes burrow. Riparian trees also add substrate diversity and aid the formation of siltbeds and clean gravels. They also provide temperature gradients in the channel that improves the availability of suitable micro-habitat.	ROYAL HASKONING, 2010. NATURAL ENGLAND & ENVIRONMENT AGENCY, 2014.
	Woody debris	See the target above for the H3260 habitat feature	Woody debris is an important component of river habitat for lampreys as well as the wider biological community. It encourages characteristic heterogeneity in biotopes, provides a mosaic of substrates types that lamprey species need to fulfil their life cycle.	

Attributes		Targets	Supporting and/or Explanatory Notes	Sources of site-based evidence (where available)
	Flow regime	See the target above for the H3260 habitat feature	The natural flow regime is critical to all aspects of lamprey life cycle. It shapes the characteristic biotope mosaic, maintains water in critical biotopes (including marginal siltbeds), and provides adequate flows for migratory passage (which is important for river and sea lamprey). The natural flow regime is also critical to all aspects of the bullhead life cycle, maintaining the high current velocities and substrate conditions that are optimal for the species.	
	Sediment regime	See the target above for the H3260 habitat feature	Natural levels of coarse sediment supply are critical to the maintenance of high quality spawning habitat for lamprey species, maintaining bed substrates in optimal condition for egg-laying and juvenile and adult cover. Excessive delivery of fine sediment, from the catchment or artificially enhanced bank erosion, can cause siltation of egg-laying sites and juvenile and adult refugia.	
	Biological connectivity	See the target above for the H3260 habitat feature	Lampreys can pass some potential barriers by attaching themselves to structures or river banks by their suctorial discs and creeping up by strong bursts of swimming. However, many in-channel structures are known to either completely or partially block access to historical spawning grounds. Whilst in-channel structures can artificially generate both silt beds and clean gravels, both of value to lamprey species, this is not a justification for their continued existence or the construction of new structures. Suitable habitat for lamprey and other species can and should be generated by natural processes - where physical restoration of the channel is required this may involve changes in the distribution of species within the river system. Vertical drops of >18 cm are sufficient to prevent upstream movement of adult bullhead. They will therefore prevent re-colonisation of upper reaches affected by lethal pollution episodes or drought, and more generally will also lead to constraints on genetic interactions that may have adverse consequences.	
	Water quality - nutrients	Restore the natural nutrient regime of the river, with any anthropogenic enrichment above natural/background concentrations to levels at which adverse effects	Nutrient enrichment can lead to loss of substrate condition for spawning, egg development and ammocoete growth, due to benthic algal growth and associated enhanced siltation and sediment anoxia.	

Attributes		Targets	Supporting and/or Explanatory Notes	Sources of site-based evidence (where available)
		on the feature are unlikely.		
Supporting habitat: structure/ function	Water quality - organic pollution	See the target above for the H3260 habitat feature	Lamprey species may be affected by both episodic and chronic organic pollution. Episodic pollution causes direct mortalities whilst chronic pollution affects substrate condition through the build-up of excessive microbial populations. The reduction in Dissolved Oxygen (DO) levels in the summer months (which is caused by warmer temperatures and increased decomposition rates) in the Humber Estuary is considered to be a barrier to lamprey migration. DO targets therefore need to be met in the Humber Estuary SAC to minimise any potential barriers to migration.	
	Water quality - acidification	See the target above for the H3260 habitat feature	Whilst this is not considered applicable to lamprey features (as WFD waterbody type is not classified as siliceous or peat on the designated section of the river which is in the lower part of the catchment), bullhead is susceptible to acidification stress in low alkalinity waters. Maps of critical loads provide an indication of acidification hotspots.	
	Water quality - other pollutants	See the target above for the H3260 habitat feature	Bullhead and Lamprey species can be detrimentally affected by a range of pollutants.	
	Invasive non-native species	See the target above for the H3260 habitat feature	Species such as signal crayfish can have a serious effect on bullhead and lamprey habitat and may predate heavily on ammoecoetes of all lamprey species if present at high densities. Chinese mitten crab is also of concern, not only in the lower reaches of main river but due to its potential to migrate long distances upstream. Chinese mitten crab has been recorded at Loftsome Bridge and Bubwith. Signal crayfish has been recorded at Settrington Beck, Priorpot Beck (Malton) and the main river at Malton/Norton. Terrapin has been recorded just downstream of Kirkham.	EA Biodiversity Technical Specialist (*pers. comm*.)
	Fisheries - introduction of fish species	Ensure fish stocking/introductions do not interfere with the ability of the river to support self-sustaining populations of each of the features	The presence of artificially high densities of fish may create unacceptably high levels of predatory pressure on the ammocoetes of all species. The management aim is to provide conditions in the river that support a healthy, natural and self-sustaining lamprey and bullhead population, achieved through habitat protection/restoration and the control of exploitation as necessary. Stocking represents a loss of naturalness and, if successful, obscures the underlying causes of poor performance (potentially allowing these risks to perpetuate). It carries various ecological risks, including the loss of natural spawning from brood stock,	

Attributes		Targets	Supporting and/or Explanatory Notes	Sources of site-based evidence (where available)
			competition between stocked and naturally produced individuals, disease introduction and genetic alterations to the population	
	Fisheries - exploitation	Ensure all exploitation (e.g. netting or angling) of lamprey species is undertaken sustainably without compromising any components of their populations	Controls on exploitation should include migratory passage within territorial waters, including estuarine and coastal net fisheries, as well as exploitation within the river.	
	Vegetation structure: riparian zone	See the target above for the H3260 habitat feature	Over-grazing of riparian areas can have a dramatic effect on fish habitat, trampling marginal silt beds, eliminating marginal vegetation and generating excessive loads of fine sediment on spawning gravels.	
Supporting habitat: structure/ function	Screening of intakes and discharges	See the target above for the H3260 habitat feature	Bullhead, adult lamprey and migrating sub-adult lamprey ('transformers') can be caught in intakes and discharges, along with other fish species.	
	Integrity of off-site habitats	See the target above for the H3260 habitat feature	Bullhead and Lamprey populations may be dependent on the integrity of sections of river channel, riparian areas and transitional and marine waters that lie outside of the site boundary. Headwater areas and tributaries may not fall within the site boundary, yet lamprey (particularly river lamprey) may use these areas for spawning and juvenile development and be critical for sustaining populations within the site downstream. To return to their riverine habitats, river and sea lamprey require safe passage through coastal waters and estuaries.	
Population (of the feature)	Population abundance	Restore the abundance of the bullhead and lamprey populations to levels which are close to that expected under un-impacted conditions throughout the site (subject to natural habitat conditions and allowing for natural fluctuations), whilst avoiding deterioration from current	This ensures there is a viable population of the features which is being maintained or increased to a level that contributes as appropriate to its Favourable Conservation Status across its natural range in the UK. The baseline extent has been generated using data gathered from the listed site-based surveys. Due to the dynamic nature of population change, the baseline-value given may be subject to periodic review and unless otherwise stated, the baseline-value will be an 'average' population size derived from standard methodologies, for example a peak mean count over a number of years. This value is also provided recognising there will be variability as a result of natural fluctuations and margins of error during data collection. Whilst we will endeavour to	ROYAL HASKONING, 2010; ENVIRONMENT AGENCY. Fish population surveys BEST Sea lamprey surveys 2007, 2009 Lamprey and

Attributes		Targets	Supporting and/or Explanatory Notes	Sources of site-based evidence (where available)
		levels as indicated by the latest count or equivalent; Sea and River lamprey: ammocoete populations should have at least two age classes Bullhead: average adult density>0.5 individuals/m² with healthy age-class structure (>40% of individuals in the 0+ age class)	keep these values as up to date as possible, local Natural England staff can advise that the figures stated are correct. The figures given below for the River Derwent SAC populations are based upon it being an 'impacted' river. Populations expected under un-impacted conditions are likely to be significantly higher. Work is being undertaken via the River Restoration Plan to potentially remove or modify causes of impaction. The current population of adult returning river lamprey is estimated to be 1,000 individuals. The current population of adult returning sea lamprey is estimated to be 1-15 individuals. Sea lamprey have been historically recorded as far upstream as Kirkham Abbey, numbers are relatively low and tend to have had a confined and infrequent distribution only being recorded downstream of Stamford Bridge. Small numbers have been recorded in routine fish population surveys undertaken by the Environment Agency at Stamford Bridge in 1998 and Elvington in 2003. In 2016 a sea lamprey ammocoete was identified at Nunnington (on the River Rye upstream of the SAC boundary) as part of EA standard surveying. This confirms for the first time that sea lamprey have spawned upstream of the SAC and are not just confined to the lower reaches. The SAC data form confirms that bullhead have a significant presence and that the river is thought to hold 0 – 2% of the national population. Within parts of the SAC they have an estimated abundance of 10-100 individuals/100m² in areas with suitable habitat. As with lamprey this is a current estimate with impacted conditions and the population under un-impacted conditions is likely to be much higher. Bullhead is also thought to be abundant outside the boundary of the SAC in the many associated tributaries.	Bullhead population estimated from Humber Estuary Review of Consents project (EA 2008)
Population (of the feature)	Juvenile densities	Restore juvenile densities to those expected under un-impacted conditions throughout the site (taking into account natural habitat conditions and allowing for natural fluctuations)	Impacts on physical, chemical or hydrological integrity, or from non-native species, may suppress juvenile densities. The figures given for the River Derwent SAC populations are based upon it being an 'impacted' river. Populations expected under un-impacted conditions are likely to be significantly higher. Work is being undertaken via the River Restoration Plan to potentially remove or modify causes of impaction. Based upon the research undertaken to support the Humber Estuary Review of Consents (EA 2008) that 1 adult = 28 leaving transformers, the current impacted	

Attributes		Targets	Supporting and/or Explanatory Notes	Sources of site-based evidence (where available)
			densities are estimated to be; Sea lamprey juveniles = 28 – 420. River lamprey juveniles = 28,000.	
Version Control Advice last updated: Explanatory notes updated in light of comments on draft advice dated 11 March 2016.				
Variations from national feature-framework of integrity-guidance: Not applicable				

Table 3: Supplementary Advice for Qualifying features: S1355 Otter *Lutra lutra*

Attributes		Targets	Supporting and/or Explanatory Notes	Sources of site-based evidence (where available)
Supporting processes (on which the feature and/or its supporting habitat relies)	Conservation measures	Maintain management or other measures (within and/or outside the site boundary as appropriate) necessary to maintain the structure, functions and supporting processes associated with the feature are underway and are not being undermined or compromised.	As above in table 2	NATURAL ENGLAND, 2015. ENGLISH NATURE, 2005. ROYAL HASKONING, 2010.
Supporting habitat: extent and distribution	Extent of supporting habitat	Maintain the extent of habitat(s) which supports the Otter feature at or above 411.23 hectares, to include: 368.8ha rivers and streams 20.9ha neutral grassland 8.7ha standing open water 6.9ha Wet woodland 2.8ha fen, marsh, swamp	In order to contribute towards the objective of achieving an overall favourable conservation status of the Otter feature at a UK level, it is important to maintain or if appropriate restore the extent of supporting habitats and their range within this SAC. Further supporting habitat is available outside the boundary of the SAC where there are numerous tributaries extending into a predominantly rural catchment with areas of relatively undisturbed wet woodland and marginal habitat. A network of farm and fishing ponds may also supplement the river's food supply. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection, and may be subject to periodic review in light of improvements in data.	
	Distribution of supporting habitat	Maintain the distribution and continuity of the feature and its supporting habitat, including where applicable its component vegetation types and associated transitional vegetation types, across the site	As above in table 2.	
Supporting processes (on which the feature and/or its supporting habitat relies)	Adaptation and resilience	Maintain the feature's ability, and that of its supporting habitat, to adapt or evolve to wider environmental change, either within or external to the site	As above in table 1	

Attributes		Targets	Supporting and/or Explanatory Notes	Sources of site-based evidence (where available)
Supporting habitat: structure/ function	Habitat quality: river	Maintain the quality of supporting river habitat features, based on the advice above for the H3260 feature, to provide a characteristic biotope mosaic required by otters	Dense bank vegetation, marshes and reed-beds are important for otters, but they will use a long stretch of river and this won't necessarily fall within a protected site. Dense bank vegetation and reedbeds are favoured as resting areas, but otters will often travel some distance to a preferred 'couch' and this will not necessarily be along the edge of the river. The structure and quality of bankside vegetation, reedbeds and other nearby habitats should be maintained, particularly where there is evidence of use by otters.	
	Habitat quality - waterways	Maintain the quality of supporting waterway habitat such as associated tributaries of the Derwent	The smaller tributaries of larger river systems (streams, becks etc) are extremely important for otters and have been shown to have been used more frequently by otters than larger rivers. This is thought to be in part due to differences in fish density and preference for hunting in shallow water with areas of riffles and boulders.	ROYAL HASKONING, 2010.
	Food availability	Maintain fish biomass at expected natural levels of biomass (subject to natural fluctuations).	In freshwaters, key fish prey sources for otters include eels, salmonids, roach and sticklebacks. Frogs can also form an important part of the diet, depending on the habitat and time of year. Crayfish and water beetles may also form part of the diet, as well as an occasional water bird (young coots, moorhens, ducks) or mammal (rabbits, water voles - although this is uncommon). The diet of otters varies depending on the availability of prey, which in turn varies with the time of year. There should be a diverse range of food sources available throughout the year, within the normal expectations of each particular water course. Otters may also take prey from adjacent fisheries which are stocked to an artificially high level, especially where there are numerous stocked gravel pits on a floodplain. This can lead to artificially high prey densities adjacent to European sites, which might be expected to, in turn, result in artificially high densities of otter on the designated sites. This highlights the importance of biosecurity around stocked fisheries, and if implemented at all artificial still water fisheries on a floodplain might result in a legitimate reduction in otter density.	
Supporting habitat: structure/ function	Abundance of breeding and resting places	Maintain an abundance of natural breeding and resting sites within the site	Otters are highly mobile and are likely to spend their time within wider territories, where designated sites only form a proportion of their range and make a contribution to their wider requirements. Otters are a European protected species, and it is an offence to disturb their	ROYAL HASKONING, 2010.

Attributes		Targets	Supporting and/or Explanatory Notes	Sources of site-based evidence (where available)
			resting places. Otters will often use many holts at any one time. They may give birth in one, but raise their young in another. Important features of a successful breeding site are the availability of food, limited disturbance and safety from the risk of flooding. It is important to consider the whole site and not just the known holts as appropriate management will influence all of these factors. Some natal den structures have a limited lifespan (e.g. hollow tree trunks, piles of timber etc.) and if alternative opportunities for natal dens are limited, suitable replacements can be created or constructed. Maintaining dense bank vegetation, areas of reed etc. will ensure that there are suitable areas for resting couches.	
	Availability of refugia	Maintain an abundance of dense bankside vegetation to limit significant disturbance to animals	For rivers, most of the floodplain lies outside the boundary of the designated site, yet the Otter feature will often be dependent upon the quality of the adjacent habitat within the river's wider floodplain. This is likely to be the case where bankside vegetation may be an important refuge from and barrier to disturbing activity but may lie adjacent to and outside the boundary. Nevertheless it will be important to maintain, or in some cases, to restore dense bankside cover.	
Supporting habitat: structure/ function	Water quantity	See target for the H3260 feature above.	Permanent or long-lasting reductions in flow may affect the availability and diversity of otter prey. This could lead to otters moving into new areas to feed, increasing the likelihood of conflict with other otters. This may also alter the prey targeted by otters as they may hunt for alternative, low-preference food such as birds, rabbits, fish carrion or for frogs, depending on the time of year, which may affect their fitness and condition.	
	Water quality/quantity	Ensure water quality and quantity is restored to a standard which provides the necessary conditions to support the feature. Flow targets for the H3260 feature should be met.	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year during key stages of their life cycle. Poor water quality and inadequate quantities of water can adversely affect the availability and suitability of breeding, rearing and feeding habitats for otter. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the SAC Conservation Objectives but in some cases more stringent standards may be needed to support the SAC feature.	NATURAL ENGLAND, 2014

Attributes		Targets	Supporting and/or Explanatory Notes	Sources of site-based evidence (where available)
			Further site-specific investigations may be required to establish appropriate standards for the SAC. The main impact of water chemistry on this feature is its effect on the food supply. For example, moderate levels of levels of eutrophication may increase certain fish populations, but excessive eutrophication can be detrimental. Excessive acidity in watercourses may also affect fish populations. Impacts from toxic pollutants can be devastating and were the major cause of otter population declines in the 1950s, 60s and 70s.	
Supporting processes (on which the feature and/or its supporting habitat relies)	Water quality : Toxic chemicals	Avoid any increase in the level of pollutants which are potentially toxic to otters.	The major cause of the decline in otter populations in the 1960s and 1970s was toxic chemicals such as dieldrin and related pesticides. Otters remain sensitive to such contaminants, as they can have indirect effects (e.g. on food supply through organic pollution, eutrophication, acidification from mine waste and acid rain), direct effects (e.g. oil spillage, radioactivity) or effects of bioaccumulation (e.g. build-up of metals, especially mercury, cadmium and lead; pesticides and PCBs). PCBs, organochlorine pesticides and heavy metals all being seen as detrimental to otters, although the use of many of these is now banned.	
Supporting processes (on which the feature and/or its supporting habitat relies)	Connectivity within and to the site	Ensure there are no significant artificial barriers to the safe passage and movement of otters into, within and away from the site	Artificial barriers to otter movement such as roads and weirs can generally increase the risk of harm to animals as they either traverse or avoid them. Otter populations within the SAC are likely to be dependent on the integrity of sections of river channel, riparian areas, freshwater still-waters, floodplains and transitional and marine waters that lie outside of the site boundary. Headwater areas and tributaries may not fall within the site boundary, yet otters may use these areas for feeding and these will be critical for sustaining populations within the site. Boundaries to river SACs often follow the first break of slope on the bank, with the result that much of the riparian habitat will lie outside the SAC, particularly if the river channel is operating under natural processes and moves laterally over time within the floodplain. It is possible that some holts of otters that form part of the population for a SAC may lie on the adjacent floodplain out with the boundary of the SAC.	
Population (of the feature)	Population abundance	Maintain the continued presence of an actively-breeding otter population within the SAC, whilst avoiding deterioration from its current level as indicated by the	This will ensure there is a viable population of the feature which is being maintained at or increased to a level that contributes as appropriate to its Favourable Conservation Status across its natural range in the UK. Due to the dynamic nature of population change, the target-value given for	JNCC. 2001. EA Review of Consents otter records (Appendix

Attributes		Targets	Supporting and/or Explanatory Notes	Sources of site-based evidence (where available)
		latest mean peak count, estimate or equivalent.	the population size or presence of this feature is considered to be the minimum standard for conservation/restoration measures to achieve. Any minimum-value given may be revised where there is evidence to show that a population's size or presence has significantly changed as a result of natural factors or management measures and has been stable at or above a new level over a considerable period. The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is designated, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account in any assessment. Unless otherwise stated, the population size or presence will be that measured using standard methods, such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of natural fluctuations and margins of error during data collection. Whilst we will endeavour to keep these values as up to date as possible, local Natural England staff can advise that the figures stated are the best available. The SAC data form confirms that otter have a significant population in the River Derwent SAC and that the river is thought to hold 0 – 2% of the national population. There is no supporting survey information for the population size specifically within the SAC. However, surveys of small sections and casual records confirm continued presence and breeding activity throughout the SAC. The National Otter Surveys do not provide a population estimate but by checking for presence at designated 600m sections can show population trends. Signs of otter presence in the 20 sections on the Derwent increased from 0 in 1977/8 to 15 in the last survey (2009/10). It is stated that the carrying capacity will be reached when 80% positive signs have been	26) CRAWFORD, 2012

Attributes		Targets	Supporting and/or Explanatory Notes	Sources of site-based evidence (where available)
			recorded on two consecutive surveys. Based upon this the River Derwent is yet to reach its carrying capacity for otters.	
Population (of the feature)	Anthropogenic mortality	Reduce otter mortality as a result of anthropogenic (man-made) factors to a level which is not adversely affecting the overall abundance and viability of the population.	High numbers of otter casualties within or adjacent to SAC catchments will adversely affect the condition and viability of the population and mitigation measures to avoid or reduce such causalities should be initiated as quickly as possible. Human-caused mortality may include roads, accidents with fishing equipment (nets, lobster creels), poisoning, pollutants, hunting and acidification/contamination of water courses. Otter mortality associated with roads has been noted within the SAC during times of flooding or when the river levels are very high and preferred movement pathways are drowned out or inaccessible. At these times the otters have been observed crossing busy roads over bridges instead of their normal route underneath. An average of one dead otter per year has been recorded on or near to road bridges since 1999 (usually in winter) with greater numbers in years of prolonged very high flows and several years with no recorded deaths. Measures may be needed to reduce otter mortality. Ledges were fitted to a bridge in Norton, Malton to prevent the need for Otters to cross the road following two fatalities in late 2005 and early 2006. Other deaths are spread across the full length of the SAC and are not thought to have adversely affected the viability of the population as a whole as otter numbers have steadily increased on the Derwent in each National Otter survey since 1978.	CRAWFORD, 2012.
Version Control Advice last updated: Not applicable				
Variations from national feature-framework of integrity-guidance: Attributes and references relating to coastal otters have not been applied as only the inland attributes are relevant to this SAC.				

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European Site Conservation Objectives for River Derwent Special Area of Conservation Site code: UK0030253

With regard to the SAC and the natural habitats and/or species for which the site has been designated (the 'Qualifying Features' listed below), and subject to natural change;

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.**

This document should be read in conjunction with the accompanying *Supplementary Advice* document, which provides more detailed advice and information to enable the application and achievement of the Objectives set out above.

Qualifying Features:

H3260. Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation; Rivers with floating vegetation often dominated by water-crowfoot

S1095. *Petromyzon marinus*; Sea lamprey

S1099. *Lampetra fluviatilis*; River lamprey

S1163. *Cottus gobio*; Bullhead

S1355. *Lutra lutra*; Otter

Explanatory Notes: European Site Conservation Objectives

These Conservation Objectives are those referred to in the Conservation of Habitats and Species Regulations 2017 as amended from time to time (the “Habitats Regulations”). They must be considered when a competent authority is required to make a ‘Habitats Regulations Assessment’, including an Appropriate Assessment, under the relevant parts of this legislation.

These Conservation Objectives and the accompanying Supplementary Advice (where available) will also provide a framework to inform the measures needed to conserve or restore the European Site and the prevention of deterioration or significant disturbance of its qualifying features.

These Conservation Objectives are set for each habitat or species of a Special Area of Conservation (SAC). Where the objectives are met, the site will be considered to exhibit a high degree of integrity and to be contributing to achieving Favourable Conservation Status for that species or habitat type at a UK level. The term ‘favourable conservation status’ is defined in regulation 3 of the Habitats Regulations.

Publication date: 27 November 2018 (version 3). This document updates and replaces an earlier version dated 30 June 2014 to reflect the consolidation of the Habitats Regulations in 2017.

European Site Conservation Objectives for Skipwith Common Special Area of Conservation Site Code: UK0030276

With regard to the SAC and the natural habitats and/or species for which the site has been designated (the 'Qualifying Features' listed below), and subject to natural change;

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

This document should be read in conjunction with the accompanying *Supplementary Advice* document, which provides more detailed advice and information to enable the application and achievement of the Objectives set out above.

Qualifying Features:

H4010. Northern Atlantic wet heaths with *Erica tetralix*; Wet heathland with cross-leaved heath

H4030. European dry heaths

Explanatory Notes: European Site Conservation Objectives

These Conservation Objectives are those referred to in the Conservation of Habitats and Species Regulations 2017 as amended from time to time (the “Habitats Regulations”). They must be considered when a competent authority is required to make a ‘Habitats Regulations Assessment’, including an Appropriate Assessment, under the relevant parts of this legislation.

These Conservation Objectives and the accompanying Supplementary Advice (where available) will also provide a framework to inform the measures needed to conserve or restore the European Site and the prevention of deterioration or significant disturbance of its qualifying features.

These Conservation Objectives are set for each habitat or species of a Special Area of Conservation (SAC). Where the objectives are met, the site will be considered to exhibit a high degree of integrity and to be contributing to achieving Favourable Conservation Status for that species or habitat type at a UK level. The term ‘favourable conservation status’ is defined in regulation 3 of the Habitats Regulations.

Publication date: 27 November 2018 (version 3). This document updates and replaces an earlier version dated 30 June 2014 to reflect the consolidation of the Habitats Regulations in 2017.

European Site Conservation Objectives: Supplementary advice on conserving and restoring site features

Skipwith Common Special Area of Conservation (SAC)
Site Code: UK0030276

Photo credit: Peter Roworth

Date of Publication: 14 March 2019

About this document

This document provides Natural England's supplementary advice about the European Site Conservation Objectives relating to Skipwith Common SAC.

This advice should therefore be read together with the SAC Conservation Objectives available here.

This advice replaces a draft version dated 25 January 2019 following the receipt of comments from the site's stakeholders.

You should use the Conservation Objectives, this Supplementary Advice and any case-specific advice given by Natural England, when developing, proposing or assessing an activity, plan or project that may affect this site.

The tables provided below bring together the findings of the best available scientific evidence relating to the site's qualifying features, which may be updated or supplemented in further publications from Natural England and other sources. The local evidence used in preparing this supplementary advice has been cited. The references to the national evidence used are available on request. Where evidence and references have not been indicated, Natural England has applied ecological knowledge and expert judgement. You may decide to use other additional sources of information.

This Supplementary Advice to the Conservation Objectives presents attributes which are ecological characteristics of the designated species and habitats within a site. The listed attributes are considered to be those that best describe the site's ecological integrity and which, if safeguarded, will enable achievement of the Conservation Objectives. Each attribute has a target which is either quantified or qualitative depending on the available evidence. The target identifies as far as possible the desired state to be achieved for the attribute.

In many cases, the attribute targets shown in the tables indicate whether the current objective is to 'maintain' or 'restore' the attribute. This is based on the best available information, including that gathered during monitoring of the feature's current condition. As new information on feature condition becomes available, this will be added so that the advice remains up to date.

The targets given for each attribute do not represent thresholds to assess the significance of any given impact in Habitats Regulations Assessments. You will need to assess this on a case-by-case basis using the most current information available.

Some, but not all, of these attributes can also be used for regular monitoring of the actual condition of the designated features. The attributes selected for monitoring the features, and the standards used to assess their condition, are listed in separate monitoring documents, which will be available from Natural England.

These tables do not give advice about SSSI features or other legally protected species which may also be present within the European Site.

If you have any comments or queries about this Supplementary Advice document please contact your local Natural England adviser or email HDIRConservationObjectivesNE@naturalengland.org.uk

About this site

European Site information

Name of European Site	Skipwith Common Special Area of Conservation (SAC)
Location	North Yorkshire
Site Map	The designated boundary of this site can be viewed here on the MAGIC website
Designation Date	01 April 2005
Qualifying Features	See section below
Designation Area	295.20 ha
Designation Changes	None
Feature Condition Status	Details of the feature condition assessments made at this site can be found using Natural England's Designated Sites System
Names of component Sites of Special Scientific Interest (SSSIs)	Skipwith Common SSSI which is also a National Nature Reserve.
Relationship with other European or International Site designations	None

Site background and geography

Skipwith Common SAC is situated approximately 10 miles south of York within the Humberhead Levels National Character Area (NCA Profile 39). It is one of only two extensive areas of open heathland in the Vale of York (the other being Strensall Common SAC to the north of York). It is located on a spur of glacial sands which forms the watershed between the valleys of the lower River Derwent to the east and River Ouse to the west. The highest point is 10.46m AOD and the lowest point is 7.80m AOD. The slight fluctuations in height across the Common show no particular trend, but has been influenced both by the natural processes of wind blowing sand and by human activities such as peat-digging and coal-mining subsidence.

The geology of the site consists of a layer of varying thickness (usually 1-2m deep) of post-glacial Aeolian sands overlying a layer of lacustrine laminated clays. The laminated clays overlay a thick belt of glacial boulder clay. The solid geology below these layers consists of a 250m thick belt of Bunter sandstone.

The soils over most of Skipwith Common are classified as Formby and Everingham series sandy gley soils. This is a deep stoneless black sandy soil, although there is widespread evidence of podsolisation across the Common. The northern part of the Common is characterised by Holme Moor/Sandburn gley-podsols. There are surface deposits of Holocene peats varying in thickness from 30-60cm, although it is likely that many deeper deposits have been cut over in the past for fuel. Areas around the concrete runways at the western end of the Common are locally more base-rich.

Skipwith Common has long been recognised for its Nature Conservation Importance and is described in the Nature Conservation review (Ratcliffe 1977) as the largest single tract of wet heathland in the north of England. The Common also supports extensive areas of dry heath and the heathland communities form a complex mosaic across the site together with areas of mire, rush pasture, reed bed and woodland. The Common is renowned for its ornithological and entomological interest. In addition to many commoner woodland birds, heathland specialists include tree pipits, green woodpeckers, woodlark and in some years, nightjars. The wetter parts of the site hold a selection of ducks, whilst water rail is also recorded. The site is supports a diverse moth community and 16 species dragonfly and damselfly.

Skipwith Common retains an extensive and intact historic landscape which provides insight into activity here from the Bronze Age to the modern day. It is situated in the centre of an area rich in evidence of prehistoric settlement and activity. Outside the common this evidence is largely known as below-ground features visible as crop-marks, however on the Common the nature of past land management has allowed very significant monuments to survive as upstanding earthworks. The importance of this survival is indicated by the scheduled status of a number of prehistoric burial monuments. Perhaps most notable amongst these are the iron-age square barrows which very rarely survive as such upstanding monuments. An Iron Age or Romano-British enclosure near the northern boundary has also been identified from aerial photography by Historic England. A much later period of activity on the Common is indicated by extensive survival of the WWII Ricall Airfield which existed here. These remains are of regional importance and contribute to our understanding of mid 20th century military activity across the region.

Today, the site is managed as a National Nature Reserve by the owner in partnership with Natural England.

About the qualifying features of the SAC

The following section gives you additional, site-specific information about this SAC's qualifying features. These are the natural habitats and/or species for which this SAC has been designated.

Qualifying habitats:

- **H4030 European dry heaths**

European dry heaths typically occur on freely-draining, acidic to circumneutral soils with generally low nutrient content. Ericaceous dwarf-shrubs dominate the vegetation. The most common is heather *Calluna vulgaris*, which often occurs in combination with gorse *Ulex* spp., bilberry *Vaccinium* spp. or bell heather *Erica cinerea*, though other dwarf-shrubs are important locally. At Skipwith Common the dry heath element is an example of H9 *Calluna vulgaris – Deschampsia flexuosa* heath dominated by heather *Calluna vulgaris.* It is relatively species poor and is considered to be an example of the species poor sub community of this NVC type. The dry heath has significant ornithological importance, with heathland specialists such as tree pipits *Anthus trivialis*, woodlark *Lullula arborea* and nightjar *Caprimulgus europaeus* all being recorded is recent years. A diverse invertebrate fauna is associated with the dry heath communities.

- **H4010 Northern Atlantic wet heaths with Erica tetralix**

Wet heath usually occurs on acidic, nutrient-poor substrates, such as shallow peats or sandy soils with impeded drainage. The vegetation is typically dominated by mixtures of cross-leaved heath *Erica tetralix*, heather *Calluna vulgaris*, grasses, sedges and *Sphagnum* bog-mosses.

The northern Atlantic wet heath at Skipwith Common is extensive. It largely comprises the M16 *Erica tetralix – Sphagnum compactum* wet heath NVC community and is dominated by cross-leaved heath *Erica tetralix* and purple moor-grass *Molinia caerulea*. Again the vegetation is relatively species poor when compared with some southern heaths but there is a small population of marsh gentian *Gentiana pneumonanthe.* The wet heath forms a complex mosaic with; open water, mire, fen, reed swamp and the European dry heath habitat. As with the dry heath communities the wet heath habitat has significant entomological and ornithological importance.

Qualifying Species:

- None

Table 1: Supplementary Advice for Qualifying Features: H4010. Northern Atlantic wet heaths with *Erica tetralix*; Wet heathland with cross-leaved heath

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	**Extent of the feature within the site**	Maintain the total extent of the H4010 feature at approximately 52ha	There should be no measurable reduction (excluding any trivial loss) in the extent and area of this feature, and in some cases, the full extent of the feature may need to be restored. The baseline-value of extent given has been generated using data gathered from the listed site-based surveys. Area measurements given may be approximate depending on the methods, age and accuracy of data collection, and as a result this value may be updated in future to reflect more accurate information. The extent of an Annex I habitat feature covers the sum extent of all of the component vegetation communities present and may include transitions and mosaics with other closely-associated habitat features. Where a feature is susceptible to natural dynamic processes, there may be acceptable variations in its extent through natural fluctuations. Where a reduction in the extent of a feature is considered necessary to meet the Conservation Objective for another Annex I feature, Natural England will advise on this on a case-by-case basis. Various surveys have been undertaken since the notification of the associated Site of Special Scientific Interest and these have shown considerable variation in the extent of wet and dry heath. Early surveys suggested that the extent of wet heath was as little as 17ha whilst an estimate from 2007 suggested c.88 ha. The Habitats Directive Site Characterisation prepared by Bullen Consultants for the Environment Agency in 2003 estimated that wet heath covered c.20% of the site (c.59ha) and the Natura 2000 standard data form suggests 58.92. The 1993 NVC survey did not quantify extent of heathland communities, but did record extensive areas of NVC community M16 *Erica tetralix – Sphagnum compactum* wet heath. The increase in extent from the earlier surveys is largely as a result as a result of heathland restoration efforts undertaken in the early 1990s under the auspices of English Nature's Wildlife	Bullen Consultants (2003) Skipwith Common c.SAC Habitats Directive Site Characterisation (Available from Natural England on request) Humphries Rowell Associates (2002) Stanley main Seam & Skipwith Common Baseline Report Julian, S. (1985) Habitat map of Skipwith Common proposed SSSI. Natural England (2013) Integrated Site Assessment (ISA) (S. Christian) (Available from Natural England on request) Small, J. (2007) Major Vegetation Communities Weston A. & Littler J. (1993) NVC of Skipwith Common SSSI and Strensall Common SSSI

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Enhancement Scheme and in the early 2000s as part of the Tomorrows Heathland Heritage, Heritage Lottery Funded (HLF) Project. Within the site wet and dry heathland communities form an intimate mosaic and this also accounts for some of the difference in extent estimates it being very difficult to differentiate between the two habitats and accurately map them. The area in 2007 is however considered an over estimate since this assumed all areas cleared of trees and scrub under the Tomorrows Heathland Heritage HLF Project would develop heathland communities. The 2013 Integrated Sites Assessment clearly indicated this had not been the case with many areas developing into a rush dominated mire vegetation. The 2013 ISA however did demonstrate that the areas of both wet and dry heathland was greater than those at the time of SSSI notification. It is therefore suggested that the 2013 extent figures be taken as a baseline, and these figures have been adopted for this supplementary advice.	
Extent and distribution of the feature	**Spatial distribution of the feature within the site**	Maintain the distribution and configuration of the feature, including where applicable its component vegetation types, across the site	A contraction in the range, or geographic spread, of the feature (and its component vegetation and typical species, plus transitional communities) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. This may also reduce and break up the continuity of a habitat within a site and how well its typical species are able to move around the site to occupy and use habitat. Such fragmentation can impact on their viability and the wider ecological composition of the Annex I habitat. Smaller fragments of habitat can typically support smaller and more isolated populations which are more vulnerable to extinction. These fragments also have a greater amount of open edge habitat which will differ in the amount of light, temperature, wind, and even noise that it receives compared to its interior. These conditions may not be suitable for some of the typical and more specialist species associated with the	Humphries Rowell Associates (2002) Stanley main Seam & Skipwith Common Baseline Report Natural England (2013) Integrated Site Assessment (ISA) (S. Christian) [Available from Natural England on request] Weston A. & Littler J.(1993) NVC of Skipwith Common SSSI and Strensall Common SSSI

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Annex I habitat feature. Distribution of the wet heath communities corresponds to the distribution of the M16 *Erica tetralix – Sphagnum compactum* wet heath NVC community. As previous stated the wet and dry heathland communities form an intricate mosaic each blending into the other. Distribution maps of the two communities are provided in the Weston and Littler (1993), Humphries Rowell Associates (2002) and the 2013 Integrated Sites Assessment. The latter survey tended to preferentially classify heath as a wet heath community. When compared with the 2002 assessment however the distribution of the main community types do correspond.	
Structure and function (including its typical species)	**Vegetation community transitions**	Maintain any areas of transition between this and communities which form other heathland-associated habitats, such as dry and humid heaths, mires, acid grasslands, scrub and woodland.	Transitions/zonations between adjacent but different vegetation communities are usually related to naturally-occurring changes in soil, aspect or slope. Such 'ecotones' retain characteristics of each bordering community and can add value in often containing species not found in the adjacent communities. Retaining such transitions can provide further diversity to the habitat feature, and support additional flora and fauna. This is an important attribute as many characteristic heathland species utilise the transitions between vegetation types or use different vegetation types during different stages of their life cycle. As stated previously within the site wet and dry heathland communities form a complex mosaic across the site, each blending into the other, together with areas of mire, rush pasture, reed bed and woodland. This transitions provide significant diversity within the site. Distribution maps of the two communities are provided in the Weston and Littler (1993), Humphries Rowell Associates (2002) and the 2013 Integrated Sites Assessment. The 2013 should be taken as the indicative baseline since this indicated distribution post the heathland restoration efforts of the Tomorrow Heathland Heritage Project. Although scrub and woodland are important features of the Common these should not expand at the expense of open	Humphries Rowell Associates (2002) Stanley main Seam & Skipwith Common Baseline Report Natural England (2013) Integrated Site Assessment (ISA) (S. Christian) [Available from Natural England on request Weston A. & Littler J.(1993) NVC of Skipwith Common SSSI and Strensall Common SSSI This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			heathland, mire and grassland communities.	
Structure and function (including its typical species)	**Vegetation community composition**	Ensure the component vegetation communities of the feature are referable to and characterised by the following National Vegetation Classification type: M16 *Erica tetralix – Sphagnum compactum* wet heath (typical sub community)	This habitat feature will comprise a number of associated semi-natural vegetation types and their transitional zones, reflecting the geographical location of the site, altitude, aspect, soil conditions (especially base-status and drainage) and vegetation management. In the UK these have been categorised by the National Vegetation Classification (NVC). Maintaining or restoring these characteristic and distinctive vegetation types, and the range of types as appropriate, will be important to sustaining the overall habitat feature. This will also help to conserve their typical plant species (i.e. the constant and preferential species of a community), and therefore that of the SAC feature, at appropriate levels (recognising natural fluctuations). The only detailed NVC survey of the whole Common was undertaken by Weston and Littler (1993) which classified wet heath as M16 *Erica tetralix – Sphagnum compactum* wet heath (typical sub community). Subsequent surveys have largely simply classified areas as “wet heath”. However wet heath was also classified as M16 in Penny Anderson Associates report (2008). All the heathland communities are relatively species poor. This was noted in the 1977 Nature Conservation Review which stated that the heathland was “rather species poor floristically” and “lacked some of the bryophytes of southern heaths”. The 1993 NVC survey confirmed this, as did the site Characterisation report (Bullen Consultants 2002), Penny Anderson Associates (2008) and the 2013 ISA.	Bullen Consultants (2003) Skipwith Common c.SAC Habitats Directive Site Characterisation. Natural England (2013) Integrated Site Assessment (ISA) Natural England (S. Christian) [Available from Natural England on request] Penny Anderson Associates Limited (2008) Skipwith Common: Impact Of Local Ammonia Emissions. Report to Natural England Ratcliffe D.A (1977) A Nature Conservation Review Vol 2. Weston A. & Littler J (1993). NVC of Skipwith Common SSSI and Strensall Common SSSI This attribute will be periodically monitored as part of Natural England’s SSSI Condition Assessments
Structure and function (including its typical species)	**Vegetation structure: cover of dwarf shrubs**	Maintain an overall cover of dwarf shrub species which is typically between 25-90%	Variations in the structure of the heathland vegetation (vegetation height, amount of canopy closure, and patch structure) is needed to maintain high niche diversity and hence high species richness of characteristic heathland plants and animals. Many species also utilise the transitions between vegetation types or use different vegetation types during different stages of their life cycle. The structural character of the heathland feature is strongly influenced by the growing habits	This attribute will be periodically monitored as part of Natural England’s SSSI Condition Assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			of its dominant species which in most cases will be ericoids (i.e. plants that look like heathers, including members of the *Ericaceae* and *Empetraceae* families). The ericaceous species heather or ling *Calluna vulgaris*, bell heather *Erica cinerea,* cross-leaved heath *Erica tetralix*, are the commonest and most characteristic dwarf-shrubs occurring at Skipwith Common.	
Structure and function (including its typical species)	**Vegetation structure: heather age structure**	Restore a diverse age structure amongst the ericaceous shrubs typically found on the site	Each phase of growth associated with the characteristic heathers which dominate this feature also represents different microclimatic conditions and microhabitats which may provide shelter or food to other organisms. Therefore, it is important to maintain a mosaic of heather in different phases of growth. Typically this age structure will consist of between 10-40% cover of (pseudo) pioneer heathers; 20-80% cover of building/mature heathers; <30% cover of degenerate heathers and less than <10% cover of dead heathers The 2013 Integrated Site Assessment (ISA) undertaken by Natural England identified that some units had low densities of mature heather and therefore were not meeting age structure requirements for favourable condition	Natural England (2013) Integrated Site Assessment (ISA) (S. Christian) [Available from Natural England on request] This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Vegetation structure: cover of gorse**	Cover of common gorse is low typically at <10%	Gorse as a component of heathland is a very valuable wildlife habitat, and often a marker of relict heath and common. Both dense and spiny, it provides good, protected cover for many wildlife species: birds, mammals and reptiles; breeding habitat for rare or declining bird species, and excellent winter roosting. The flowers, borne at a time of year when other sources of pollen or nectar are in short supply, are particularly good for insects and other invertebrate pollinators. However gorse may cause problems if unchecked by dominating an area, eliminating other typical heathland species. Mature stands en masse may also be serious fire hazards. Gorse is relatively scarce on Skipwith Common.	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Vegetation structure: tree cover**	Maintain the open character of the feature, with a typically scattered and low cover of trees and scrub <20% cover.	Scrub (mainly trees or tree saplings above 1 m in height) and isolated trees are usually very important in providing warmth, shelter, cover, food plants, perches, territorial markers and sources of prey for typical heathland invertebrates and vertebrates. But overall cover of scrub and trees across this habitat feature should be maintained or restored to a fairly	Small, J. (2007) Major Vegetation Communities, Natural England archive files available on request. Natural England (2013) Integrated Site Assessment (ISA)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			sparse level, with a structurally complex edge and with characteristic heathland vegetation as ground cover. If scrub is locally important for any associated species with their own specific conservation objectives, then a higher level of cover will be acceptable. The area of scrub/tree cover should be stable or not increasing as a whole. Although scrub and woodland are important features of Skipwith Common these should not expand at the expense of open heathland, mire and grassland communities. An assessment of woodland cover was made by aerial photograph interpretation in 2007 (Small 2007) following the last phase of extensive woodland /scrub clearance undertaken under the auspices of the Tomorrow's Heathland Heritage Project. This estimated c.116ha of woodland. By extrapolation the 2013 ISA survey suggests just over 100ha of woodland cover. A woodland Management Plans produced as part of a Countryside Stewardship Application in 2017 (Willison A.) estimated 138 ha of woodland cover however this included **35.6ha** areas of "birch wood pasture" which is likely to have been classified as heathland in previous assessments. If this area is excluded woodland cover would be 102.4ha Given past assessments and for the purposes of this advice woodland cover should not exceed the 116ha reported in 2007 (This excludes areas of birch wood pasture included in the overall woodland cover estimate included within the woodland management plan). The open character dry heath areas should be retained, with a typically scattered and low cover of trees and scrub (<20% cover) as specified by the target.	Natural England (S. Christian) (Available from Natural England on request) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical	**Vegetation composition: bracken cover**	Maintain a cover of dense bracken which is low, typically at <5%	The spread of bracken *Pteridium aquilinum* is a problem on many lowland heathlands. The unpalatable nature and density of bracken as a tall-herb fern, and its decomposing litter, can smother and shade out smaller and more characteristic	Bullen Consultants (2003) Skipwith Common c.SAC Habitats Directive Site Characterisation.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
species)			heathland vegetation. Usually active management of bracken is required to reduce or contain its cover across this habitat feature. But this fern has also some nature conservation value, for example on sites where fritillary butterflies occur and utilise bracken litter habitat. Bracken stands have been mapped in 1991 (English Nature, quoted in Bullen Consultants 2003), Weston and Littler (1993), (2002) and the 2013 Integrated Sites Assessment. Stands tend to be restricted to the drier fringes of the Common and for the most part are long established. The vegetation estimates (Small 2007) estimated extent as 8.8ha and this corresponds with figures form 1985 and 1991 quoted in the SAC site Characterisation report (Bullen Consultants 2003). The majority of bracken stands appear to have been long established. The 2018 ISA reported a slightly higher area of c.16ha and is thought to be most accurate being determined through site survey and aerial photograph interpretation. This is therefore taken as baseline.	Humphries Rowell Associates (2002) Stanley main Seam & Skipwith Common Baseline Report Natural England (2013) Integrated Site Assessment (ISA) (S. Christian) [Available from Natural England on request Weston A. & Littler J.(1993) NVC of Skipwith Common SSSI and Strensall Common SSSI This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Key structural, influential and/or distinctive species**	Maintain and/or restore the abundance of the typical species listed below to enable each of them to be a viable component of the Annex 1 habitat; • Constant and preferential plant species of M16 NVC vegetation types at this SAC • Marsh Gentian *Gentiana pneumonanthe* • Pilwort *Pilularia globulifera*	Some plant or animal species (or related groups of such species) make a particularly important contribution to the necessary structure, function and/or quality of an Annex I habitat feature at a particular site. These species will include; • **Structural** species which form a key part of the Annex I habitat's structure or help to define that habitat on a particular SAC (see also the attribute for 'vegetation community composition'). • **Influential** species which are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of soil/sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat) • **Site-distinctive** species which are considered to be a particularly special and distinguishing component of an Annex I	Ratcliffe D.A. (1977) A Nature Conservation Review Vol 2. Rodwell, J.S. (1991) British Plant Communities (Volume 2) Mires and Heaths Weston A. & Littler J. (1993) NVC of Skipwith Common SSSI and Strensall Common SSSI Bullen Consultants (2003) Skipwith Common c.SAC Habitats Directive Site Characterisation. Penny Anderson Associates Limited (2008) Skipwith Common:

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			habitat on a particular SAC. There may be natural fluctuations in the frequency and cover of each of these species. The relative contribution made by them to the overall ecological integrity of a site may vary, and Natural England will provide bespoke advice on this as necessary. The list of species given here for this Annex I habitat feature at this SAC is not necessarily exhaustive. The list may evolve, and species may be added or deleted, as new information about this site becomes available. All the heathland communities are relatively species poor. This was noted in the 1977 Nature Conservation Review which stated that the wet heath was “rather species poor floristically” and “lacked some of the bryophytes of southern heaths”. The 1993 NVC survey confirmed this, as have subsequent surveys. Species of particular note include a small, but long established population of Marsh Gentian (*Gentiana pneumonanthe*) in the south west corner of Bomb Bays SE653372 Although not strictly a wet heath species being more closely associated with ephemeral ponds within the heathland vegetation, Pillwort (*Pilularia globulifera*) is a key species on the site. Main location SE647374 It has been suggested (Small 2009) that *Sphagnum compactum* should be present to frequent amongst wet heath communities. *S. compactum* is typically strongly associated with the NVC community M16 (Rodwell 1991) and is present locally on the Common. A review by Small suggested it had once been more widespread. It would therefore seem to be an appropriate typical species associated with wet heath.	Impact Of Local Ammonia Emissions. Report to Natural England. Natural England (2013) Integrated Site Assessment (ISA) Natural England (S. Christian) [Available from Natural England on request].
Structure and function (including its typical species)	**Vegetation: undesirable species**	Maintain the frequency/cover of the following undesirable species to within acceptable levels and prevent changes in surface condition, soils, nutrient levels or hydrology which may encourage	Undesirable non-woody and woody vascular plants species may require active management to avert an unwanted succession to a different and less desirable state. Often they may be indicative of a negative trend relating to another aspect of a site's structure and function. These species will vary depending on the nature of the particular feature, and in some	This attribute will be periodically monitored as part of Natural England’s SSSI Condition Assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		their spread;	cases these species may be natural/acceptable components or even dominants. At present scrub encroachment particularly Birch *Betula pendula* is the main woody species requiring control to keep site in favourable condition. Himalayan Balsam *Impatiens glandulifera* is present is some areas and is a non woody species of concern and management is undertaken to ensure that this invasive does not spread. Undesirable species include: *Rhododendron ponticum, Fallopia japonica, Apium nodiflorum, Cirsium arvense, Digitalis purpurea, Epilobium spp. (excl. E. palustre), , Juncus effusus, Phragmites spp., Ranunculus repens, Senecio jacobaea, Rumex obtusifolius, Typha spp., Urtica spp. Alnus glutinosa, Betula spp., Prunus spinosa, Pinus spp., Rubus spp., Quercus spp. Acrocarpous* mosses <occasional.	
Structure and function (including its typical species)	**Functional connectivity with wider landscape**	Maintain the overall extent, quality and function of any supporting features within the local landscape which provide a critical functional connection with the site	This recognises the potential need at this site to maintain or restore the connectivity of the site to its wider landscape in order to meet the conservation objectives. These connections may take the form of landscape features, such as habitat patches, hedges, watercourses and verges, outside of the designated site boundary which are either important for the migration, dispersal and genetic exchange of those typical species closely associated with qualifying Annex I habitat features of the site. These features may also be important to the operation of the supporting ecological processes on which the designated site and its features may rely. In most cases increasing actual and functional landscape-scale connectivity would be beneficial. Where there is a lack of detailed knowledge of the connectivity requirements of the qualifying feature, Natural England will advise as to whether these are applicable on a case by case basis. Skipwith Common SAC forms part of the larger “Skipwith Common”, the total area of the Common occupying 331.73 ha (Aitchison and Ashby 2000). This area excludes the area of Skipwith Common in Riccall Parish which occupies an	Aitchison, J & Ashby, M. (2000) The Common Lands of Yorkshire – A Biological survey, Volume 1. Department of the Environment, Transport and the Regions _ Rural Surveys Research unit.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			additional 20ha. The 2000 survey identified a number of habitats on the wider Common including extensive stands of a birch woodland that has developed on area of previously open heathland. The wider Common (often referred to as "Back Common") to the north of the SAC. On other areas the SAC is bounded by mixed farming, much of which is managed under agri-environment schemes.	
Structure and function (including its typical species)	**Adaptation and resilience**	Maintain the feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either within or external to the site	This recognises the increasing likelihood of natural habitat features to absorb or adapt to wider environmental changes. Resilience may be described as the ability of an ecological system to cope with, and adapt to environmental stress and change whilst retaining the same basic structure and ways of functioning. Such environmental changes may include changes in sea levels, precipitation and temperature for example, which are likely to affect the extent, distribution, composition and functioning of a feature within a site. The vulnerability and response of features to such changes will vary. Using best available information, any necessary or likely adaptation or adjustment by the feature and its management in response to actual or expected climatic change should be allowed for, as far as practicable, in order to ensure the feature's long-term viability. The overall vulnerability of this SAC to climate change has been assessed by Natural England (2015) as being high, taking into account the sensitivity, fragmentation, topography and management of its habitats. This means that this site is considered to be the most vulnerable sites overall and are likely to require the most adaptation action, most urgently. A site based assessment should be carried out as a priority. This means that action to address specific issues is likely, such as reducing habitat fragmentation, creating more habitat to buffer the site or expand the habitat into more varied landscapes and addressing particular management and condition issues. Individual species may be more or less vulnerable than their habitat itself. In many cases, change will	Natural England, 2015. Climate Change Theme Plan and supporting NBCCV Assessments for SACs and SPAs

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			be inevitable so appropriate monitoring would be advisable.	
Supporting processes (on which the feature relies)	**Conservation measures**	Maintain the management measures (either within and/or outside the site boundary as appropriate) which are necessary to maintain structure, functions and supporting processes associated with the feature	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. Grazing management is currently undertaken by the owner under an agri-environment scheme, the site being grazed by a combination of long-horn cattle, Hebridean sheep and Exmoor Ponies at a level sympathetic to maintain favourable condition. Any activity threatening the viability of this management could pose a risk to heathland habitat. Uncontrolled dogs can pose a risk to livestock and are an ongoing concern. Scrub management is undertaken by both the owner as part of agri-environment scheme and by Natural England National Nature Reserve site staff and volunteers. Scrub management is likely to be an ongoing requirement in addition to grazing management. Both these issues are highlighted in the Site Improvement Plan for Skipwith Common (2014)	Natural England (2014) Site Improvement Plan Skipwith Common.
Supporting processes (on which the feature relies)	**Soils, substrate and nutrient cycling**	Maintain the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal: bacterial ratio, to within typical values for the habitat.	Soil is the foundation of basic ecosystem function and a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species which together form vegetation types, and therefore provides a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the ecological structure, function and processes associated with this Annex I feature.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			This Annex 1 habitat has essentially raw soils with little humus and low nutrient status.	
Supporting processes (on which the feature relies)	**Air quality**	Maintain as necessary, the concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	This habitat type is considered sensitive to changes in air quality. Exceedance of these critical values for air pollutants may modify the chemical status of its substrate, accelerating or damaging plant growth, altering its vegetation structure and composition and causing the loss of sensitive typical species associated with it. Critical Loads and Levels are recognised thresholds below which such harmful effects on sensitive UK habitats will not occur to a significant level, according to current levels of scientific understanding. There are critical levels for ammonia (NH3), oxides of nitrogen (NOx) and sulphur dioxide (SO2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. An initial assessment of air quality impacts in relation to ammonia has been undertaken by Penny Anderson Associates (2008). This concluded "*Vegetation described for all three heathland areas was consistent with NVC designations for M16/H9 wet/dry lowland heath, with Sphagnum and macrolichen species frequent throughout, and met the conservation objectives with respect to the lower plants and the presence/absence of negative and positive species, although only two forb species (Galium saxatile and Potentilla erecta)*	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk). Penny Anderson Associates Limited (2008) Skipwith Common: Impact Of Local Ammonia Emissions. Report to Natural England

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			were recorded".	
Supporting processes (on which the feature relies)	**Water quality**	Where the feature is dependent on surface water and/or groundwater maintain water quality and quantity to a standard which provides the necessary conditions to support the feature	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases more stringent standards may be needed. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC. Changes in hydrology have occurred as a result of mining subsidence in the past. Although mitigation has been implemented to rectify hydrological changes, periodic monitoring may be required in order to ensure mitigation continues to deliver desired results. Any plans relating to drainage of the site through existing or new drains will require detailed assessment to ensure that adverse impacts do not occur.	
Supporting processes (on which the feature relies)	**Hydrology**	At a site, unit and/or catchment level (as necessary, maintain the natural hydrological regime to provide the conditions necessary to sustain the feature within the site	Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature. Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts. Changes in hydrology have occurred as a result of mining subsidence in the past. Although mitigation has been implemented to rectify hydrological changes, periodic monitoring may be required in order to ensure mitigation continues to deliver desired results. Any plans relating to drainage of the site through existing or new drains will require detailed assessment to ensure that adverse impacts do not	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			occur.	
Version Control Advice last updated **14 March 19:** Following stakeholder feedback, additional text add**ed Vegetation structure: tree cover** attribute to clarify woodland extent across the site.				
Variations from national feature-framework of integrity-guidance: N/A				

Table 2: Supplementary Advice for Qualifying Features: H4030. European dry heaths

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	**Extent of the feature within the site**	Maintain the total extent of the H4030 feature at approximately 18ha	There should be no measurable reduction (excluding any trivial loss) in the extent and area of this feature, and in some cases, the full extent of the feature may need to be restored. The baseline-value of extent given has been generated using data gathered from the listed site-based surveys. Area measurements given may be approximate depending on the methods, age and accuracy of data collection, and as a result this value may be updated in future to reflect more accurate information. The extent of an Annex I habitat feature covers the sum extent of all of the component vegetation communities present and may include transitions and mosaics with other closely-associated habitat features. Where a feature is susceptible to natural dynamic processes, there may be acceptable variations in its extent through natural fluctuations. Where a reduction in the extent of a feature is considered necessary to meet the Conservation Objective for another Annex I feature, Natural England will advise on this on a case-by-case basis. Various surveys have been undertaken since the notification of the associated Site of Special Scientific Interest and these have shown some variation in the extent of wet and dry heath. Early surveys suggested that the extent of dry heath was as little as 10ha in 1991 (English Nature, quoted in Bullen Consultants 2003) whilst an estimate from 2007 (small 2007) suggested c.43 ha. The 1993 NVC survey did not quantify extent of heathland communities, but did record extensive areas of NVC community H9c *Calluna vulgaris* (heather) -*Deschampsia flexuosa* (wavy hair grass). The Habitats Directive Site Characterisation prepared by Bullen Consultants for the Environment Agency in 2003 estimated that dry heath covered c.10% of the site (c.29ha) and the Natura 2000 standard data form suggests a similar figure of 29.46ha. The 2013 ISA survey suggested 18ha.	Bullens Consultants (2003) Skipwith Common c.SAC Habitats Directive Site Characterisation English Nature (1991) Phase 1 Habitat Survey. Natural England Archive files. Humphries Rowell Associates (2002) Stanley main Seam & Skipwith Common Baseline Report. Natural England (2013) Integrated Site Assessment (ISA) (S. Christian) [Available form Natural England on request] Small, J. (2007) Major Vegetation Communities, Natural England archive files available on request. Weston A. & Littler J. (1993) NVC of Skipwith Common SSSI and Strensall Common SSSI

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Within the site wet and dry heathland communities form an intimate mosaic and this also accounts for some of the difference in extent estimates it being very difficult to differentiate between the two habitats and accurately map them and this is likely to account for the difference in extent between the various surveys. The lower figure reported by the 2013 ISA can be explained by the open heathland being preferentially classified as wet heath community when compared with earlier assessments. The area in 2007 is also considered an over estimate since this assumed all areas cleared of trees and scrub under the Tomorrows Heathland Heritage HLF Project would develop heathland communities. The 2013 Integrated Sites Assessment clearly indicated this had not been the case with many areas developing into a rush dominated mire vegetation. The 2013 ISA also demonstrated that the areas of both wet and dry heathland was greater than those at the time of SSSI notification. The 2013 ISA extent figures be taken as a baseline, and these figures have been adopted for this supplementary advice. These figures also concur with the previous estimate of extent made by Humphries Rowell in 2002.	
Extent and distribution of the feature	**Spatial distribution of the feature within the site**	Maintain distribution and configuration of the feature, including where applicable its component vegetation types, across the site	A contraction in the range, or geographic spread, of the feature (and its component vegetation and typical species, plus transitional communities) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. This may also reduce and break up the continuity of a habitat within a site and how well its typical species are able to move around the site to occupy and use habitat. Such fragmentation can impact on their viability and the wider ecological composition of the Annex I habitat. Smaller fragments of habitat can typically support smaller and more isolated populations which are more vulnerable to extinction. These fragments also have a greater amount of open edge habitat which will differ in the amount of light,	Humphries Rowell Associates (2002) Stanley main Seam & Skipwith Common Baseline Report. Natural England (2013) Integrated Site Assessment (ISA) (S. Christian) [Available form Natural England on request] Weston A. & Littler J. (1993) NVC of Skipwith Common SSSI and Strensall Common SSSI

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			temperature, wind, and even noise that it receives compared to its interior. These conditions may not be suitable for some of the typical and more specialist species associated with the Annex I habitat feature. Distribution of the dry heath communities corresponds to the distribution of the H9 *Calluna vulgaris* (heather) *-Deschampsia flexuosa* (wavy hair grass) NVC community. As previous stated the wet and dry heathland communities form an intricate mosaic each blending into the other. Distribution maps of the two communities are provided in the Weston and Littler (1993), Humphries Rowell Associates (2002) and the 2013 Integrated Sites Assessment. The latter survey tended to preferentially classify heath the wet heath community when compared with the 2002 assessment however the distribution of the main community types do correspond with previous surveys and are taken as baseline.	
Structure and function (including its typical species)	**Vegetation community composition**	Ensure the component vegetation communities of the feature are referable to and characterised by the following National Vegetation Classification type: • H9c *Calluna vulgaris* (heather) *-Deschampsia flexuosa* (wavy hair grass) Species poor sub community	This habitat feature will comprise a number of associated semi-natural vegetation types and their transitional zones, reflecting the geographical location of the site, altitude, aspect, soil conditions (especially base-status and drainage) and vegetation management. In the UK these have been categorised by the National Vegetation Classification (NVC). Maintaining or restoring these characteristic and distinctive vegetation types, and the range of types as appropriate, will be important to sustaining the overall habitat feature. This will also help to conserve their typical plant species (i.e. the constant and preferential species of a community), and therefore that of the SAC feature, at appropriate levels (recognising natural fluctuations). All the heathland communities are relatively species poor. This was noted in the 1977 Nature Conservation Review which stated that the heathland was “rather species poor floristically” and “lacked some of the bryophytes of southern heaths”. The 1993 NVC survey (Weston and Littler) confirmed this, as did the site Characterisation report (Bullen Consultants 2002) and the 2013 ISA. It has been suggested (YWT 1998, referenced in	Bullens Consultants (2003) Skipwith Common c.SAC Habitats Directive Site Characterisation Fitzgerald. C. (1998) Draft Management Plan. Yorkshire Wildlife Trust Humphries Rowell Associates (2002) Stanley main Seam & Skipwith Common Baseline Report. Natural England (2013) Integrated Site Assessment (ISA) (S. Christian) [Available form Natural England on request] Ratcliffe D.A. (1997) A Nature Conservation Review Vol 2.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Bullen consultants 2002) suggests that this could be related to high levels of atmospheric pollution in the Vale of York, atmospheric pollution being a controlling factor for the distribution of dry heathland (Rodwell 1991) communities	Weston A. & Littler J. (1993) NVC of Skipwith Common SSSI and Strensall Common SSSI
Structure and function (including its typical species)	**Vegetation community transitions**	Maintain any areas of transition between this and communities which form other heathland-associated habitats, such as dry and humid heaths, mires, acid grasslands, scrub and woodland.	Transitions/zonations between adjacent but different vegetation communities are usually related to naturally-occurring changes in soil, aspect or slope. Such 'ecotones' retain characteristics of each bordering community and can add value in often containing species not found in the adjacent communities. Retaining such transitions can provide further diversity to the habitat feature, and support additional flora and fauna. This is an important attribute as many characteristic heathland species utilise the transitions between vegetation types or use different vegetation types during different stages of their life cycle. As previous stated the wet and dry heathland communities form an intricate mosaic each blending into the other. Distribution maps of the two communities are provided in the Weston and Littler (1993), Humphries Rowell Associates (2002) and the 2013 Integrated Sites Assessment.	Humphries Rowell Associates (2002) Stanley main Seam & Skipwith Common Baseline Report. Natural England (2013) Integrated Site Assessment (ISA) (S. Christian) [Available form Natural England on request] Weston A. & Littler J. (1993) NVC of Skipwith Common SSSI and Strensall Common SSSI This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Vegetation structure: cover of dwarf shrubs**	Maintain overall cover of dwarf shrub species which is typically between 25-90%	Variations in the structure of the heathland vegetation (vegetation height, amount of canopy closure, and patch structure) is needed to maintain high niche diversity and hence high species richness of characteristic heathland plants and animals. Many species also utilise the transitions between vegetation types or use different vegetation types during different stages of their life cycle. The structural character of the heathland feature is strongly influenced by the growing habits of its dominant species which in most cases will be ericoids (i.e. plants that look like heathers, including members of the *Ericaceae* and *Empetraceae* families). The ericaceous species heather or ling *Calluna vulgaris,* bell heather *Erica cinerea*, cross-leaved heath *Erica tetralix* are the commonest and most characteristic dwarf-shrubs found at Skipwith Common.	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	**Vegetation composition: bracken cover**	Maintain a cover of dense bracken which is low, typically at <5%	The spread of bracken *Pteridium aquilinum* is a problem on many lowland heathlands. The unpalatable nature and density of bracken as a tall-herb fern, and its decomposing litter, can smother and shade out smaller and more characteristic heathland vegetation. Usually active management of bracken is required to reduce or contain its cover across this habitat feature. But this fern has also some nature conservation value, for example on sites where fritillary butterflies occur and utilise bracken litter habitat. Bracken stands have been mapped in 1991 (English Nature, quoted in Bullen Consultants 2003), Weston and Littler (1993) and the 2013 Integrated Sites Assessment. Stands tend to be restricted to the drier fringes of the Common and for the most part are long established. Small's 2007 estimate estimated extent as 8.8ha and this corresponds with figures from 1985 and 1991 quoted in the SAC site Characterisation report (Bullen Consultants 2003). The 2018 ISA reported a slightly higher area of c.16ha and is thought to be most accurate being determined through site survey and aerial photograph interpretation. This is therefore taken as baseline.	Bullen Consultants (2003) Skipwith Common c.SAC Habitats Directive Site Characterisation English Nature (1991) Phase 1 Habitat Survey. (Available on request from Natural England) Natural England (2013) Integrated Site Assessment (ISA) (S. Christian) [Available form Natural England on request] Small, J (2007) Major Vegetation Communities, Natural England archive files available on request. Weston A. & Littler J.(1993) NVC of Skipwith Common SSSI and Strensall Common SSSI This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Vegetation structure: cover of gorse**	Maintain cover of common gorse *Ulex europaeus* at <25%	Gorse as a component of heathland is a very valuable wildlife habitat, and often a marker of relict heath and common. Both dense and spiny, it provides good, protected cover for many wildlife species: birds, mammals and reptiles; breeding habitat for rare or declining bird species, and excellent winter roosting. The flowers, borne at a time of year when other sources of pollen or nectar are in short supply, are particularly good for insects and other invertebrate pollinators. However gorse may cause problems if unchecked by dominating an area, eliminating other typical heathland species. Mature stands en masse may also be serious fire hazards.	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Gorse is relatively scarce on Skipwith Common and western gorse *Ulex gallii* absent from the Common.	
Structure and function (including its typical species)	**Vegetation structure: tree cover**	Maintain the open character of the feature, with a typically scattered and low cover of trees and scrub (<20% cover)	Scrub (mainly trees or tree saplings above 1 m in height) and isolated trees are usually very important in providing warmth, shelter, cover, food plants, perches, territorial markers and sources of prey for typical heathland invertebrates and vertebrates. But overall cover of scrub and trees across this habitat feature should be maintained or restored to a fairly sparse level, with a structurally complex edge and with characteristic heathland vegetation as ground cover. If scrub is locally important for any associated species with their own specific conservation objectives, then a higher level of cover will be acceptable. The area of scrub/tree cover should be stable or not increasing as a whole. Although scrub and woodland are important features of the Common these should not expand at the expense of open heathland, mire and grassland communities. An assessment of woodland cover was made by aerial photograph interpretation in 2007 (Small) following the last phase of extensive woodland /scrub clearance undertaken under the auspices of the Tomorrow's Heathland Heritage Project. This estimated c.116ha of woodland. By extrapolation the 2013 ISA survey suggests just over 100ha of woodland cover. A woodland management plan produced in 2017 (Willison A.) estimated 138 ha of woodland cover however this included 35.6ha areas of "birch wood pasture" which is likely to have been classified as heathland in previous assessments. If this area is excluded woodland cover would be 102.4ha. Given past assessments and for the purposes of this advice woodland cover should not exceed the 116ha reported in 2007. (This excludes areas of birch wood pasture included in the overall woodland cover estimate included within the woodland management plan).	Small, J. (2007) Major Vegetation Communities, Natural England archive files available on request. Natural England (2013) Integrated Site Assessment (ISA) (S. Christian) [Available form Natural England on request] This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			The open character dry heath areas should be retained, with a typically scattered and low cover of trees and scrub (<20% cover) as specified by the target.	
Structure and function (including its typical species)	**Vegetation structure: heather age structure**	Restore a diverse age structure amongst the ericacerous shrubs typically found on the site	Each phase of growth associated with the characteristic heathers which dominate this feature also represents different microclimatic conditions and microhabitats which may provide shelter or food to other organisms. Therefore, it is important to maintain a mosaic of heather in different phases of growth. Typically this age structure will consist of between 10-40% cover of (pseudo) pioneer heathers; 20-80% cover of building/mature heathers; <30% cover of degenerate heathers and less than <10% cover of dead heathers The 2013 Integrated Site Assessment (ISA) undertaken by Natural England identified that some units had low densities of mature heather and therefore were not meeting age structure requirements for favourable condition	
Structure and function (including its typical species)	**Vegetation: undesirable species**	Maintain the frequency/cover of the following undesirable species to within acceptable levels and prevent changes in surface condition, soils, nutrient levels or hydrology which may encourage their spread.	Undesirable non-woody and woody vascular plants species may require active management to avert an unwanted succession to a different and less desirable state. Often they may be indicative of a negative trend relating to another aspect of a site's structure and function. These species will vary depending on the nature of the particular feature, and in some cases these species may be natural/acceptable components or even dominants. At present scrub encroachment particularly Birch *Betula pendula* is the main woody species requiring control to keep site in favourable condition. Himalayan Balsam *Impatiens glandulifera* is present is some areas and is a non woody species of concern and management is undertaken to ensure that this invasive does not spread. Negative' indicator species present or potentially present on site; *Rhododendron ponticum, Cirsium arvense, Digitalis purpurea, Epilobium spp. (excl. E. palustre), Chamerion*	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			angustifolium, Impatiens glandulifera, Juncus effusus, J. squarrosus, Ranunculus repens, Senecio jacobaea, Rumex obtusifolius, Urtica spp., Betula spp., Pinus spp., Rubus spp., Acrocarpous mosses All species should be <occasional.	
Structure and function (including its typical species)	**Typical species: flora and fauna**	Maintain the abundance of the species listed to enable each of them to be a viable component of the Annex I habitat feature • Constant and preferential plant species of H9c *Calluna vulgaris* (heather) - *Deschampsia flexuosa* (wavy hair grass) species poor NVC sub-community at this site.	Some plant or animal species (or related groups of such species) make a particularly important contribution to the necessary structure, function and/or quality of an Annex I habitat feature at a particular site. These species will include; • **Influential** species which are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of soil/sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat) • **Site-distinctive** species which are considered to be a particularly special and distinguishing component of an Annex I habitat on a particular SAC. There may be natural fluctuations in the frequency and cover of each of these species. The relative contribution made by them to the overall ecological integrity of a site may vary, and Natural England will provide bespoke advice on this as necessary. The list of species given here for this Annex I habitat feature at this SAC is not necessarily exhaustive. The list may evolve, and species may be added or deleted, as new information about this site becomes available. Dry heath communities are relatively species poor. This was noted in the 1977 Nature Conservation Review which stated that the heathland was “rather species poor floristically” and “lacked some of the bryophytes of southern heaths”. The 1993 NVC survey confirmed this, as did the site Characterisation report (Bullen Consultants 2002) and the 2013 ISA	
Structure and function	**Functional connectivity**	Maintain the overall extent, quality and function of any	This recognises the potential need at this site to maintain or restore the connectivity of the site to its wider landscape in	Aitchison, J. & Ashby M. (2000) Department of the Environment,

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
(including its typical species)	**with wider landscape**	supporting features within the local landscape which provide a critical functional connection with the site	order to meet the conservation objectives. These connections may take the form of landscape features, such as habitat patches, hedges, watercourses and verges, outside of the designated site boundary which are either important for the migration, dispersal and genetic exchange of those typical species closely associated with qualifying Annex I habitat features of the site. These features may also be important to the operation of the supporting ecological processes on which the designated site and its features may rely. In most cases increasing actual and functional landscape-scale connectivity would be beneficial. Where there is a lack of detailed knowledge of the connectivity requirements of the qualifying feature, Natural England will advise as to whether these are applicable on a case by case basis. Skipwith Common forms part of a larger "Common", the total area of the Common occupying 331.73 ha (Aitchison and Ashby 2000). This area excludes the area of Skipwith Common in Riccall Parish which occupies an additional 20ha. The 2000 survey identified a number of habitats on the wider Common including extensive stands of a birch woodland that has developed on area of previously open heathland. The wider Common (often referred to as "Back Common") lies to the north of the SAC. On other areas the SAC is bounded by mixed farming, much of which is managed under agri-environment schemes.	Transport and the Regions _ Rural Surveys Research unit (The Common Lands of Yorkshire – A Biological survey, Volume 1.
Structure and function (including its typical species)	**Adaptation and resilience**	Maintain the feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either within or external to the site	This recognises the increasing likelihood of natural habitat features to absorb or adapt to wider environmental changes. Resilience may be described as the ability of an ecological system to cope with, and adapt to environmental stress and change whilst retaining the same basic structure and ways of functioning. Such environmental changes may include changes in sea levels, precipitation and temperature for example, which are likely to affect the extent, distribution, composition and functioning of a feature within a site. The vulnerability and response of features to such changes will vary.	Natural England, 2015. Climate Change Theme Plan and supporting NBCCV Assessments for SACs and SPAs

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Using best available information, any necessary or likely adaptation or adjustment by the feature and its management in response to actual or expected climatic change should be allowed for, as far as practicable, in order to ensure the feature's long-term viability. The overall vulnerability of this SAC to climate change has been assessed by Natural England (2015) as being high, taking into account the sensitivity, fragmentation, topography and management of its habitats. This means that this site is considered to be the most vulnerable sites overall and are likely to require the most adaptation action, most urgently. A site based assessment should be carried out as a priority. This means that action to address specific issues is likely, such as reducing habitat fragmentation, creating more habitat to buffer the site or expand the habitat into more varied landscapes and addressing particular management and condition issues. Individual species may be more or less vulnerable than their habitat itself. In many cases, change will be inevitable so appropriate monitoring would be advisable.	
Structure and function (including its typical species)	**Soils, substrate and nutrient cycling**	Maintain the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal: bacterial ratio, to within typical values for the habitat.	Soil is the foundation of basic ecosystem function and a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species which together form vegetation types, and therefore provides a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the ecological structure, function and processes associated with this Annex I feature.	
Supporting processes (on which the feature relies)	**Conservation measures**	Maintain the management measures (either within and/or outside the site boundary as appropriate) which are necessary to maintain the structure, functions and supporting processes associated with the feature	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about	Natural England (2014) Site Improvement Plan Skipwith Common.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Management Statement for the underpinning SSSI and/or management agreements. Management that may be appropriate for this feature includes: • Maintain low nutrient levels to maintain high numbers of species through the management activities of grazing, mowing, and scrub/tree cutting. Management of succession is a critical aspect of management for this habitat, by a combination of active processes and grazing/cutting. • A range of invertebrates and plants require bare ground/peat where it is not too frequently disturbed by vehicles or feet. Grazing management is currently undertaken by owner under an agri-environment scheme, the site being grazed by a combination of long-horn cattle, Hebridean sheep and Exmoor ponies at a level sympathetic to maintain favourable condition. Any activity threatened the viability of this management could pose a risk to heathland habitat. Uncontrolled dogs can pose a risk to livestock and are an ongoing concern. Scrub management is undertaken by both the owner as part of agri-environment scheme and by Natural England National Nature Reserve site staff and volunteers. Scrub management is likely to be an ongoing requirement in addition to grazing management. This is highlighted in the Site Improvement Plan for Skipwith Common (2014)	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting processes (on which the feature relies)	**Air quality**	Maintain as necessary, the concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	This habitat type is considered sensitive to changes in air quality. Exceedance of these critical values for air pollutants may modify the chemical status of its substrate, accelerating or damaging plant growth, altering its vegetation structure and composition and causing the loss of sensitive typical species associated with it. Critical Loads and Levels are recognised thresholds below which such harmful effects on sensitive UK habitats will not occur to a significant level, according to current levels of scientific understanding. There are critical levels for ammonia (NH3), oxides of nitrogen (NOx) and sulphur dioxide (SO2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. An initial assessment of air quality impacts in relation to ammonia has been undertaken by Penny Anderson Associates (2008). This concluded "*Vegetation described for all three heathland areas was consistent with NVC designations for M16/H9 wet/dry lowland heath, with Sphagnum and macrolichen species frequent throughout, and met the conservation objectives with respect to the lower plants and the presence/ absence of negative and positive species, although only two forb species (Galium saxatile and Potentilla erecta) were recorded*".	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk). Penny Anderson Associates Limited (2008) Skipwith Common: Impact Of Local Ammonia Emissions. Report to Natural England
Supporting processes	**Water quality**	Where the feature is dependent on surface water and/or	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
(on which the feature relies)		groundwater, maintain water quality and quantity to a standard which provides the necessary conditions to support the feature.	the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases more stringent standards may be needed. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC.	
Supporting processes (on which the feature relies)	**Hydrology**	At a site, unit and/or catchment level (as necessary, Maintain natural hydrological processes to provide the conditions necessary to sustain the feature within the site	Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature. Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts. Changes in hydrology have occurred as a result of mining subsidence in the past. Although mitigation has been implemented to rectify hydrological changes, periodic monitoring may be required in order to ensure mitigation continues to deliver desired results. Any plans relating to drainage of the site through existing or new drains will require detailed assessment to ensure that adverse impacts do not occur.	
Version Control Advice last updated: Advice last updated **14 March 19:** Following stakeholder feedback, additional text add**ed Vegetation structure: tree cover** attribute to clarify woodland extent across the site.				
Variations from national feature-framework of integrity-guidance: N/A				

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European Site Conservation Objectives for Thorne and Hatfield Moors Special Protection Area Site Code: UK9005171

With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified (the 'Qualifying Features' listed below), and subject to natural change;

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.**

This document should be read in conjunction with the accompanying *Supplementary Advice* document, which provides more detailed advice and information to enable the application and achievement of the Objectives set out above.

Qualifying Features:

A224 *Caprimulgus europaeus*; European nightjar (Breeding)

Explanatory Notes: European Site Conservation Objectives

These Conservation Objectives are those referred to in the Conservation of Habitats and Species Regulations 2017 (as amended) ('the Habitats Regulations'). They must be considered when a competent authority is required to make a 'Habitats Regulations Assessment' including an Appropriate Assessment, under the relevant parts of this legislation.

These Conservation Objectives, and the accompanying Supplementary Advice (where this is available), will also provide a framework to inform the management of the European Site and the prevention of deterioration of habitats and significant disturbance of its qualifying features

These Conservation Objectives are set for each bird feature for a Special Protection Area (SPA).

Where these objectives are being met, the site will be considered to exhibit a high degree of integrity and to be contributing to achieving the aims of the Wild Birds Directive.

Publication date: 21 February 2019 (version 3). This document updates and replaces an earlier version dated 30 June 2014 to reflect the consolidation of the Habitats Regulations in 2017.

European Site Conservation Objectives: Supplementary advice on conserving and restoring site features

Thorne and Hatfield Moors Special Protection Area (SPA)
Site code: UK9005171

Photograph: Neil Pike/Natural England

Date of Publication: 8 February 2019

About this document

This document provides Natural England's supplementary advice for the European Site Conservation Objectives relating to Thorne and Hatfield Moors SPA. This advice should therefore be read together with the SPA's Conservation Objectives available here.

This site overlaps with other European Sites. You should also refer to the separate European Site Conservation Objectives and Supplementary Advice (where available) provided for those sites. This advice should therefore be read together with the SAC Conservation Objectives available for Thorne Moor SAC here and for Hatfield Moor SAC here

You should use the Conservation Objectives, this Supplementary Advice and any case-specific advice given by Natural England when developing, proposing or assessing an activity, plan or project that may affect this site'

This Supplementary Advice to the Conservation Objectives presents attributes which are ecological characteristics of the designated species and habitats within a site. The listed attributes are considered to be those that best describe the site's ecological integrity and which, if safeguarded, will enable achievement of the Conservation Objectives. Each attribute has a target which is either quantified or qualitative depending on the available evidence. The target identifies as far as possible the desired state to be achieved for the attribute.

The tables provided below bring together the findings of the best available scientific evidence relating to the site's qualifying features, which may be updated or supplemented in further publications from Natural England and other sources. The local evidence used in preparing this supplementary advice has been cited. The references to the national evidence used are available on request. Where evidence and references have not been indicated, Natural England has applied ecological knowledge and expert judgement. You may decide to use other additional sources of information.

In many cases, the attribute targets shown in the tables indicate whether the current objective is to 'maintain' or 'restore' the attribute. This is based on the best available information, including that gathered during monitoring of the feature's current condition. As new information on feature condition becomes available, this will be added so that the advice remains up to date.

The targets given for each attribute do not represent thresholds to assess the significance of any given impact in Habitats Regulations Assessments. You will need to assess this on a case-by-case basis using the most current information available.

Some, but not all, of these attributes can also be used for regular monitoring of the actual condition of the designated features. The attributes selected for monitoring the features, and the standards used to assess their condition, are listed in separate monitoring documents, which will be available from Natural England.

These tables do not give advice about SSSI features or other legally protected species which may also be present within the European Site.

If you have any comments or queries about this Supplementary Advice document please contact your local Natural England adviser or email HDIRConservationObjectivesNE@naturalengland.org.uk

About this site

European Site information

Name of European Site	Thorne and Hatfield Moors Special Protection Area (SPA)
Location	Doncaster, East Riding of Yorkshire and North Lincolnshire
Site Map	The designated boundary of this site can be viewed here on the MAGIC website
Designation Date	16 August 2000
Qualifying Features	See section below
Designation Area	2,449.2 ha
Designation Changes	N/A
Feature Condition Status	Details of the feature condition assessments made at this site can be found using Natural England's Designated Sites System
Names of component Sites of Special Scientific Interest (SSSIs)	Hatfield Moors SSSI, Thorne, Crowle and Goole Moors SSSI
Relationship with other European or International Site designations	Thorne and Hatfield Moors Special Protection Area (SPA) overlaps with Thorne Moors SAC and Hatfield Moors SAC

Site background and geography

Thorne and Hatfield Moors SPA lies within the flat, low-lying and large scale agricultural landscape of the Humberhead Levels National Character Area. Thorne Moor is England's largest area of raised bog, lying a few kilometres from the smaller Hatfield Moors, both within the former floodplain of the rivers feeding the Humber estuary (Humberhead Levels), and includes the sub-components Goole Moors and Crowle Moors.

The SPA is managed as a National Nature Reserve.

Although management has increased the proportion of active raised bog at Thorne Moors, the inclusion of Goole Moors, where peat-extraction has now ceased, means that the site is still predominantly degraded raised bog. The restored secondary surface is rich in species of bog-mosses *Sphagnum* spp., common and hare's-tail cottongrasses *Eriophorum angustifolium* and *E. vaginatum*, heather *Calluna vulgaris*, cross-leaved heath *Erica tetralix*, round-leaved sundew *Drosera rotundifolia*, cranberry *Vaccinium oxycoccos* and bog-rosemary *Andromeda polifolia*

Hatfield Moors is a remnant of an extensive lowland raised bog which once occupied the Humberhead levels. Hatfield is unique in having developed directly upon nutrient deficient gravels without an initial reed-swamp phase. Much of the bog has been cut for peat yet a restricted representative flora and fauna persists within a mosaic of mire and dry heath habitats beneath birch scrub. The mire communities are dominated by cottongrasses *Eriophorum vaginatum* and *E. angustifolium*, cross-leaved heath *Erica tetralix* and bog-mosses *Sphagnum* spp., but include locally rare species such as cranberry *Vaccinium oxycoccus*, bog myrtle *Myrica gale* and bog rosemary *Andromeda polifolia*.

In addition to breeding nightjars, the site also supports small numbers (at non-qualifying levels) of other Annex 1 species: Hen Harrier *Circus cyaneus*, Merlin *Falco columbarius* and Short-eared Owl *Asio flammeus* hunt over the site in winter and at least one pair of Hobbies *Falco subbuteo* feed over the site in summer. Also notable are Nightingales *Luscinia megarhynchos* which breed at one of their most northerly regular sites in Britain.

About the qualifying features of the SPA

The following section gives you additional, site-specific information about this SPA's qualifying features. These are the individual species of wild birds listed on Annex I of the European Wild Birds Directive, and/or the individual regularly-occurring migratory species, and/or the assemblages (groups of different species occurring together) of wild birds for which the SPA was classified for.

Qualifying individual species listed in Annex I of the Wild Birds Directive

During the breeding season the SPA regularly supports:

A224 Nightjar (*Caprimulgus europaeus)*

At the time of its classification, the SPA supported 66 pairs of nightjar, representing at least 1.9% of the breeding population in Great Britain.

Nightjars are nocturnal birds and can often be seen hawking for food at dusk and dawn. With pointed wings and a long tails their shape is similar to a kestrel or cuckoo. They are ground nesters, and their cryptic, grey-brown, mottled, streaked and barred plumage provides ideal camouflage in the daytime. They are insectivorous birds, feeding primarily on moths and beetles.

Nightjars are migratory, generally arriving in the UK to breed in May and spending the winter months feeding in parts of Africa. The species is considered to be vulnerable to the effects of long-term climate change on drought-prone areas of Africa.

The Nightjar population on Thorne & Hatfield Moors SPA has been surveyed annually since 2005. Numbers of singing or 'churring' males has varied from 71 to 95 during this time. Breeding nightjar territories are located on suitable habitats across Thorne, Hatfield and Crowle Moors. Although one or two pairs annually nest on high tussocks of vegetation on the lowland raised bog habitat, the majority of the population is situated on those drier parts of the site with mature trees and a mosaic of scrub and dry heath.

Breeding concentrations will move on a year by year basis to exploit on-site habitat management but will always gravitate to locations with mature trees (used by males as 'churring' posts) and dry habitat mosaics. This combination of habitat features is located on both Hatfield Moor and Thorne Moors and breeding pairs are distributed fairly evenly across both sites. On-going survey of the nightjar populations on the SPA has revealed that feeding flights are not confined to the SPA, and birds will utilise the hinterland of the site, with birds flying up to 5km from the site for feeding purposes.

As a result of its extensive habitats, relatively few visitors, isolated location and management to support nature conservation objectives, nightjars on Thorne and Hatfield Moors suffer relatively little from disturbance and predation. Availability of suitable open, dry habitats, as well as general population trends are likely to be the primary population drivers for the species on Thorne and Hatfield Moors. This is supported by the fact that the nightjar population on site has remained relatively stable over recent years at levels consistently above that required to meet the conservation objectives for the SPA.

Qualifying individual species not listed in Annex I of the Wild Birds Directive: N/A

Qualifying assemblage of species: N/A

Site-specific seasonality of qualifying SPA features

The table below highlights in grey those months in which significant numbers of each mobile qualifying feature are most likely to be present at the SPA during a typical calendar year. This table is provided as a general guide only.

Unless otherwise indicated, the months shown below are primarily based on information relating to the general months of occurrence of the feature in the UK. Where site-based evidence is available and has been used to indicate below that significant numbers of the feature are typically present at this SPA outside of the general period, the site-specific references have been added to indicate this.

Applicants considering projects and plans scheduled in the periods highlighted in grey would benefit from early consultation with Natural England given the greater scope for there to be likely significant effects that require consideration of mitigation to minimise impacts to qualifying bird features during the principal periods of site usage by those features. The months which are *not* highlighted in grey are not ones in which the features are necessarily absent, rather that features may be present in less significant numbers in typical years. Furthermore, in any given year, features may occur in significant numbers in months in which typically they do not. Thus, applicants should not conclude that projects or plans scheduled in months not highlighted in grey cannot have a significant effect on the features. There may be a lower likelihood of significant effects in those months which nonetheless will also require prior consideration.

Any assessment of potential impacts on the features must be based on up-to-date count data and take account of population trends evident from these data and any other available information. Additional site-based surveys may be required.

Feature	Season	Period	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Site-specific references where available
Nightjar	Breeding	Summer													

Guide to terms:
Breeding – present on a site during the normal breeding period for that species
Non-breeding - present on a site outside of the normal breeding period for that species (includes passage and winter periods).
Summer – the period generally from April to July inclusive
Passage - the periods during the autumn and spring when migratory birds are moving between breeding areas and wintering areas. These periods are not strictly defined but generally include the months of July – October inclusive (autumn passage) and March – April inclusive (spring passage).
Winter - the period generally from November to February inclusive.

Table 1: Supplementary Advice for Qualifying Features: A224. *Caprimulgus europaeus*; European nightjar (Breeding)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Breeding population (within the SPA)	**Population abundance**	Maintain the size of the breeding Nightjar population at a level which is above 66 pairs, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	Annual population surveys carried out between 2005 and 2018 demonstrate a fluctuation in numbers on a year by year basis of between 71 (2005, 2008) and 95 (2017) churring males. Populations fluctuate based on habitat availability, the wetness of the site when birds arrive in April and factors external to site condition. This will sustain the site's population and ensures it contributes to a viable local, national and bio-geographic population. Due to the mobility of birds and the dynamic nature of population change, the target-value given for the abundance of this feature is considered to be the minimum standard for conservation/ restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size has significantly changed as a result of natural factors or management measures and has been stable at or above a new level over a considerable period. The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current abundance of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is classified, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account. Maintaining or restoring bird abundance depends on the suitability of the site. However, factors affecting suitability can also determine other demographic rates of birds using the site including survival (dependent on factors such as body condition which influences the ability to breed or make foraging and / or migration movements) and breeding productivity. Adverse anthropogenic impacts on either of these rates	KOHLER, T, 2018. - Humberhead Peatlands NNR Management Plan (draft) – Natural England MIDDLETON BELL ECOLOGY, 2018. Nightjar breeding survey, Humberhead Peatlands NNR, 2018. Unpublished NE report BRIGHT, LANGSTON & BIERMAN, 2007. Habitat associations of nightjar *Caprimulgus europaeus* breeding on heathland in England - (RSPB). NATURAL ENGLAND, 2014. Site Improvement Plan: Thorne & Hatfield Moors (SIP246). (can be downloaded here) JNCC SPA citation for: Thorne & Hatfield Moors SPA. (Can be downloaded here)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			may precede changes in population abundance (e.g. by changing proportions of birds of different ages) but eventually may negatively affect abundance. These rates can be measured/estimated to inform judgements of likely impacts on abundance targets. Unless otherwise stated, the population size will be that measured using standard methods such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of natural fluctuations and margins of error during data collection. Whilst we will endeavour to keep these values as up to date as possible, local Natural England staff can advise on whether the figures stated are the best available.	
Supporting habitat (both within and outside the SPA): disturbance	**Minimising disturbance caused by human activity**	Reduce the frequency, duration and/or intensity of disturbance affecting nesting, roosting, foraging or feeding birds so that the breeding Nightjar population is not significantly disturbed	The nature, scale, timing and duration of some human activities can result in the disturbance of birds at a level that may substantially affect their behaviour, and consequently affect the long-term viability of the population. Such disturbing effects can for example result in changes to feeding or roosting behaviour, increases in energy expenditure due to increased flight, abandonment of nest sites and desertion of supporting habitat (both within or outside the designated site boundary where appropriate). This may undermine successful nesting, rearing, feeding and/or roosting, and/or may reduce the availability of suitable habitat as birds are displaced and their distribution within the site contracts. Disturbance associated with human activity may take a variety of forms including noise, light, sound, vibration, trampling, presence of people, animals and structures. The nightjar project associated with the LIFE+ programme on Thorne & Hatfield Moors has demonstrated that disturbance currently is not a significant factor in the success or otherwise of nightjar populations on-site. Although the SPA is managed as a nature reserve, the size, visitor infrastructure and scale of the habitats available to breeding nightjar means that disturbance impacts are insubstantial. This will need to be monitored over time.	BRIGHT, LANGSTON & BIERMAN, 2007.Habitat associations of nightjar *Caprimulgus europaeus* breeding on heathland in England - (RSPB). MIDDLETON BELL ECOLOGY, 2018– Nightjar breeding survey, Humberhead Peatlands NNR, Unpublished NE report KOHLER, T, 2018. Humberhead Peatlands NNR Management Plan (draft) – Natural England 2018
Supporting habitat (both within	**Extent and distribution of supporting**	Maintain the extent, distribution and availability of suitable breeding habitat which supports	Conserving or restoring the extent of supporting habitats and their range will be key to maintaining the site's ability and capacity to support the SPA population. The information available on the extent and	MIDDLETON BELL ECOLOGY, 2018.Nightjar breeding survey,

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
and outside the SPA): extent and distribution	**breeding habitat**	Nightjar for all necessary stages of its breeding cycle (courtship, nesting, feeding).	distribution of supporting habitat used by the feature may be approximate depending to the nature, age and accuracy of data collection. This target will apply to any supporting habitat which is known to occur outside the site boundary. Thorne and Hatfield Moors SPA overlaps with Thorne and Hatfield Moors SAC, the qualifying feature of which is lowland raised bog. The nightjar population on the SPA is far more reliant on European dry heath and successional woodland habitats than it is on lowland raised bog. Whilst nightjars will utilise larger hummocks of dry ground within raised bogs, the population density of nightjars on areas managed as raised bog is considerably lower than that on dry heathland. It is therefore important to balance the need to maintain sufficient habitat to support a healthy population of nightjars with the need to ensure that sufficient lowland raised bog habitat is maintained for the SAC to meet its condition targets. Continued habitat, population and distribution surveys will be necessary to ensure that habitat management for nightjars is successfully meeting this target, but also to ensure that habitat management for the SAC lowland raised bog qualifying feature is not detrimentally impacting on the nightjar population. The need to balance the requirements for SAC and SPA condition will be determined in the nature reserve management plan	Humberhead Peatlands NNR, 2018. Unpublished NE report RYAN, WHITE & ARNOLD, 2017.That's Life: Monitoring of European Nightjar 2015-2017. University of York 2017. Draft Natural England report KOHLER, T., 2018. Humberhead Peatlands NNR Management Plan (draft) – Natural England 2018
Supporting habitat (within the SPA): function/ supporting process	**Air quality**	Restore where necessary the concentrations and deposition of air pollutants to below the site-relevant Critical Load or Level values given for the supporting habitats of this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	The structure and function of the habitats which support this SPA feature may be sensitive to changes in air quality. Exceeding critical values for air pollutants may result in changes to the chemical status of its habitat substrate, accelerating or damaging plant growth, altering vegetation structure and composition and thereby affecting the quality and availability of nesting, feeding or roosting habitats. Critical Loads and Levels are thresholds below which such harmful effects on sensitive UK habitats will not occur to a noteworthy level, according to current levels of scientific understanding. There are critical levels for ammonia (NH3), oxides of nitrogen (NOx) and sulphur dioxide (SO2), and critical loads for nutrient nitrogen deposition and acid deposition. It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic	More information about site-relevant Critical Loads and Levels for this SPA is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk). KOHLER, T., 2018. - Humberhead Peatlands NNR Management Plan (draft) – Natural England

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			timescales. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development.	
Supporting habitat (both within and outside the SPA): function/ supporting process	**Connectivity with supporting habitats**	Maintain the safe passage of breeding Nightjars moving between nesting and feeding areas	The ability of the feature to safely and successfully move between feeding and nesting areas using flight-lines and movement routes is critical to their breeding success and to adult fitness and survival. This target will apply within the site boundary and where birds regularly move to and from off-site habitat where this is relevant. The foraging range of nightjar is known to extend up to several kilometres from their nest sites. The nightjar is insectivorous, feeding primarily on moths and beetles. The location of feeding areas which support the SPA's nightjar population is often not well understood and may require specific studies or research. Radio-tracking studies at other sites have shown that nightjars will often avoid some areas and instead travel to superficially similar habitat further away, suggesting that they exploit a few particularly rich feeding sites. Tagging data on the birds breeding on Thorne & Hatfield has demonstrated that some individuals will fly considerable distances from the SPA to feed – routes utilised in these cases often mirror linear features such as hedgerows and field drains. Although many birds did utilise habitat fringing the SPA, very few flew more than 3km from the site boundary. The hinterland around the edge of the SPA is therefore utilised by feeding birds extensively.	RYAN, WHITE & ARNOLD, 2017.That's Life: Monitoring of European Nightjar 2015-2017. University of York 2017. Draft Natural England report
Supporting habitat (both within and outside the SPA): function/ supporting	**Conservation measures**	Maintain management or other measures (whether within and/or outside the site boundary as appropriate) necessary to maintain the structure, function and/or the supporting processes associated with the breeding	Active and ongoing conservation management is often needed to protect, maintain or restore this feature at this site. Other measures may also be required, and in some cases, these measures may apply to areas outside of the designated site boundary in order to achieve this target. Further details about the necessary conservation measures for this site can be provided by Natural England.	KOHLER, T, 2018. - Humberhead Peatlands NNR Management Plan (draft) – Natural England 2018 MIDDLETON BELL

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
process		Nightjar population and its supporting habitats.	This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. Habitat management should retain the open, mosaic structure of lowland wet and dry heath, ensuring all life cycles of heather are present. It may, in certain areas, be appropriate to maintain scrubby vegetation and occasional taller trees should be available for the nightjar to "churr" from. Population surveys have demonstrated that the habitats most frequently utilised by nightjars are in sufficient supply on site to maintain the population at the desired levels. Managing to ensure that the required habitat mosaic and open structure preferred by the species is included as part of the National Nature Reserve management plan.	ECOLOGY, 2018. – Nightjar breeding survey, Humberhead Peatlands NNR, 2018. Unpublished NE report BRIGHT, LANGSTON & BIERMAN, 2017. Habitat associations of nightjar *Caprimulgus europaeus* breeding on heathland in England - (RSPB), 2007
Supporting habitat (both within and outside the SPA): function/ supporting process	**Food availability within supporting habitat**	Maintain the distribution, abundance and availability of key prey items (e.g. moths, beetles) at prey sizes preferred by breeding Nightjar.	The availability of an abundant food supply is critically important for successful breeding, adult fitness and survival and the overall sustainability of the population. As a result, inappropriate management and direct or indirect impacts which may affect the distribution, abundance and availability of prey may adversely affect the population. Tagging data on the birds breeding on Thorne & Hatfield has demonstrated that some individual Nightjars will fly considerable distances from the SPA to feed – routes utilised in these cases often mirror linear features such as hedgerows and field drains. Although many birds did utilise habitat fringing the SPA, very few flew more than 3km from the site boundary. The hinterland around the edge of the SPA is therefore utilised by feeding birds extensively	KOHLER, T, 2018. Humberhead Peatlands NNR Management Plan (draft) – Natural England. BRIGHT, LANGSTON & BIERMAN, 2007. Habitat associations of nightjar *Caprimulgus europaeus* breeding on heathland in England - (RSPB), 2007 RYAN, WHITE & ARNOLD, 2017. That's Life: Monitoring of European Nightjar 2015-2017. University of York. Draft Natural England report
Supporting habitat (both within and outside	**Water quality/ quantity**	Where the supporting habitats of the SPA feature are dependent on surface water, maintain water quality and	For many SPA features which are dependent on wetland habitats supported by surface water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year during key stages of their life cycle.	KOHLER, T, 2018. - Humberhead Peatlands NNR Management Plan (draft) – Natural England.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
the SPA): function/ supporting process		quantity at a standard which provides the necessary conditions to support the feature.	Poor water quality and inadequate quantities of water can adversely affect the availability and suitability of breeding, rearing, feeding and roosting habitats. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the SPA Conservation Objectives but in some cases more stringent standards may be needed to support the SPA feature. Further site-specific investigations may be required to establish appropriate standards for the SPA. The nightjar population on Thorne and Hatfield is not dependent on water quality, however, there is a risk to the population from an over-abundance of water on site, One of the primary issues affecting the SAC lowland raised bog qualifying feature is the availability of water to re-wet degraded peat. The need for water to support the restoration of peat bog will have to be balanced against the risks of high water levels on the extent of dry habitats needed to support the nightjar population. The risk of this is reduced, but not entirely eliminated, by the recent improvement of the water control infrastructure on-site and so careful ongoing management is required.	
Supporting habitat (within the SPA): predation	**Predation**	Reduce the predation and disturbance of breeding Nightjars caused by native and non-native predators.	This will ensure that breeding productivity (number of chicks per pair) and survival are sustained at rates that maintain or restore the abundance of the feature. Impacts to breeding productivity can result directly from predation of eggs, chicks, juveniles and adults, and also from significant disturbance. The presence of predators can influence bird behaviours, such as abandonment of nest sites or reduction of effective feeding. Where evidence suggests predator management is required, measures can include their exclusion through fencing and scaring or by direct control. Any such measures must consider the legal protection of some predators, as well as the likely effects of such control on other qualifying features. Predation has not been identified as a significant factor in nightjar populations on Thorne & Hatfield moors SPA.	KOHLER, T, 2018. Humberhead Peatlands NNR Management Plan (draft) – Natural England.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting habitat (both within and outside the SPA): structure	**Landscape**	Maintain the amount of open and unobstructed patches within nesting and foraging areas, including areas of clear-fell, windfall, wide tracks, open forest and heath.	This feature is known to favour large areas of open terrain, largely free of obstructions, in and around its nesting, roosting and feeding areas. Often there is a need to maintain an unobstructed line of sight within nesting, feeding or roosting habitat to detect approaching predators, or to ensure visibility of displaying behaviour. An open landscape may also be required to facilitate movement of birds between the SPA and any off-site supporting habitat.	KOHLER, T, 2018. Humberhead Peatlands NNR Management Plan (draft) – Natural England 2018 RYAN, WHITE & ARNOLD, 2017. That's Life: Monitoring of European Nightjar 2015-2017. University of York. Draft Natural England report.
Supporting habitat (within the SPA): structure	**Vegetation characteristics**	Maintain sufficient ground vegetation in a suitable condition for nesting, mostly 20-60 cm tall with frequent bare patches of >2 m², 10-20% bare ground and <50% tree/scrub cover overall; trees <2 m in height) throughout the nesting area.	The height, cover, variation and composition of vegetation are often important characteristics of habitats supporting this feature which enable successful nesting/ rearing/ concealment/roosting. Many bird species will have specific requirements that conservation measures will aim to maintain, for others such requirements will be less clear. Activities that may directly or indirectly affect the vegetation of supporting habitats and modify these characteristics may adversely affect the feature.	KOHLER, T - Humberhead Peatlands NNR Management Plan (draft) – Natural England.
Supporting habitat: Structure/ function	**Adaptation and resilience**	Maintain the feature's ability, and that of its supporting habitats, to adapt or evolve to wider environmental change, either within or external to the site	This recognises the increasing likelihood of habitat features to absorb or adapt to wider environmental changes. Resilience may be described as the ability of an ecological system to cope with, and adapt to environmental stress and change whilst retaining the same basic structure and ways of functioning. Such environmental changes may include changes in sea levels, precipitation and temperature for example, which are likely to affect the extent, distribution, composition and functioning of a feature within a site. The vulnerability and response of features to such changes will vary. Using best available information, any necessary or likely adaptation or adjustment by the feature and its management in response to actual or expected climatic change should be allowed for, as far as practicable, in order to ensure the feature's long-term viability. The overall vulnerability of this particular SPA to climate change has been assessed by Natural England as being moderate, taking into	NATURAL ENGLAND (2015) Climate Change Theme Plan and National Biodiversity Climate Change Vulnerability Assessments (NBCCVAs). Available at: http://publications.naturalengland.org.uk/publication/4954594591375360

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			account the sensitivity, fragmentation, topography and management of its supporting habitats. This means that some adaptation action for specific issues may be required, such as reducing habitat fragmentation, creating more habitat to buffer the site or expand the habitat into more varied landscapes and addressing particular management and condition issues. Individual species may be more or less vulnerable than their habitat itself. In many cases, change will be inevitable so appropriate monitoring would be required.	
Version Control Advice last updated: n/a				
Variations from national feature-framework of integrity-guidance: none.				

European Site Conservation Objectives for Thorne Moor Special Area of Conservation Site Code: UK0012915

With regard to the SAC and the natural habitats and/or species for which the site has been designated (the 'Qualifying Features' listed below), and subject to natural change;

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**

This document should be read in conjunction with the accompanying *Supplementary Advice* document, which provides more detailed advice and information to enable the application and achievement of the Objectives set out above.

Qualifying Features:

H7120. Degraded raised bogs still capable of natural regeneration

Explanatory Notes: European Site Conservation Objectives

These Conservation Objectives are those referred to in the Conservation of Habitats and Species Regulations 2017 as amended from time to time (the “Habitats Regulations”). They must be considered when a competent authority is required to make a ‘Habitats Regulations Assessment’, including an Appropriate Assessment, under the relevant parts of this legislation.

These Conservation Objectives and the accompanying Supplementary Advice (where available) will also provide a framework to inform the measures needed to conserve or restore the European Site and the prevention of deterioration or significant disturbance of its qualifying features.

These Conservation Objectives are set for each habitat or species of a Special Area of Conservation (SAC). Where the objectives are met, the site will be considered to exhibit a high degree of integrity and to be contributing to achieving Favourable Conservation Status for that species or habitat type at a UK level. The term ‘favourable conservation status’ is defined in regulation 3 of the Habitats Regulations.

Publication date: 27 November 2018 (version 3). This document updates and replaces an earlier version dated 30 June 2014 to reflect the consolidation of the Habitats Regulations in 2017.

European Site Conservation Objectives: Supplementary advice on conserving and restoring site features

Thorne Moor Special Area of Conservation (SAC)
Site Code UK0012915

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Date of Publication: 11 February 2019

About this document

This document provides Natural England's supplementary advice about the European Site Conservation Objectives relating to Thorn Moor SAC. This advice should therefore be read together with the SAC Conservation Objectives available here.

Where this site overlaps with other European Sites, you should also refer to the separate European Site Conservation Objectives and Supplementary Advice (where available) provided for those sites.

You should use the Conservation Objectives, this Supplementary Advice and any case-specific advice given by Natural England, when developing, proposing or assessing an activity, plan or project that may affect this site.

This Supplementary Advice to the Conservation Objectives presents attributes which are ecological characteristics of the designated species and habitats within a site. The listed attributes are considered to be those that best describe the site's ecological integrity and which, if safeguarded, will enable achievement of the Conservation Objectives. Each attribute has a target which is either quantified or qualitative depending on the available evidence. The target identifies as far as possible the desired state to be achieved for the attribute.

The tables provided below bring together the findings of the best available scientific evidence relating to the site's qualifying features, which may be updated or supplemented in further publications from Natural England and other sources. The local evidence used in preparing this supplementary advice has been cited. The references to the national evidence used are available on request. Where evidence and references have not been indicated, Natural England has applied ecological knowledge and expert judgement. You may decide to use other additional sources of information.

In many cases, the attribute targets shown in the tables indicate whether the current objective is to 'maintain' or 'restore' the attribute. This is based on the best available information, including that gathered during monitoring of the feature's current condition. As new information on feature condition becomes available, this will be added so that the advice remains up to date.

The targets given for each attribute do not represent thresholds to assess the significance of any given impact in Habitats Regulations Assessments. You will need to assess this on a case-by-case basis using the most current information available.

Some, but not all, of these attributes can also be used for regular monitoring of the actual condition of the designated features. The attributes selected for monitoring the features, and the standards used to assess their condition, are listed in separate monitoring documents, which will be available from Natural England.

These tables do not give advice about SSSI features or other legally protected species which may also be present within the European Site.

If you have any comments or queries about this Supplementary Advice document please contact your local Natural England adviser or email HDIRConservationObjectivesNE@naturalengland.org.uk

About this site

European Site information

Name of European Site	Thorn Moor Special Area of Conservation (SAC)
Location	South Yorkshire, East Riding of Yorkshire, North Lincolnshire
Site Map	The designated boundary of this site can be viewed here on the MAGIC website
Designation Date	1 April 2005
Qualifying Features	See section below
Designation Area	1911.02 ha
Designation Changes	N/A
Feature Condition Status	Details of the feature condition assessments made at this site can be found using Natural England's Designated Sites System
Names of component Sites of Special Scientific Interest (SSSIs)	Thorne, Crowle and Goole Moors SSSI
Relationship with other European or International Site designations	The SAC overlaps part of the Thorne and Hatfield Moors SPA. Further information about this site can be found here.

Site background and geography

Thorne Moors SAC lies within the Humberhead Levels National Character Area. Thorne Moor is England's largest area of raised bog, lying a few kilometres from the smaller Hatfield Moors, both within the former floodplain of the rivers feeding the Humber estuary (Humberhead Levels), and includes the sub-components Goole Moors and Crowle Moors. The Moors lie on a flat plain formed from the bed of the glacial Lake Humber, which drained out through the Humber Gap after the last ice age. The site formed about 4-5000 years before present after a period of sea level rise caused the rivers flowing through the area to back up, and originally formed part of a vast marsh and fen covering around 500 square miles around the upper Humber, and in the Axholme and Hull valleys.

Drainage, land reclamation for agriculture, and peat extraction over the last 500 years has resulted in the loss of this wetland area, leaving Thorne and Hatfield Moors as the only remaining large scale wetlands. Although the Moors retain a significant wildlife interest and wetland character, they have been extensively damaged by peat extraction and the drainage of surrounding land. The site now sits as an island within an intensively managed, highly productive, arable landscape.

About the qualifying features of the SAC

The following section gives you additional, site-specific information about this SAC's qualifying features. These are the natural habitats and/or species for which this SAC has been designated.

Qualifying habitats:

- ***H7120*** **Degraded raised bogs still capable of natural regeneration**

Thorne Moor is England's largest area of raised bog, lying a few kilometres from the smaller Hatfield Moors, both within the former floodplain of the rivers feeding the Humber estuary (Humberhead Levels), and includes the sub-components Goole Moors and Crowle Moors. Although recent management has increased the proportion of **7110 active raised bog** at Thorne Moors, the inclusion of Goole Moors, where peat-extraction has now ceased, means that the site is still predominantly **degraded raised bog**. The restored secondary surface is rich in species of **7110 Active raised bogs** with bog-mosses S*phagnum* spp., cottongrasses *Eriophorum angustifolium* and *E. vaginatum*, heather *Calluna vulgaris,* cross-leaved heath Erica tetralix, round-leaved sundew Drosera rotundifolia, cranberry *Vaccinium oxycoccos* and bog-rosemary *Andromeda polifolia*

Qualifying Species:

None

Table 1: Supplementary Advice for Qualifying Features: H7120. Degraded raised bogs still capable of natural regeneration

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	**Extent of the feature within the site**	Restrict the further degradation of the extent of the H7120 feature, whilst restoring 1798 hectares of the H7120 feature to H7110 Active Raised Bogs	There should be no measurable increase in the extent and area of this feature, the full extent of the feature should be restored to H7110 Active Raised Bogs. The baseline-value of extent given has been generated using data taken from the Site Management Plan and the Definition of Favourable Condition for the SSSI. Area measurements given may be approximate depending on the methods, age and accuracy of data collection, and as a result this value may be updated in future to reflect more accurate information. The extent of an Annex I habitat feature covers the sum extent of all of the component vegetation communities present and may include transitions and mosaics with other closely-associated habitat features. For this feature, 'Bog' is taken here to be the peat deposit together with typical bog vegetation, irrespective of the precise nature and condition of that vegetation. The figure of 1798 ha includes all the peat based soils within the site but excludes areas where these have been modified by warping (deposition of river silt over the peat by deliberate flooding) or where all peat has been removed. 'Lagg fen' comprises both peat deposit and vegetation, irrespective of nature and condition	Natural England. 2013. Definition of Favourable Condition – Thorne Crowle and Goole Moors SSSI Natural England. 2018. Humberhead Peatlands Site Management Plan Natural England. 2014. Site Improvement Plan – Thorne and Hatfield Moors
Extent and distribution of the feature	**Spatial distribution of the feature within the site**	Restrict the further degradation of the distribution of the H7120 feature, whilst expanding the distribution of the H7110 Active Raised Bog feature within the site	A contraction in the range, or geographic spread, of the current H7120 feature (and its component vegetation and typical species, plus transitional communities) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its capacity to be restored to the H7110 active raised bog feature. This may also reduce and break up the continuity of a habitat within a site and how well its typical species are able to move around the site to occupy and use habitat. Such fragmentation can impact on their viability and the wider ecological composition of the Annex I habitat. Smaller fragments of habitat can typically support smaller and more isolated populations which are more vulnerable to extinction. These fragments also have a greater amount of open edge habitat which will differ in	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			the amount of light, temperature, wind, and even noise that it receives compared to its interior. These conditions may not be suitable for some of the typical and more specialist species associated with the Annex I habitat feature. On this site the spatial extent of the feature is taken to encompass all the peat soil.	
Structure and function (including its typical species)	**Soils, substrate and nutrient cycling**	Restrict further degradation of the peat substrate of the H7120 feature and restore the properties of the underlying peat type, including its structure, bulk density, total carbon, pH, soil nutrient status and fungal/bacterial ratio, to within typical values for H7110 Active Raised Bog habitat.	Changes to natural properties of the bog's peat body may affect the ecological structure, function and processes associated with this Annex I feature. The typical substrate for this feature is acidic and nutrient-poor peat. Peat is distinguished from other soil types by its high content of organic matter, which results from plant growth and waterlogging combining to reduce decomposition rates and allow a build-up, over time, of semi-decomposed plant material to form peat. Peat is naturally lacking in nutrients with typically low values of calcium, phosphate, nitrate and pH. While on a typical active raised bog the surface should be made up of two distinct layers; an acrotelm and a catotelm. The thin upper layer, or 'acrotelm', is typically up to 30cms deep and consists of living plant material and is a zone of fluctuating water table, where relatively rapid plant decomposition occurs. Below this is the 'catotelm', a much thicker layer of peat which comprises broken down plant material and is always below the water table. On this site, the surface acrotelm layer has been affected by past drainage and peat cutting and has been replaced with a single layer of damaged catotelm ('haplotelm') between 0-3 metres thick, which in some places is not entirely below the water table.	
Structure and function (including its typical species)	**Vegetation community composition**	Restore the component vegetation communities of the H7210 feature to those resembling and characterised by the following National Vegetation Classification types typical of H7110 Active Raised Bog	This habitat feature when restored will comprise a number of associated semi-natural and natural vegetation types associated with H7110 Active Raised Bog and their transitional zones, reflecting the geographical location of the site, altitude, aspect, soil conditions (especially base-status and hydrology) and vegetation management. In the UK these have been categorised by the National Vegetation Classification (NVC).	This attribute will be periodically monitored as part of Natural England's site condition assessments McDonald *et al.*2014. Thorne Moors, A Botanical Survey

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		M2 *Sphagnum cuspidatum/ Sphagnum recurvum* bog pool community (mire expanse and rand) M4 *Carex rostrata-Sphagnum recurvum* mire M6 *Carex echinata-Sphagnum recurvum/auriculatum* mire M18 *Erica tetralix-Sphagnum papillosum* raised and blanket mire	Restoring degraded bog vegetation to characteristic and distinctive H7110 active bog vegetation types will be important to restoring the overall habitat feature. This will also help to conserve their typical plant species (including the constant and preferential species of a vegetation community), and therefore those of the SAC feature, at appropriate levels (recognising natural fluctuations). The component wetland types of active raised bog will comprise the bog expanse, the sloping margins of the bog (or 'rand') (although this may not always be possible to map) and lagg fen. The bog expanse will typically be characterised by ombrotrophic vegetation (such as M18 Erica tetralix-Sphagnum papillosum raised and blanket mire and M2 Sphagnum cuspidatum/recurvum bog pool community). It should comprise an intimate mix of typical bryophytes (predominantly Sphagnum spp), grasses/sedges and dwarf shrubs, with no one group dominating at the expense of others on 'active' sites. Sphagnum should predominate on hyper-oceanic sites, while its cover may be slightly lower on eastern sites with lower rainfall. The bog rand will typically consist of communities of drier peat and the lagg fen by vegetation associated with swamp and fen habitats. The existing habitats currently fit very badly into NVC categories due to the extensive damage from drainage and peat cutting, and comprise only a small suite of the typical species. While the aim will be to restore to recognisable NVC communities, these are likely to limited in their diversity for the foreseeable future	Thorne and Hatfield Moors Conservation Forum That's LIFE – The Restoration of the Humberhead Peatlands – Final Report (LIFE 13NAT/UK/000451), 2019, Natural England
Structure and function (including its typical species)	**Structural diversity**	Restore the full range of structural features (e.g. vegetation cover, surface patterning and hydrological transitions) typically associated with H7110 Active Raised Bog to the H7120 feature at this site.	Active raised bogs in particular show varying degrees of structural variation and surface patterning reflecting hydrological gradations (which may be natural or the result of previous damage). These can occur at both macro and micro scales across the habitat and include alternative aquatic and terrestrial surface features, such as bog pools and hummocks, ridges and hollows. These features will support distinctive patterns of bog vegetation, and so will be sensitive to changes	This attribute will be periodically monitored as part of Natural England's site condition assessments Natural England. 2013. Definition of Favourable Condition – Thorne Crowle and Goole Moors SSSI

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			in topography and hydrology. All previous natural features have been destroyed on this site, due to the removal of the original peat surface by peat cutting. However an extensive network of flooded cuttings and drains mimics some of the expected features. Typical Lagg Fen habitats have been mostly been lost, but small areas remain in places. These include small areas of fen and wet woodland	Natural England. 2018. Humberhead Peatlands Site Management Plan
Structure and function (including its typical species)	**Key structural, influential and/or distinctive species**	Restore the abundance of the typical species listed below to enable each of them to be a viable component of H7110 Active Raised Bog habitat The constant and preferential plants of the mire NVC community types which forms a key component of the H7210 feature *Sphagnum mosses including Sphagnum capillifolium; S. magellanicum; S. papillosum; S. tenellum*; *Sphagnum cuspidatum*; *S. pulchrum*	Some plant or animal species (or related groups of such species) make a particularly important contribution to the necessary structure, function and/or quality of an Annex I habitat feature at a particular site. These species will include; • **Structural** species which form a key part of the Annex I habitat's structure or help to define that habitat on a particular SAC (see also the attribute for 'vegetation community composition'). • **Influential** species which are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of soil/sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat) • **Site-distinctive** species which are considered to be a particularly special and distinguishing component of an Annex I habitat on a particular SAC. There may be natural fluctuations in the frequency and cover of each of these species. The relative contribution made by them to the overall ecological integrity of a site may vary, and Natural England will provide bespoke advice on this as necessary. The list of species given here for this Annex I habitat feature at this SAC is not necessarily exhaustive. The list may evolve, and species may be added or deleted, as new information about this site becomes available.	This attribute will be periodically monitored as part of Natural England's site condition assessments Natural England. 2013. Definition of Favourable Condition – Thorne Crowle and Goole Moors SSSI Natural England. 2018. Humberhead Peatlands Site Management Plan

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			For this feature, the vegetation of the mire expanse should comprise an inter-mix of typical bryophytes (predominantly Sphagnum spp), graminoids and dwarf shrubs, with no one group dominating at the expense of others on 'active' sites. Although Sphagnum may predominate on hyper-oceanic sites, purple moor-grass Molinia may be typical and abundant on the bog margin ('rand') of active sites and more widely on degraded sites.	
Structure and function (including its typical species)	**Invasive, non-native and/or introduced species**	Ensure invasive and introduced non-native species are either rare or absent, and if present are not undermining the restoration of the H7120 feature	Invasive or introduced non-native species can be a serious potential threat to the structure and function of these habitats, because they are able to exclude, damage or suppress the growth of their associated typical species, reduce structural diversity of the habitat and prevent the natural regeneration of characteristic site-native species. Once established, the measures to control such species may also impact negatively on the features of interest (e.g. use of broad spectrum herbicides). The main damaging invasive non-native species on the site are Rhododendron, *rhododendron ponticum* and Himalayan Balsam *Impatiens glandulifera* is also widespread in more nutrient rich areas. Water fern, *Azolla filiculoides* has also been found.	Species taken from site monitoring visits and McDonald *et al*, Thorne Moors, A Botanical Survey, 2014. Thorne & Hatfield Moors Conservation Forum
Structure and function (including its typical species)	**Supporting off-site habitat**	Restore the extent, quality and spatial configuration of land or habitat surrounding or adjacent to the site which is known to support the restoration of the H7120 raised bog feature	The structure and function of the qualifying habitat, including its typical species, may rely upon the continued presence of areas which surround and are outside of the designated site boundary. Changes in surrounding land-use may adversely (directly/indirectly) affect the functioning of the feature and its component species. The protection and management of peripheral peat and the land immediately around the peat body will be of critical functional importance to the restoration of the H7120 feature to active bog and lag. The hydrology and ongoing management of this land must also be compatible with the long-term recovery and maintenance of the bog. The nature of the wider landscape within which the bog sits will determine the extent of the functionally important off-site habitat, and will need site-by-site assessment.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			There are a few areas of supporting habitat (birch woodland on peat). There are also extensive adjacent areas which would support lagg fen if not in agricultural use, and would formerly have been part of the bog ecosystem	
Structure and function (including its typical species)	**Hydrology**	At a site, unit and/or catchment level (as necessary), restore natural hydrological processes to provide the water levels and conditions necessary to prevent further degradation of the H7120 feature within the site and to enable its restoration to H7110 active raised bog	Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site. The restoration of this structural attribute of the H7120 degraded bog feature will be a key element of its recovery to H7110 active raised bog. The hydrology of degraded raised bog fails to support the processes and vegetation of active raised bog, which is the desired feature on this part of the site. Low and/or fluctuating water levels in the peat leads to oxidation and loss (wastage) of the peat along with loss of ability of the peat body to retain rainwater and accumulate peat. Bog species adapted to waterlogged, acidic and nutrient-poor conditions will be lost. Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. The surface of an active raised bog has low nutrient, waterlogged or high water table conditions. An abundance of the bog-mosses *Sphagnum papillosum, S. capillifolium, S. tenellum* and *S. magellanicum* will often indicate good surface conditions. At this site the hydrology has been significantly modified by drainage channels and removal of peat, resulting in a risk of flooding in the northern part of the site. Recovery is considered possible but will require active management for a significant period of time.	Natural England. 2014. Site Improvement Plan – Thorne and Hatfield Moors Natural England. 2014. Thorne Moors Detailed Notification Review Tween Bridge Internal Drainage Board. 2010. Thorne Moors Water Level Management Plan
Structure and function (including its typical species)	**Water chemistry**	Maintain the surface water and groundwater supporting the hydrology of the rain-fed bog at a low nutrient status.	Active raised bog in an undamaged state is characterised by a dome of peat which has developed through several thousand years of peat accumulation. This dome stands above the level of the surrounding land surface and effectively isolates the surface of the raised bog from the influence of groundwater. By	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			being elevated, the raised bog is directly fed by atmospheric precipitation and so it has an acidic nature that is naturally poor in nutrients and which sustains its characteristic bog communities and associated typical species. Active raised bogs are naturally lacking in nutrients with typically low values of calcium, phosphate, nitrate and pH. The mire expanse of an active raised bog typically has low nutrient, waterlogged or high water table conditions. An abundance of the bog-mosses *Sphagnum papillosum, S. capillifolium, S. tenellum* and *S. magellanicum* will often indicate good surface condition. There are not thought to be any water inputs to the site other than rainfall.	
Structure and function (including its typical species)	**Adaptation and resilience**	Reduce the further degradation of the feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either within or external to the site	This recognises the increasing likelihood of natural habitat features to absorb or adapt to wider environmental changes. Resilience may be described as the ability of an ecological system to cope with, and adapt to environmental stress and change whilst retaining the same basic structure and ways of functioning. Such environmental changes may include changes in sea levels, precipitation and temperature for example, which are likely to affect the extent, distribution, composition and functioning of a feature within a site. The vulnerability and response of features to such changes will vary. The overall vulnerability of this SAC to climate change has been assessed by Natural England (2015) as being high, taking into account the sensitivity, fragmentation, topography and management of its habitats. This means that this site is considered to be the most vulnerable sites overall and are likely to require the most adaptation action, most urgently. A site based assessment should be carried out as a priority. This means that action to address specific issues is likely, such as reducing habitat fragmentation, creating more habitat to buffer the site or expand the habitat into more varied landscapes and addressing particular management and condition issues. Individual species may be more or less vulnerable than their habitat itself. In many cases, change will	Natural England. 2015. Climate Change Theme Plan and supporting National Biodiversity Climate Change Vulnerability assessments ('NBCCVAs') for SACs and SPAs in England [Available at http://publications.naturalengland.org.uk/publication/4954594591375360].

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			be inevitable so appropriate monitoring would be advisable. Using best available information, any necessary or likely adaptation or adjustment by the feature and its management in response to actual or expected climatic change should be allowed for, as far as practicable, in order to ensure the feature's recovery and long-term viability as an Active Raised Bog. Current climate change models indicate little overall change in total rainfall, but wetter winters and drier summers.	
Supporting processes (on which the feature relies)	**Air quality**	Restore as necessary, the concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	This habitat type is considered sensitive to changes in air quality. Exceedance of these critical values for air pollutants may modify the chemical status of its substrate, accelerating or damaging plant growth, altering its vegetation structure and composition and causing the loss of sensitive typical species associated with it. Critical Loads and Levels are recognised thresholds below which such harmful effects on sensitive UK habitats will not occur to a significant level, according to current levels of scientific understanding. There are critical levels for ammonia (NH3), oxides of nitrogen (NOx) and sulphur dioxide (SO2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales.	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk). Natural England. 2014. Site Improvement Plan – Thorne and Hatfield Moors
Supporting processes (on which the feature relies)	**Functional connectivity with wider landscape**	Restore the overall extent, quality and function of any supporting features within the local landscape which provide a critical functional connection with	This recognises the potential need at this site to maintain or restore the connectivity of the site to its wider landscape in order to meet the conservation objectives. These connections may take the form of landscape features, such as habitat patches, hedges, watercourses and verges, outside of the	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		the site	designated site boundary which are either important for the migration, dispersal and genetic exchange of those typical species closely associated with qualifying Annex I habitat features of the site. These features may also be important to the operation of the supporting ecological processes on which the designated site and its features may rely. In most cases increasing actual and functional landscape-scale connectivity would be beneficial. Where there is a lack of detailed knowledge of the connectivity requirements of the qualifying feature, Natural England will advise as to whether these are applicable on a case by case basis.	
Supporting processes (on which the feature relies)	**Conservation measures**	Maintain the management measures (either within and/or outside the site boundary as appropriate) which are necessary to restore the structure, functions and supporting processes for restoration to H7110 Active Raised Bog	This information will typically be found within, where applicable, supporting documents such as the Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. Active and ongoing conservation management is needed to prevent further degradation of the H7120 Degraded Raised Bog feature at this site, and, more importantly, to restore it to H7110 Active Raised Bog habitat. Usually, raised bog restoration measures will aim to elevate and stabilise the underlying water table and re-establish waterlogged conditions, so the bog can re-grow and regain its characteristic structural features (e.g. bog pools) and its typical plant assemblages. Further details about the necessary conservation measures for this site can be provided by contacting Natural England.	Natural England. 2018. Humberhead Peatlands Site Management Plan Natural England (2014) Site Improvement Plan – Thorne and Hatfield Moors
Version Control Advice last updated: N/A				
Variations from national feature-framework of integrity-guidance: N/A				