



Inshore Special Area of Conservation: Margate and Long Sands

Draft Conservation Objectives and Advice on Operations



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1 Margate and Long Sands pSAC: Draft conservation objectives and operations advice

1.1 Natural England's role

The Conservation (Natural Habitats &c.) Regulations 1994 transpose the Habitats Directive into law in Great Britain. It gives Natural England a statutory responsibility to advise relevant authorities as to the conservation objectives for European marine sites in England and to advise relevant authorities as to operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species for which the sites have been designated. This information will be a key component of the management schemes which may be developed for these sites.

This document is the foundation for Natural England's advice for the Margate and Long Sands pSAC which will be issued in fulfilment of Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994 (the 'Regulation 33 package') on adoption of the site as a candidate SAC by UK government.

In addition to providing such advice, the Regulation 33 package will inform the scope and nature of any 'appropriate assessment' which the Directive requires to be undertaken for plans and projects (Regulations 48 & 50 and by Natural England under Regulation 20). Natural England may also provide more detailed advice to competent and relevant authorities assessing the implications of any such plans or projects.

This advice is also required under the Offshore Petroleum Activities (Conservation of Habitats) Regulations (as amended in 2007); the Environmental Impact Assessment and Natural Habitats (Extraction of Minerals by Marine Dredging) Regulations 2007.

1.2 The role of relevant authorities

The Conservation (Natural Habitats &c.) Regulations 1994 require competent authorities to exercise their functions so as to secure compliance with the Habitats Directive. A single management scheme which the relevant authorities may draw up under Regulation 34 for the European Marine Site provides a framework through which this could be done and it should be based on the advice in this package. Relevant authorities must, within their areas of jurisdiction, have regard to both direct and indirect effects on interest features of the site. This may include consideration of issues outside the boundary of the site.

1.3 Activity outside the control of relevant authorities

Nothing within a Regulation 33 package will require relevant authorities to undertake any actions or ameliorate changes in the condition of interest features if it is shown that the changes result wholly from natural causes¹. Having issued Regulation 33 advice for European marine sites, Natural England will work with relevant authorities and others to agree, within a defined time frame, a protocol for evaluating all observed changes to baselines and to develop an understanding of natural change and provide further guidance as appropriate and possible. This does not, however, preclude relevant authorities from taking action to prevent deterioration to the interest features, and indeed such actions should be taken when required.

¹ Determination of what constitutes natural change will be based on the best available information and scientific opinion at the time.

1.4 Role of conservation objectives

Conservation objectives are the starting point from which management schemes and monitoring programmes may be developed as they provide the basis for determining what is currently or may cause a significant effect, and they inform the scope of appropriate assessments of plans or projects. The conservation objectives set out what needs to be achieved and thus deliver the aims of the Habitats Directive.

1.5 Role of advice on operations

The advice on operations set out in Section 3 provides the basis for discussion about the nature and extent of the operations taking place within or close to the site and which may have an impact on its interest features. The advice should also be used to identify the extent to which existing measures of control, management and forms of use are, or can be made, consistent with the conservation objectives, and thereby focus the attention of relevant authorities and surveillance to areas that may need management measures.

This operations advice may need to be supplemented through further discussions with the relevant authorities and any advisory groups formed for the SAC.

1.6 Precautionary principle

All forms of environmental risk should be tested against the precautionary principle which means that where there are real risks to the site, lack of full scientific certainty should not be used as a reason for postponing measures that are likely to be cost effective in preventing such damage. It does not however imply that the suggested cause of such damage must be eradicated unless proved to be harmless and it cannot be used as a licence to invent hypothetical consequences. Moreover, it is important, when considering whether the information available is sufficient, to take account of the associated balance of likely costs, including environmental costs, and benefits (DETR & the Welsh Office, 1998).

2. Conservation objectives

2.1 Background to conservation objectives

The Conservation Objectives and definitions of favourable condition for features on the site may inform the scope and nature of any 'appropriate assessment' under the Habitats Regulations. An appropriate assessment will also require consideration of issues specific to the individual plan or project. The habitat quality definitions do not by themselves provide a comprehensive basis on which to assess plans and projects as required under:

- Regulations 20-21; 24; 48-50 and 54 – 85 of the Conservation (Natural Habitats &c.) Regulations 1994;
- Regulation 5 (1 – 4) of the Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001
- Regulations 6; 13(1); 18(3); 13(3); 19(3); 24 & Schedule 3 of the Environmental Impact Assessment and Natural Habitats (Extraction of Minerals by Marine Dredging) (England and Northern Ireland Regulations 2007).

The scope and content of an appropriate assessment will depend upon the location, size and significance of the proposed project. Natural England will advise on a case by case basis.

Following an appropriate assessment, competent authorities are required to ascertain the effect on the integrity of the site. The integrity of the site is defined in paragraph 20 of ODPM Circular 06/2005 (DEFRA Circular 01/2005) as the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified. The determination of favourable condition is separate from the judgement of effect upon integrity. For example, there may be a time-lag between a plan or project being initiated and a consequent adverse effect upon integrity becoming manifest in the condition assessment. In such cases, a plan or project may have an adverse effect upon integrity even though the site remains in favourable condition, at least in the short term.

The Conservation Objectives for European Sites under the Habitats Regulations are provided in accordance with paragraph 17 of ODPM Circular 06/2005 (DEFRA Circular 01/2005) which outlines the appropriate assessment process. The entry on the Register of European Sites gives the reasons for which a European Site was classified or designated.

2.2 Margate and Long Sands pSAC draft Conservation objectives

Under Regulation 33(2)(a) of the Conservation (Natural Habitats &c.) Regulations 1994, Natural England has a duty to advise other relevant authorities as to the conservation objectives for the European marine site. The draft conservation objectives for the Margate and Long Sands pSAC interest features are provided below. These are high level objectives for the site features, and Natural England / JNCC may refine them in future as our understanding of the features improves. They should be read in the context of other advice given, particularly:

- the Site Assessment Document which provides more detailed information about the site and evaluates its interest features according to the Habitats Directive selection criteria and guiding principles;

- the summary favourable condition table, which further defines favourable condition for the interest feature.

2.2.1 The draft conservation objective for sandbanks slightly covered by seawater all the time

Subject to natural change maintain, the **Sandbanks slightly covered by seawater all the time** in favourable condition², in particular:

- Dynamic sand communities
- Muddy sand and gravel communities

2.3 Background to favourable condition tables

The favourable condition table is the principle source of information that Natural England will use to assess the condition of an interest feature and as such comprises indicators of condition. Favourable condition tables will be drafted in detail on designation of the SAC and its adoption as a European marine site. This will involve the collation and quantification of a number of indicators of condition 'Attributes' which is a considerable task. For these draft objectives, an indication of the Attributes³ to be included in the condition table are given in table 2.2, and this will form the basis for the condition monitoring process as described below.

On many terrestrial European sites, we know sufficient about the required condition of qualifying habitats to be able to define favourable condition with confidence. In contrast understanding the functioning of large, varied, dynamic marine and estuarine sites, which experience a variety of pressures resulting from historic and current activities, is much more difficult, consequently it is much harder to define favourable condition so precisely in such sites. In general the conservation objectives provided are based on a *working* assumption that the *current* condition of the features is favourable for most attributes.

Where there are more than one year's observations on the condition of marine habitats, all available information will need to be analysed to determine, where possible, any natural environmental trends at the site. This will provide the basis for judgements of favourable condition to be determined in the context of natural change. Where it becomes clear that certain attributes may indicate a cause for concern, and if further investigation indicates this is justified, restorative management actions will need to be taken. The aim of such action would be to return the interest feature to favourable condition from any unfavourable state. Future editions of the advice within this document, produced by Natural England, will revise the current assumptions about feature condition in light of ongoing and future monitoring. This will be linked with any developments in our understanding of the structure and functioning of features and the pressures they are exposed to.

This advice also provides the basis for discussions with relevant authorities, and as such the attributes and associated measures and targets may be modified over time. The aim is to have a single agreed set of attributes that will be used as a basis for

² The summary favourable condition table outline in table 2.2 further defines favourable condition of the interest feature

³ Selected characteristic of an interest feature/sub-feature which provides an indication of the condition of the feature to which it applies.

monitoring in order to report on the condition of features. Condition monitoring of the attributes may be of fairly coarse methodology, underpinned by more rigorous methods on specific areas within the site. To meet UK common standards, Natural England will be committed to reporting on each of the attributes listed in the final version of the table. This information may be generated by Natural England or collected by other organisations through agreements.

The favourable condition table will be an important, but not the only, driver of the site monitoring programme. Other data, such as results from compliance monitoring, (assessing the conduct of activities in relation to licence conditions, conducted by relevant / competent authorities and their statutory advisors), together with data obtained to inform appropriate assessments, will also have an important role in assessing condition. The condition monitoring programme will be developed through discussion with the relevant / competent authorities and other interested parties, ideally as part of the management scheme process. Natural England will be responsible for collating the information required to assess condition, and will form a judgement on the condition of each feature within the site. The condition assessment will take into account all available information using the favourable condition table to guide the process.

Table 2.1 Indication of attributes to be used in defining favourable condition for the Margate and Long Sands pSAC

Favourable condition tables will be drafted in detail on designation of the SAC and its adoption as a European marine site

Attribute	Target	Comments
Extent of sandbanks	No change in extent of sublittoral sandbank sediment habitat allowing for natural fluctuation / known cyclical change	Consideration of changes in extent will need to take account of the dynamic nature of the sandbank, but a trend of reduction in extent may indicate long-term changes in the physical conditions influencing the feature.
Topography of sandbanks	No alteration in topography of the sandbanks allowing for natural responses to hydrodynamic regime	The depth and distribution of the sandbanks reflects the energy conditions and stability of the sediment, which is key to the structure of the feature. However, it should be noted that subtidal sandbanks are naturally dynamic environments and sections of them may be subject to significant fluctuations in height over time, while other sections are more stable.
Sediment character: sediment type	No change in composition of sediment types across the sandbank, allowing for natural succession/ known cyclical change.	Sediment character is key to the structure of the sandbank, and reflects the physical processes acting on it. In addition to this, the sediment character is instrumental in determining the biological communities present on the sandbank.
Distribution of biotopes	Maintain the distribution of subtidal sandbank communities, allowing for natural succession/ known cyclical change.	Changes in the distribution of communities of both sub-features may indicate long-term changes in the physical conditions at the site, and a deterioration in the overall biological value of the site. The communities are given in Table 2 below.
Extent of sub-feature	No change in extent of the	Muddy sand and gravel communities are of

Attribute	Target	Comments
or representative/ notable biotope(s)	muddy sand and gravel communities allowing for natural succession/ known cyclical change.	high biodiversity value to the site. Changes in the extent and of muddy sand and gravel communities within this sub-feature may indicate long-term changes in the physical conditions at the site, and a deterioration in the overall biological value of the site. Communities present are given in Table 2 below.
Species composition of representative biotopes	No decline in biotope quality as a result of reduction in species richness or loss of species of ecological importance, allowing for natural succession/ known cyclical change.	Whilst some change in community composition over time is expected (for example, as part of cyclic changes or successional trends) changes in the overall nature of communities across the key representative biotopes sandbank, may indicate deterioration in the condition of the biodiversity of the sandbanks.
Species population measures: Population structure of individual species	Maintain age/size class structure of individual species.	Whilst some change in community structure over time is expected (for example, as part of cyclic changes or successional trends) changes in the overall nature of communities across the sandbank, including mobile species e.g. fish, crustacean species etc, may indicate deterioration in the condition of the biodiversity of the sandbanks. Species selected for monitoring should reflect the specific biological characteristics or key conservation interest of the designated site.

Table 2.2 Sandbank communities which occur within the Margate and Long Sands pSAC

Biotopes (from Connor et al 2004)		Occurrence in dynamic sand communities	Occurrence in muddy sand and gravel communities
SS.SBR.PoR.SspiMx	<i>Sabellaria spinulosa</i> on stable circalittoral mixed sediment		*
SS.SCS.CCS.MedLu mVen	<i>Mediomastus fragilis</i> , <i>Lumbrineris</i> spp. and venerid bivalves in circalittoral coarse sand or gravel	*	
SS.SCS.CCS.PomB	<i>Pomatoceros triqueter</i> with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles	*	
SS.SCS.ICS.MoeVen	<i>Moerella</i> spp. with venerid bivalves in infralittoral gravelly sand		*
SS.SCS.ICS.SLan	Dense <i>Lanice conchilega</i> and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand	*	*
SS.SMu.CSaMu.AfilN ten	<i>Amphiura filiformis</i> and <i>Nuculoma tenuis</i> in circalittoral and offshore		*

Biotores (from Connor et al 2004)		Occurrence in dynamic sand communities	Occurrence in muddy sand and gravel communities
	sandy mud		
SS.SMU.CSaMu.Lkor Ppel	<i>Lagis koreni</i> and <i>Phaxas pellucidus</i> in circalittoral sandy mud		*
SS.SSA.CFiSa.Epus OborApri	<i>Echinocyamus pusillus</i> , <i>Ophelia borealis</i> and <i>Abra prismatica</i> in circalittoral fine sand	*	
SS.SSa.CMuSa.Aalb Nuc	<i>Abra alba</i> and <i>Nucula nitidosa</i> in circalittoral muddy sand or slightly mixed sediment		*
SS.SSA.IFiSa.IMoSa	Infralittoral mobile clean sand with sparse fauna	*	
SS.SSA.IFiSa.NcirBat	<i>Nephtys cirrosa</i> and <i>Bathyporeia</i> spp. in infralittoral sand	*	
SS.SSA.IFiSa.ScupHyd	<i>Sertularia cupressina</i> and <i>Hydrallmania falcata</i> on tide-swept sublittoral sand with cobbles or pebbles.	*	
SS.SSA.IMuSa.EcorE ns	<i>Echinocardium cordatum</i> and <i>Ensis</i> spp. in lower shore and shallow sublittoral slightly muddy fine sand	*	
SS.SSA.IMuSa.Ffab Mag	<i>Fabulina fabula</i> and <i>Magelona mirabilis</i> with venerid bivalves and amphipods in infralittoral compacted fine muddy sand		*
SS.SSA.IMuSa.Ssub Nhom	<i>Arenicola marina</i> in infralittoral fine sand or muddy sand		*

3. Advice on operations

Natural England has a duty under Regulation 33(2)(b) of the Conservation (Natural Habitats &c.) Regulations 1994 to advise other relevant authorities as to any operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species, for which the site has been designated.

The advice is provided in summary form in Table 3 with more detail in Appendix B. Sections 3.7.1 to 3.7.5 provide advice in relation to specific interest features and their sub-features.

3.1 Purpose of advice

The aim of this advice is to enable all relevant authorities to direct and prioritise their work on the management of activities that pose the greatest potential threat to the favourable condition of interest features on the Margate and Long Sands pSAC. The advice is linked to the conservation objectives for interest features and will help provide the basis for detailed discussions between relevant authorities enabling them to formulate and agree a management scheme for the site should one be deemed necessary.

The advice given here will inform, but is without prejudice to, any advice given under Regulation 48 or Regulation 50 on operations that qualify as plans or projects within the meaning of Article 6 of the Habitats Directive.

3.2 Methods for assessment

To develop this advice on operations Natural England has used a three step process involving:

- an assessment of the **sensitivity** of the interest features or their component sub-features to operations;
- an assessment of the **exposure** of each interest feature or their component sub-features to operations; and
- a final assessment of **current vulnerability** of interest features or their component sub-features to operations.

This three step process builds up a level of information necessary to manage activities in and around the European Marine Site in an effective manner. Through a consistent approach, this process enables Natural England to both explain the reasoning behind our advice and identify to competent and relevant authorities those operations which pose the most current threats to the favourable condition of the interest features on the site.

All the scores of relative sensitivity, exposure and vulnerability are derived using best available scientific information and informed scientific interpretation and judgement. The process uses sufficiently coarse categorisation to minimise uncertainty in information, reflecting the current state of our knowledge and understanding of the marine environment.

3.2.1 Sensitivity assessment

The sensitivity assessment used is an assessment of the relative sensitivity of the interest features or the component sub-features of the Margate and Long Sands pSAC to the effects of broad categories of human activities. In relation to this assessment, sensitivity has been defined as the intolerance of a habitat, community or individual (or individual colony) of a species to damage, or death, from an external factor (Hiscock, 1996). Sensitivity is dependent on the intolerance of a species or habitat to damage from an external factor and the time taken for its subsequent recovery. For example, a very sensitive species or habitat is one that is very adversely affected by an external factor arising from human activities or natural events (killed/destroyed, 'high' intolerance) and is expected to recover over a very long period of time, i.e. >10 or up to 25 years ('low'; recoverability). The sensitivity of the interest sub-features was based on the sensitivities of their component biotopes, listed in Table 2.3. Biotope sensitivities were derived from the Marine Life Information Network (MarLIN) biology and sensitivity database (Tyler-Walters & Hiscock, 2003). Biotope sensitivities were assessed using the MarLIN approach (Hiscock & Tyler-Walters, 2005, 2006; Tyler-Walters et al., 2001). Sensitivities are available from the MarLIN website (www.marlin.ac.uk).

3.2.2 Exposure assessment

This has been undertaken for the Margate and Long Sands pSAC by assessing the relative exposure of the interest features or their component sub-features on the site to the effects of broad categories of human activities currently occurring on the site (as at April 2008). These assessments were made on the best available advice.

3.2.3 Vulnerability assessment

The third step in the process is to determine the vulnerability of interest features or their component sub-features to operations. This is an integration of sensitivity and exposure. Only if a feature is both sensitive and exposed to a human activity will it be considered vulnerable. In this context therefore, 'vulnerability' has been defined as the exposure of a habitat, community or individual (or individual colony) of a species to an external factor to which it is sensitive (Hiscock, 1996). The process of deriving and scoring relative vulnerability is provided in Appendix A.

3.3 Format of advice

The advice is provided within six broad categories of operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species. This approach therefore:

- enables links to be made between human activities and the ecological requirements of the habitats or species, as required under Article 6 of the Habitats Directive;
- provides a consistent framework to enable relevant authorities in England to assess the effects of activities and identify priorities for management within their areas of responsibility; and
- is appropriately robust to take into account the development of novel activities or operations which may cause deterioration or disturbance to the interest features of the site and should have sufficient stability to need only infrequent review and updating by Natural England.

These broad categories provide a clear framework against which relevant authorities can assess activities under their responsibility.

3.4 Update and review of advice

Information as to the operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species, for which the site has been designated, is provided in light of what Natural England knows about current activities and patterns of usage at the Margate and Long Sands pSAC. Natural England expects that the information on current activities and patterns of usage (which was used to derive Table 3) will be refined as part of the process of developing the management scheme and through discussion with the relevant authorities. As part of this process the option of identifying a number of spatial zones with different activity levels may be appropriate. It is important that future consideration of this advice by relevant authorities and others takes account of changes in the usage patterns that have occurred at the site, over the intervening period, since the information was gathered. In contrast, the information provided in this advice on the sensitivity of interest features or sub-features is relatively stable and will only change as a result of an improvement in our scientific knowledge, which will be a relatively long term process. Advice for sites will be kept under review and will be periodically updated through discussions with relevant authorities and others to reflect significant changes in our understanding of sensitivity together with the potential effects of plans and projects on the marine environment.

3.5 Plans and Projects

Under the following regulations:

- Regulation 48(1) of the Conservation (Natural Habitats, &c.) Regulations 1994,
- Regulation 5 of the Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001 and
- Schedule 3, paragraph 2 of the Environmental Impact Assessment and Natural Habitats (Extraction of Minerals by Marine Dredging) (England and Northern Ireland) Regulations 2007,

an appropriate assessment needs to be undertaken in respect of any plan or project which:

- a. either alone or in combination with other plans or projects would be likely to have a **significant effect** on a European Site; and
- b. is not directly connected with the management of the site for nature conservation.

A site that is being considered for designation as a SAC under the Habitats Directive becomes a European site for the purposes of the above Regulations at the point in time at which it is proposed to the Commission by the secretary of State or a Devolved Administration as a site eligible for designation as a SAC. On submission, the site becomes known in the UK as a candidate SAC (cSAC).

Whilst there is no obligation in domestic law to make this assessment in respect of a site prior to it becoming a cSAC, it should be considered a matter of good practice for Competent Authorities, before deciding to undertake or permit a plan or project, to assess its implications for sites such as this, whose proposed details are in the public domain, in accordance with the process described in Article 6.3 of the Habitats Directive. In doing so, a Competent Authority will be reducing the likelihood of the UK jeopardising the fulfilment of its obligations under the Habitats Directive. Further, without pre-judging any review of extant consents that may be required by the Habitats Regulations, undertaking *such an assessment* and determining any consents in accordance with it, will reduce the uncertainty for developers who are granted consent but have not fully implemented it by the time the site becomes a cSAC.

4. Specific advice on operations for the Margate and Long Sands pSAC

The following sections provide information to help relate general advice to each of specific interest features for the Margate and Long Sands pSAC.

This advice relates to the vulnerability of the interest features and sub-features of the Margate and Long Sands pSAC as summarised in Table 4.1 and detailed in the Tables in appendix B. Further explanation of the sensitivity of the interest features or sub-features follows with examples of their exposure and therefore their vulnerability to damage or disturbance from the listed categories of operations. This enables links to be made between the categories of operation and the ecological requirements of the features.

This advice relates to the vulnerability of the interest features and sub-features of the Margate and Long Sands pSAC to current levels of human usage (as at April 2008).

Details of human activity in and around the Margate and Long Sands pSAC are presented in a separate stakeholder report (Entec 2008).

Table 4.1 Summary of operations which may cause deterioration or disturbance of the Margate and Long Sands pSAC at current levels of use

The advice below is not a list of prohibitions but rather a checklist for operations which may need to be subject to some form of management measures(s) or further measures where actions are already in force. Examples of activities under relevant authority jurisdiction are also provided. Operations marked with a ✓ indicate those features (or some component of them) that are considered to be vulnerable to the effects of the operations.

Operations which may cause deterioration or disturbance	Margate and Long Sands pSAC Subtidal sandbanks
Physical loss	
Removal (e.g. capital dredging, offshore development)	✓
Smothering (e.g. by aggregate dredging, disposal of dredge spoil)	✓
Physical damage	
Siltation (e.g. run-off, channel dredging, outfalls)	✓
Abrasion (e.g. boating, anchoring, demersal fishing)	✓
Selective extraction (e.g. aggregate dredging)	✓
Non-physical disturbance	
Noise (e.g. boat activity)	
Visual (e.g. recreational activity)	
Toxic contamination	
Introduction of synthetic compounds (e.g. pesticides, TBT, PCBs)	✓
Introduction of non-synthetic compounds (e.g. heavy metals, hydrocarbons)	✓
Introduction of radionuclides	
Non-toxic contamination	
Changes in nutrient loading (e.g. agricultural run-off, outfalls)	✓
Changes in organic loading (e.g. mariculture, outfalls)	✓
Changes in thermal regime (e.g. power stations)	✓
Changes in turbidity (e.g. run-off, dredging)	✓
Changes in salinity (e.g. water abstraction, outfalls)	✓
Biological disturbance	
Introduction of microbial pathogens	
Introduction of non-native species and translocation	✓
Selective extraction of species (e.g. commercial & recreational fishing)	✓

4.1 Detailed advice for subtidal sandbanks in the Margate Sands pSAC

4.1.1 Physical loss

Subtidal sandbanks are relatively high energy environments, often with a good ability to recover from physical disturbance, however, loss of distinct assemblages within the habitat sub-features through removal of sediment habitat may result in a decrease in the overall diversity of the interest feature. Thus sandbank features are considered to have low sensitivity to smothering, but be moderately sensitive to physical loss due to removal sediment.

A consented offshore wind farm overlaps the northern end of the Long Sands sandbank feature; construction of phase 1 is expected to commence in 2011⁴, and therefore the effects of this development have been taken into account in the exposure assessment. When constructed, piling activities and the placement of structures on the bed would result in the direct loss of habitat area within the site, and possibly additional losses as a result of scour and/ or the placement of scour protection around turbine bases. Although direct loss will occur the proportion of the feature affected is considered to be small. For these reasons, the site is considered to have moderate exposure to physical loss.

Overall the vulnerability of sub-features within the Margate and Long Sands pSAC to physical loss is considered to be moderate.

4.1.2 Physical damage

Dynamic sand communities are characterised by frequent disturbance by tidal currents, and contain organisms which are adapted to recurrent erosion and accretion (for example, polychaetes and amphipods which are able to reburrow rapidly following disturbance). Following significant disturbance, communities can re-establish relatively quickly from the planktonic larval pool or migration from areas nearby, particularly as communities are largely composed of opportunistic species. Indications are that this re-establishment can occur within a few tidal cycles (Sherman & Coull 1980, Palmer 1988, Giere 1993). Sensitivity is considered to be low.

Gravelly muddy sand communities are generally based on more stable sediments with higher levels of organic matter. Whilst exposed to tidal currents, the habitats tend to be more diverse and contain a wide range of infauna and epifauna. These communities are more sensitive to physical damage as it takes longer for sediments and 'climax' communities to re-establish. Sensitivity is considered to be low to moderate.

Habitats within the Margate and Long Sands pSAC are considered to have a moderate exposure to physical damage. Physical damage may arise from periodic maintenance dredging within the adjacent Prince's Channel, use of the licensed sand placement site for dredged material in the North Edinburgh Channel, commercial fishing activities within the area (including trawling and suction dredging for cockles), along with cable laying as part of offshore wind developments.

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Overall the vulnerability of sub-features within the Margate and Long Sands pSAC to physical damage is considered to be low to moderate.

4.1.3 Toxic contamination

Toxic substances can have a number of effects on benthic communities depending on the nature of the contaminant and receiving biota. Some may be lethal, removing individuals and species; others may be sub-lethal, which could affect functioning of organisms such as the reproduction, reducing the fitness for survival, and hence populations in the longer term (Nedwell, 1997). For many benthic communities, the sensitivity of exposure to different chemicals is unknown, or limited to a small number of toxicity studies on specific species. Based on available published information, the sensitivity of dynamic sand communities and gravelly muddy sand communities to different types of toxic contamination has been classified as moderate.

The pathways by which toxic contaminants can reach these sub-tidal features would include point source discharges of effluents, land run-off (mainly via rivers/estuaries), atmospheric deposition, and accidental spillage at sea (eg oil spills).

A number of operators will discharge effluent upstream into the Thames estuary and into the adjacent coastal waters. Direct discharges into the site include low levels of radionuclides, and heavy metals, however significant dilution afforded to these low inputs, together with the high energy environments associated with sandbanks, mean that they have a low susceptibility to toxic contamination from these sources (Elliot *et al.*, 1998).

Prince's Channel (which runs through the site to the north of Margate Sands) carries a significant amount of vessel traffic in and out of ports in the inner Thames Estuary. Fisherman's Gat is also an active commercial shipping channel. In addition, smaller vessels use the shallower inshore channels across the site. This means that the risk of contamination by accidental spillages of fuel or cargo is increased, and a small level of contamination will exist as a result of normal shipping activities. The exposure of communities within the Margate and Long Sands site to toxic contamination is considered to be low.

Overall the vulnerability of sub-features within the Margate and Long Sands pSAC to toxic contamination is considered to be low.

4.1.4 Non-toxic contamination

Non-toxic contamination can lead to changing levels of nutrients, organic enrichment, temperature, turbidity and salinity. All of which could have direct and in-direct effects on the exposed features and their communities. The sensitivity of dynamic sand communities and gravelly muddy sand communities to different types of non-toxic contamination is considered to be low.

The principle pathways by which non-toxic contaminants can reach these sub-tidal features would include point source discharges of effluents, land run-off (mainly via rivers/estuaries), and offshore operations (e.g. shipping).

A number of operators will discharge effluent upstream into the Thames estuary and into the adjacent coastal waters, although there are no significant point sources directly into the site. Offshore operations such as channel dredging and disposal of dredged material may be localised sources of turbidity. In general, it is considered

that the habitat features within the site have a low exposure to non-toxic contamination.

Vulnerability of habitat features within the Margate and Long Sands pSAC to non-toxic contamination is therefore low.

4.1.5 Biological disturbance

Biological disturbance includes the introduction of pathogens or non-native species as well as selective extraction of species from the ecosystem. Removal of fish species and larger molluscs can have significant impacts on the structure and functioning of benthic communities over and above the physical effects of fishing methods, particularly as some fish species fill upper roles in the trophic web.

Alien species occurring within the site include razorshell *Ensis americanus* which are widespread in the Queens Channel (Eno *et al.* 1997) and the amphipod *Corophium sextonae* in the South Edinburgh channel (EMU 2006). The American slipper limpet *Crepidula fornicata* is also abundant across the sandbanks. *Crepidula fornicata* is typically found attached to shells (often the mussels *Mytilus edulis* and oysters *Ostrea edulis*) and stones on soft substrata around the low water mark and the shallow sublittoral. It competes with other filter-feeding invertebrates for food and space, and in waters of high concentrations of suspended material it encourages the deposition of mud. Although in general the sensitivity of subtidal sandbank communities to such invasive species is not well understood, in this instance the feature is considered to have a low to moderate sensitivity to these effects.

The site is not affected by direct discharges from the coastline, nor is there any known aquaculture within the site. Fishing activities within the site include suction dredging for cockles, set and drift-net trammelling, drift gill netting, and a limited amount of beam trawling for demersal species. As noted above a number of alien species are present. Exposure of habitats within the site to biological disturbance is therefore considered to be moderate.

Overall vulnerability of the habitat features to biological disturbance within the Margate and Long Sands pSAC is assessed as low to moderate due to fishing activities and the presence of alien species.

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Appendix A Methods deriving vulnerability.

Sensitivity	
None	-
Low	•
Moderate	••
High	•••

Exposure	
None	-
Low	+
Medium	++
High	+++

Vulnerability	
None detectable	
Low	
Moderate	
High	

The relative vulnerability of an interest feature or sub-feature is determined by multiplying the scores for relative sensitivity and exposure, and classifying that total into categories of relative vulnerability.

Relative sensitivity of the interest feature

		High (3)	Moderate (2)	Low (1)	None detectable (0)
Relative exposure of the interest feature	High (3)	9	6	3	0
	Medium (2)	6	4	2	0
	Low (1)	3	2	1	0
	None (0)	0	0	0	0

Categories of relative vulnerability	
High	6-9
Moderate	3-5
Low	1-2
None detectable	0

Appendix B

Assessment of the relative vulnerability of interest features and sub-features of the Margate and Long Sands pSAC to different categories of operations (for key see appendix A)

Operations which may cause deterioration or disturbance	Annex I Subtidal sandbanks					
	Dynamic sand community			Gravelly muddy sand community		
	Sensitivity	Exposure	Vulnerability	Sensitivity	Exposure	Vulnerability
Physical loss						
Removal (e.g. capital dredging, offshore development)	••	++	Moderate	•••	++	Moderate
Smothering (e.g. by aggregate dredging, disposal of dredge spoil)	•	++	Low	•	++	Low
Physical damage						
Siltation (e.g. run-off, channel dredging, outfalls)	•	++	Low	••	++	Moderate
Abrasion (e.g. boating, anchoring, demersal fishing)	•	++	Low	••	++	Moderate
Selective extraction (e.g. aggregate dredging)	••	+	Low	•••	+	Moderate
Non-physical disturbance						
Noise (e.g. boat activity)	-	-		-	-	
Visual (e.g. recreational activity)	-	-		-	-	
Toxic contamination						
Introduction of synthetic compounds (e.g. pesticides, TBT, PCBs)	••	+	Low	••	+	Low
Introduction of non-synthetic compounds (e.g. heavy metals, hydrocarbons)	••	+	Low	••	+	Low
Introduction of radionuclides	Insufficient information	+	Insufficient information	Insufficient information	+	Insufficient information
Non-toxic contamination						

Operations which may cause deterioration or disturbance	Annex I Subtidal sandbanks					
Changes in nutrient loading (e.g. agricultural run-off, outfalls)	•	+	Low	•	+	Low
Changes in organic loading (e.g. mariculture, outfalls)	•	+	Low	•	+	Low
Changes in thermal regime (e.g. power stations)	•	+	Low	•	+	Low
Changes in turbidity (e.g. run-off, dredging)	•	+	Low	•	+	Low
Changes in salinity (e.g. water abstraction, outfalls)	•	+	Low	•	+	Low
Biological disturbance						
Introduction of microbial pathogens	Insufficient information	-		Insufficient information	-	
Introduction of non-native species and translocation	•	++	Low	••	++	Moderate
Selective extraction of species (e.g. bait digging, wildfowling, commercial & recreational fishing)	••	++	Moderate	••	++	Moderate
<p>* Sensitivity of the 'dynamic sand communities' sub-feature has largely been based on information regarding sublittoral mobile sandbanks, drawn from Elliot <i>et al.</i> (1998). Sensitivity of the 'gravelly muddy sand communities' sub-feature has been based on information for gravel/mud communities drawn from Tyler-Walters & Hiscock (2005).</p>						