



Inshore Special Area of Conservation: Shell Flat and Lune Deep

Draft Conservation Objectives and Advice on Operations



Version 2.0 (10th November 2009)

DRAFT

Document version control

Version and date	Amendments made	Issued to and date
Shellflatlunedeep_cons_obs_110609	-	Informal dialogue (11/06/09)
Shellflatlunedeep_cons_obs_101109	Change in status from dSAC to pSAC	Formal consultation November 2009

Further information

Please return comments or queries to:

Peter Clement
Natural England
Northminster House,
Northminster Rd,
Peterborough,
PE1 1UA

Email: europeanmarinesites@naturalengland.org.uk

Tel: +44 (0)300 0601089

Fax: +44 (0)300 060 3888

Website: <http://www.naturalengland.org.uk>

1 Shell Flat and Lune Deep 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 Shell Flat and Lune Deep 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.

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 should 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 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 any appropriate action to prevent deterioration to the interest features and indeed such actions should be undertaken 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.

The conservation objectives set out what needs to be achieved for the site to make the appropriate contribution to the conservation status of the features for which the site is designated 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 help 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 group 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 Shell Flat and Lune Deep pSAC 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 Shell Flat and Lune Deep pSAC interest features are provided below. These are high level objectives for the site features, and Natural England 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 Selection 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 Annex 1 Reefs

Subject to natural change, maintain the **Reefs** in favourable condition², in particular:

- Bedrock reefs
- Stony reefs

2.2.2 The draft conservation objective for Annex 1 Sandbanks slightly covered with seawater all the time

Subject to natural change, maintain the **Sandbanks slightly covered by seawater all the time** in favourable condition³, in particular:

- Sand and muddy sand communities

² Favourable condition relates to the maintenance of the structure, function and typical species for that feature. A summary favourable condition table outlined in table 2.1 further defines favourable condition of the interest feature.

³ Favourable condition relates to the maintenance of the structure, function and typical species for that feature. A summary favourable condition table outlined in table 2.2 further defines favourable condition of the interest feature.

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 Attributes⁴ to be included in the condition table are given in tables 2.1 and 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 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

⁴ Selected characteristic of an interest feature/sub-feature which provides an indication of the condition of the feature to which it applies.

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 Annex I reef in the Shell Flat and Lune Deep 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	No change in extent of reef allowing for natural change.	While changes in extent may be unlikely due to low / removal of the bedrock reef itself, loss of extent may occur due to excessive smothering by sediment as part of natural coastal processes or anthropogenic activity.
Biotope composition of the bedrock and biogenic reefs	Maintain the full variety of biotopes identified for the site (see table 2.3), allowing for natural succession or known cyclical change.	Where changes in biotope composition are known to be attributable to natural processes (e.g. winter storm/flood events, changes in supporting processes or mass recruitment or dieback of characterising species) then the target value should accommodate this variability. Where a change in biotope composition occurs outside the expected variation, or a loss of the conservation interest of the site is identified, then condition should be considered unfavourable.
Distribution of biotopes: Spatial arrangement of bedrock reef biotopes at specified locations	Maintain the distribution of biotopes, allowing for natural succession/known cyclical change	Where changes in distribution/spatial pattern are known to be clearly attributable to cyclical succession or an expected shift in distribution then the target value should accommodate this variability. Where a change in biotope distribution/spatial pattern occurs outside the expected variation or a loss of the conservation interest of the site is identified, then condition should be considered unfavourable.
Extent of sub-feature or representative /notable biotopes	No change in the extent of the biotope(s) allowing for natural succession/known cyclical change	Where a change in extent outside the expected variation occurs or a change in the structure of the biotope leading to a loss of the conservation interest of the site is identified, then condition should be considered unfavourable. Notable biotopes present include: (HCR.XFa.FluHocu).
Species composition of representative or notable biotopes	No decline in biotope quality due to change in species composition or loss of notable species allowing for natural succession/ known cyclical change.	Where changes in species composition are known to be clearly attributable to natural succession, known cyclical change or mass recruitment or dieback of characterising species, then the target value should accommodate this variability. Where there is a change in biotope quality outside the expected variation or a loss of the conservation interest of the site, then condition should be considered unfavourable.
Species population	Maintain age/size class	Whilst some change in community structure over

Attribute	Target	Comments
measures: Population structure of individual species.	structure of individual species.	time is expected (for example, as part of cyclic changes or successional trends) changes in the overall nature of reef communities, including mobile species e.g. fish, crustacean species etc, may indicate deterioration in the condition of the biodiversity of the reef community. Species selected for monitoring should reflect the specific biological characteristics or key conservation interest of the designated site.

Table 2.2 indication of attributes to be used in defining favourable condition for Annex I sandbank in the Shell Flat and Lune Deep pSAC

Favourable condition tables will be drafted in detail on designation of the SAC and it's 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 or representative/ notable biotope(s)	No change in extent of the muddy sand and gravel communities allowing for natural succession/ known cyclical change.	Muddy sand and gravel communities are of 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 2.3

Attribute	Target	Comments
		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 2.3 Reef communities which occur within the Shell Flat and Lune Deep pSAC (From Haskoning 2008)

Biotope (from Connor <i>et al</i> 2004)		Bedrock reef	Stony reef	Sand and muddy sand
CR.HCR.XFa	Mixed faunal turf communities	*	*	
CR.HCR.XFa.FluH ocu	<i>Flustra foliacea</i> and <i>Haliclona oculata</i> with a rich faunal turf on tide-swept circalittoral mixed substrata		*	
CR.HCR.XFa.FluC oAs	<i>Flustra foliacea</i> , <i>Nemertesia antennina</i> , <i>Hydrallmania falcata</i> , and <i>Alcyonidium diaphanum</i> .		*	
SS.SSa.CMuSa.Aa lbNuc	<i>Abra alba</i> and <i>Nucula nitidosa</i> in circalittoral muddy sand or slightly mixed sediment.			*

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 3.6.1 to 3.7.2 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 Shell Flat and Lune Deep 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 given without prejudice to, any advice provided 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 Shell Flat and Lune Deep 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 Shell Flat and Lune Deep 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 July 2008). These assessments were made on the basis of the best available information and 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 and recent activities and patterns of usage at the Shell Flat and Lune Deep pSAC. Natural England expects that the information on 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.”

DRAFT

4 Specific advice on operations for the Shell Flat and Lune Deep pSAC

The following sections provide information to help relate general advice to each of specific interest features for the Shell Flat and Lune Deep pSAC.

This advice relates to the vulnerability of the interest features and sub-features of the Shell Flat and Lune Deep pSAC as summarised in Table 3 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 Shell Flat and Lune Deep pSAC to current levels of human usage (as at July 2008).

Table 3 Summary of operations which may cause deterioration or disturbance of the Shell Flat and Lune Deep 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	Shell Flat and Lune Deep pSAC reefs	Shell Flat and Lune Deep pSAC 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)	✓	

Operations which may cause deterioration or disturbance	Shell Flat and Lune Deep pSAC reefs	Shell Flat and Lune Deep pSAC sandbanks
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. bait digging, wildfowling, commercial & recreational fishing)	✓	✓

4.1 Detailed advice for reefs in Shell Flat and Lune Deep pSAC

4.1.1 Physical loss

Both reef sub-features are considered to have moderate sensitivity to loss through direct removal. They are considered to have a relatively low degree of sensitivity smothering due to the high degree of natural sediment influence that the communities of Lune deep experience and their relatively high level of recoverability. However, any loss of reef communities would be of concern due to their ecological importance within the reef habitat. Many communities that use the reef habitats are interdependent upon the ecological functioning of others (for example, invertebrate communities and fish) and it is important that this potential indirect effect is considered when the effects of removal or smothering are assessed.

There is a licences dredge disposal site within Lune Deep, which deposits spoil from maintenance dredging operations in Morecambe Bay, however this is some way from the site boundary. As a consequence the reefs are currently considered to have only low exposure to physical loss due to smothering.

Overall the vulnerability of reef sub-features within the Shell Flat and Lune Deep pSAC to physical loss is considered to be low.

4.1.2 Physical damage

Both reef subfeatures are considered to have a low degree of sensitivity to siltation commensurate with their sensitivity to smothering. They also share moderate sensitivity to abrasion which can cause damage to a significant proportion of the species found in relatively stable cobble, boulder and bedrock reef communities. In addition stony reef is considered to have a low degree of sensitivity to selective extraction of the substratum.

Again due to the presence of the dredge disposal site within Lune Deep the exposure of the reef feature to siltation is considered to be low resulting in an assessment of low vulnerability.

Despite the sensitivity of both subfeatures to physical damage through abrasion, and of stony reef to selective extraction, the reef is not identified as having a significant degree of exposure to activities such as towed demersal fisheries or aggregate extraction which can result in such effects and thus the exposure to abrasion is considered to be low. Thus vulnerability of the reef feature to abrasion or selective extraction is also considered to be low.

4.1.3 Toxic contamination

The dominant reef biotopes are considered to have intermediate intolerance to contamination by both synthetic and non synthetic substances; and recover moderately quickly once the contamination is removed. Thus their overall level of sensitivity is considered to be moderate.

Due to the proximity of the reef sub-features to the coast, e.g. the waste water discharge into Lune Deep from the Fylde coast they are currently considered to be exposed to moderate levels of toxic contamination from land based discharges. This judgement results from both the distance of the reef to the waste water discharge and known levels of heavy metals, and certain synthetic substances.

Overall the vulnerability of reef sub-features within the Shell Flat and Lune Deep pSAC to toxic contamination is considered to be moderate.

4.1.4 Non-Toxic contamination

The dominant biotopes are likely to be of low sensitivity to nutrient enrichment.

Due to the proximity of the reef sub-features to the coast, and in particular local waste water discharges they are currently exposed to moderate- levels of non-toxic contamination from land based discharges.

Overall the vulnerability of reef sub-features within the Shell Flat and Lune Deep pSAC to non-toxic contamination is considered to be low.

4.1.5 Biological disturbance

Biological disturbance can include the introduction of pathogens or non-native species as well as selective extraction of species from the ecosystem. Removal of fish and crustacean species can have significant impacts on the structure and functioning of benthic communities over and above the physical effects of fishing methods. Thus both reef sub-features are considered to be moderately sensitive to selective extraction of species.

As indicated above the exposure of the reef feature to fishing is considered to be relatively low at this site and therefore its vulnerability to biological disturbance due to selective extraction of species is considered to be low.

4.2 Detailed advice for Sandbanks in Shell Flat and Lune Deep pSAC

4.2.1 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 of sediment.

An offshore wind farm has previously been proposed for a site which overlaps the sandbank, however this proposal has now been withdrawn and therefore this is not considered further in the assessment of exposure.

Overall the site is considered to have negligible exposure to physical loss by removal or smothering.

4.2.2 Physical damage

Sandbank 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 to physical damage resulting from siltation or abrasion is considered to be low.

Sandbank habitats within the Shell Flat and Lune Deep pSAC have a moderate exposure to physical damage, from commercial fishing activities within the area (mainly demersal trawling).

Overall the vulnerability of sub-features within the Shell Flat and Lune Deep pSAC to physical damage is considered to be low.

4.2.3 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 sand and muddy sand communities to different types of toxic contamination has been classified as low to moderate.

The pathways by which toxic contaminants can reach these sub-tidal features would include point source discharges of effluents and land run-off from Morecambe Bay and the Fylde coast, atmospheric deposition, and accidental spillage at sea (eg oil spills).

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 sandbank, mean that they have a low exposure to toxic contamination from these sources. (Elliot *et al.*, 1998).

Overall the vulnerability of sandbanks within the Shell Flat and Lune Deep pSAC to toxic contamination is considered to be low.

4.2.4 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 e.g. from local waste water treatment works, land run-off (mainly from Morecambe Bay), and offshore operations (eg shipping). In general, however, it is considered that the habitat features within the site have a low exposure to non-toxic contamination.

Vulnerability of habitat features within the Shell Flat and Lune Deep pSAC to non-toxic contamination is therefore low.

4.2.5 Biological disturbance

Biological disturbance can include 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 including sandbanks over and above the physical effects of fishing methods, particularly as some fish species fill upper roles in the trophic web.

As indicated above sandbank habitats within the site are considered to have a moderate exposure to commercial fishing activities within the area (mainly demersal trawling) and therefore the exposure and vulnerability to biological disturbance due to selective extraction is considered to be moderate.

5 References

CONNOR, D.W., ALLEN, J.H., GOLDING, N., HOWELL, K.L., LIEBERKNECHT, L.M., NORTHEN, K.O. & REKER, J.B. (2004). The Marine Habitat Classification for Britain and Ireland Version 04.05 JNCC, Peterborough

DETR & THE WELSH OFFICE. 1998. *European Marine Sites in England & Wales - A guide to the Conservation (Natural Habitats &c.) Regulations 1994 and to the Preparation and Application of Management Schemes.* London: DETR.

ELLIOTT, M., NEDWELL, S., JONES, N.V., READ, S.J., CUTTS, N.D. & HEMINGWAY, K.L.. 1998. *Intertidal Sand and Mudflats & Subtidal Mobile Sandbanks (volume II). An overview of dynamic and sensitivity characteristics for conservation management of marine SACs.* Scottish Association for Marine Science (UK Marine SACs Project). 151 Pages.

HISCOCK, K. 1996. Marine Nature Conservation Review: rationale and methods. Peterborough, JNCC.

HISCOCK, K. & TYLER-WALTERS, H., 2006. Assessing the sensitivity of seabed species and biotopes - the Marine Life Information Network (*MarLIN*). *Hydrobiologia*, 555, 309-320.

ROYAL HASKONING 2008. Inshore Special Area of Conservation (SAC): Shell Flat and Lune Deep, SAC Selection Assessment. Report No. 9S02829S0282/SSR/MORECAMBE/01.

TYLER-WALTERS, H. & HISCOCK, K., 2003. A biotope sensitivity database to underpin delivery of the Habitats Directive and Biodiversity Action Plan in the seas around England and Scotland. *Report to English Nature and Scottish Natural Heritage from the Marine Life Information Network (MarLIN).* Plymouth: Marine Biological Association of the UK. [English Nature Research Reports, ENRR No. 499.]

TYLER-WALTERS, H. & HISCOCK, K., 2005. Impact of human activities on benthic biotopes and species. *Report to Department for Environment, Food and Rural Affairs from the Marine Life Information Network (MarLIN).* Plymouth: Marine Biological Association of the UK. [Contract no. CDEP 84/5/244]

TYLER-WALTERS, H., HISCOCK, K., LEAR, D.B. & JACKSON, A., 2001. Identifying species and ecosystem sensitivities. *Report to the Department for Environment, Food and Rural Affairs from the Marine Life Information Network (MarLIN), Marine Biological Association of the United Kingdom, Plymouth.* Contract CW0826.

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 Shell Flat and Lune Deep pSAC to different categories of operations (for key see appendix A)

Operations which may cause deterioration or disturbance	Annex I Reefs						Annex I sandbanks		
	Bedrock reef			Stony reef			Sand and muddy sand		
	Sensitivity	Exposure	Vulnerability	Sensitivity	Exposure	Vulnerability	Sensitivity	Exposure	Vulnerability
Physical loss									
Removal (e.g. harvesting, coastal development)	••	-	-	••	-	-	••	-	
Smothering (e.g. by artificial structures, disposal of dredge spoil)	•	+	Low	•	++	Low	•	-	
Physical damage									
Siltation (e.g. run-off, channel dredging, outfalls)	•	+	Low	•	+	Low	•	+	Low
Abrasion (e.g. boating, anchoring, trampling)	••	+	Low	••	+	Low	•	++	Low
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)	••	++	Moderate	••	++	Moderate	••	+	Low
Introduction of non-synthetic compounds (e.g. heavy metals, hydrocarbons)	••	++	Moderate	••	++	Moderate	••	+	Low

Operations which may cause deterioration or disturbance	Annex I Reefs						Annex I sandbanks		
	Bedrock reef			Stony reef			Sand and muddy sand		
	Sensitivity	Exposure	Vulnerability	Sensitivity	Exposure	Vulnerability	Sensitivity	Exposure	Vulnerability
Introduction of radionuclides	Insufficient information	+	Insufficient information	Insufficient information	+	Insufficient information	Insufficient information	+	Insufficient information
Non-toxic contamination									
Changes in nutrient loading (e.g. agricultural run-off, outfalls)	•	++	Low	•	++	Low	-	+	-
Changes in organic loading (e.g. mariculture, outfalls)	•	++	Low	•	++	Low	•	+	Low
Changes in thermal regime (e.g. power stations)	•	-	-	•	-	-	•	-	-
Changes in turbidity (e.g. run-off, dredging)	•	+	Low	•	+	Low	•	+	Low
Changes in salinity (e.g. water abstraction, outfalls)	•	-		•	-	-	•	-	-
Biological disturbance									
Introduction of microbial pathogens	Insufficient information	-	-	Insufficient information	-	-	Insufficient information	-	-
Introduction of non-native species and translocation	Insufficient information	+	-	Insufficient information	+	-	•	-	-
Selective extraction of species (e.g. bait digging, wildfowling, commercial & recreational fishing)	••	+	Low	••	+	Low	••	++	Moderate