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16th July 2016.

Dear Sir, Marine Aggregate Dredging Application : MLA/2016/00227
South Goodwin Sands, Area 521.

These are the comments and observations of Marinet Limited in respect of the application by the Dover Harbour Board (Port of Dover) to apply for a licence, ref. MLA/2016/00227, to dredge the Goodwin Sands for aggregate (sand) in connection with construction work at the Port (Dover Western Docks Revival Scheme - DWDR).

We understand that the application is for 2.5 million cubic metres of aggregate (sand), which is equivalent to 3.75 million tonnes.

We also understand that it is proposed that dredging will take place between September 2017 and July 2019 in three stages corresponding to the relevant DWDR construction stages. The dredging will involve extracting 1 million cubic metres (1.5 million tonnes) per stage, up to a maximum total of 2.5 million cubic metres. The design schedule of the construction works for the DWDR is as follows:

Stage 1: September-December 2017
Stage 2: May-August 2018
Stage 3: April-July 2019

We understand that it is proposed that dredging in connection with each stage will be undertaken 24 hours per day, seven days per week, and that it is anticipated that a complete dredge cycle will take 8 hours. Each 8 hours cycle will comprise dredging to fill the hopper of the dredger(s), transit to the DWDR scheme at the Port's Western Docks, discharge of the aggregate, and transit back to the proposed dredge area at South Goodwin Sands. Therefore, in good weather conditions it is anticipated that three dredging cycles will be completed by one dredger over a 24 hour period.

We also understand that South Goodwin Sands (Area 521) lies within the recommended Goodwin Sands Marine Conservation Zone (Marine and Coastal Access Act 2009), and this rMCZ is a candidate for full designation in the next stage of MCZ designations by H.M. Government (Defra).

We understand that Defra advises, June 2015, that the observed conservation features for the rMCZ are currently listed as:

Broadscale Habitats.
Moderate energy circalittoral rock (11.19 km^2)
Subtidal coarse sediment (133.19 km)

Broadscale Habitats (continued)
Subtidal sand (89.48 km^2)
Subtidal mixed sediments (24.09 km^2)

Habitat Features of Conservation Importance.
Blue Mussel Beds (312.57 m^2)
Ross Worm Reefs (625.29 m^2)
Subtidal Sands and Gravels (222.68 km^2)
Subtidal Chalk ((11.19 km^2)

Defra also state that 59 wrecks were visible in the multibeam bathymetric survey for this rMCZ.

Source: http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&ProjectID=18983&FromSearch=Y&Publisher=1&SearchText=mb0129&SortString=ProjectCode&SortOrder=Asc&Paging=10#Description

Archaeology, Ship and Aircraft Wrecks.

The Goodwin Sands is the site of numerous ship and aircraft wrecks, the former going back over many centuries and the estimated number probably in excess of 1000 (ref. Shipwrecks of the Goodwin Sands by Richard and Bridget Larn, Chapter 1, published 1995), and the latter during the 20th Century, particularly during the years of World War II (ref. Kent Battle of Britain Museum and the RAF Museum, London).

It is therefore clear that a very careful assessment of this matter is required.

To begin this assessment it is best to consider first the statutory legal requirements under planning law, namely the UK National Planning Policy Framework 2012 and the Marine Policy Statement (HMSO) 2012.

National Planning Policy Framework (NPPF).

128: In determining applications, local planning authorities should require an applicant to describe the significance of any heritage assets affected, including any contribution made by their setting. The level of detail should be proportionate to the assets' importance and no more than is sufficient to understand the potential impact of the proposal on their significance. As a minimum the relevant historic environment record should have been consulted and the heritage assets assessed using appropriate expertise where necessary. Where a site on which development is proposed, includes or has the potential to include heritage assets with archaeological interest, local planning authorities should require developers to submit an appropriate desk-based assessment and, where necessary, a field evaluation.

129: Local planning authorities should identify and assess the particular significance of any heritage asset that may be affected by a proposal (including by development affecting the setting of a heritage asset) taking account of the available evidence and any necessary expertise. They should take this assessment into account when considering the impact of a proposal on a heritage asset, to avoid or minimise conflict between the heritage asset's conservation and any aspect of the proposal.

132: When considering the impact of a proposed development on the significance of a designated heritage asset, great weight should be given to the asset's conservation. The more important the asset, the greater the weight should be. Significance can be harmed or lost through alteration or destruction of the heritage asset or development within its setting.

135: The effect of an application on the significance of a non-designated heritage asset should be taken into account in determining the application. In weighing applications that affect directly or indirectly non-designated heritage assets, a balanced judgement will be required having regard to the scale of any harm or loss and the significance of the heritage asset.

139: Non-designated heritage assets of archaeological interest that are demonstrably of equivalent significance to scheduled monuments, should be considered subject to the policies for designated heritage assets. **[**Note**:** e.g. *Britannia*].

141: Local planning authorities should make information about the significance of the historic environment gathered as part of plan-making or development management publicly accessible. They should also require developers to record and advance understanding of the significance of any heritage assets to be lost (wholly or in part) in a manner proportionate to their importance and the impact, and to make this evidence (and any archive generated) publicly accessible.

Marine Policy Statement.

With respect to the historic environment, the Marine Policy Statement also reflects the principles set out in the NPPF and states that: "*The view shared by the UK Administrations is that heritage assets should be enjoyed for the quality of life they bring to this and future generations, and that they should be conserved through marine planning in a manner appropriate and proportionate to their significance.*"

2.6.6.3: Opportunities should be taken to contribute to our knowledge and understanding of our past by capturing evidence from the historic environment and making this publicly available, particularly if a heritage asset is to be lost.

2.6.6.5: Many heritage assets with archaeological interest in these areas are not currently designated as scheduled monuments or protected wreck sites but are demonstrably of equivalent significance. The absence of designation for such assets does not necessarily indicate lower significance and the marine plan authority should consider them subject to the same policy principles as designated heritage assets (including those outlined) based on information and advice from the relevant regulator and advisors. [Note: e.g. *Britannia*]

2.6.6.7: In considering the significance of heritage assets and their setting, the marine plan authority should take into account the particular nature of the interest in the assets and the value they hold for this and future generations. This understanding should be applied to avoid or minimise conflict between conservation of that significance and any proposals for development.

2.6.6.8: The marine plan authority, working with the relevant regulator and advisors, should take account of the desirability of sustaining and enhancing the significance of heritage assets and should adopt a general presumption in favour of the conservation of designated heritage assets within an appropriate setting. The more significant the asset, the greater should be the presumption in favour of its conservation. Substantial loss or harm to designated assets should be exceptional, and should not be

permitted unless it can be demonstrated that the harm or loss is necessary in order to deliver social, economic or environmental benefits that outweigh the harm or loss.

2.6.6.9: Where the loss of the whole or a material part of a heritage asset's significance is justified, the marine plan authority should identify and require suitable mitigating actions to record and advance understanding of the significance of the heritage asset before it is lost. Requirements should be based on advice from the relevant regulator and advisors.

The statutory framework is also embraced by two Acts of Parliament, namely:

The Protection of Wrecks Act 1973 which provides protection for designated shipwrecks. Wrecks may be designated because of historical, archaeological or artistic value. Wreck sites must have a known location in order to be designated. It is a criminal offence to interfere with a wreck designated under the Act without a licence.

The Protection of Miltary Remains Act 1986 which provides, inter alia, protection to military aircraft crash sites. "The Act stipulates that no licence to extract will be allowed if there are human remains present, the intention being that such remains are left in peace where they lie" (ref. Crown Estate, Aggregate Dredging and the Marine Environmen, page 66, published 2013); and, "*all aircraft that have crashed whilst in military service are automatically protected under the Protection of Military Remains Act 1986. As such, all military military aircraft should be considered to be* ***high value.*** *Due to the high potential for associated loss of life associated loss of life with aircraft crashes, and due to the potential for remains of high archaeological value to be present, all non-military aircraft should also be regarded as* ***high*** *value as a precautionary measure*" (ref. Applicant's Appendix 14.1 Archaeological Desk Based Assessment, section 6.3.3. Note: Bold emphasis in the original).

Assessment of Archaeological Issues.

The Goodwin Sands are the graveyard of inumerable ships over the centuries, and an almost equally difficult to determine number of aircraft, particularly as a result of World War II.

The applicant's ES notes that it has been estimated that over 800 shipwrecks have been documented on the Goodwin Sands (re. Appendix 14.1 para. 6.2.2) and other sources estimate this figure as even higher and possibly well over 1000 in number (ref. Richard and Bridget Larn, Op.cit, Chapter 1). Shipwrecks arise for a great variety of reasons, and their archaeological value is equally as diverse, embracing not just vessels associated with the British Isles but also many different nations. For example, in 1639 during the Eighty Years War the Dutch fought the Spanish in The Downs (the sea between the Kent coast and Goodwin Sands) and a large number of vessels from both sides, including six German vessels inadvertently caught up in the battle, were lost in the immediate area and on the Goodwin Sands (ref. Appendix 14.1 para.6.2.2). Thus the diversity of the naval archaeological heritage is both very great and reaches back significantly in time. Both of these dimensions regarding the diversity and abundance of this naval archaeological heritage can be seen in in the Maps of Shipwrecks in the vicinity of or on the Goodwin Sands for 1450-1699, 1700-1799, 1800-1854, 1855-1874, 1875-1899, 1900-1919, 1920-1992 (R. and B. Larn, Op.Cit).

With regard to aircraft, particularly military aircraft, lost in this area during World War II the applicant's ES notes "*the high potential for losses to have occurred over the study area*" and "*maps of Second World War RAF Air/Sea Rescue records indicate a high concentration of losses, particlarly off the east and south coasts of Kent throughout the War*." (ref. Appendix 14.1 para 6.3.2). In addition research undertaken by the Save Our Sands campaign group notes "*The Kent Battle of Britain*

Museum has identified that at least 11 Dornier, 17 bombers, one Junkers 88 lie buried around the proposed dredging zone, while an unknown number of other Allied and Axis planes and their airmen are believed to rest here. The RAF Museum in London also believes that a lot of wartime aircraft lie undiscovered in the Goodwin Sands." (ref. Save Our Sands press release, 3rd July 2016). None of this is surprising since the Battle of Britain was fought in air space over this area, and throughout the War years (1939-1945) Allied and Axis aircraft constantly flew in this air space on missions and in combat.

All sources are agreed that the Goodwin Sands are the site of an immense archaeological heritage dating from Palaeolithic times.

Apart from the scale and range of activity in the area, the Goodwin Sands are a rich archaeological site precisely because they are, geologically speaking, sand. When a human artefact is lost on a seabed made of sand it rarely rests upon the seabed as it would, in contrast, on a harder base e.g. rock. This is because sand, being made of fine loose grains, is essentially "fluid" in the presence of water - i.e. water permeates the sand and flows between the grains. Thus when an object of a density greater than water comes to rest on sand it "sinks" into the sand by virtue of its density and weight. Accordingly, the wreck of a ship or aircraft will sink into the sand rather than rest on the seabed's surface. The only constraint on this process is the size of the wreck (principally its dimensions, particularly height) and the depth of the sand.

Thus in an area where the sand is, for example, 10 metres deep all objects whose height is less than 10 metres will sink from visibility and be buried beneath the sand. Consequently most archaeological remains in the Goodwin Sands - whether ships, aircraft or of whatever kind - will be buried rather than lying on the seabed's surface.

Given this important fact, the issue is therefore how to detect whether archaeological remains are present – and particularly so when the proposed activity is the dredging and removal of the sand.

In the applicant's Environmental Statement it is observed *"The resource thickness within the proposed dredge area ranges from 0.5-19m. The average resource thickness is 7.6m".* (ref. Section 2.4).

It is also stated in the Environmental Statement that "*it is anticipated that the dredging depth will be in the 1-4m range"*. (ref. Section 8.5.2).

In the detection of potential archaeological remains the applicant has employed sidescan sonar data, multibeam echosound data, and sub-bottom profiler (boomer data). The applicant records the effectiveness of this methodology in Appendix 14.2 (Archaeological Review of Geophysical Data). Sidescan sonar has a penetration depth of 25cms (max. 50cms) into the sands and multibeam echosounder data has a similar penetration depth. App. 14.2 states "*only the boomer data* [sub-bottom profiler] *were used for the archaeological assessment, as the boomer data provided greater penetration into the sediments than the chirp data."* (Section 2.2.6)

We observe that there is difficulty is establishing the integrity of the applicant's archaeological data from this means of detection. Whilst this means of detection is the accredited means for archaeological surveys of this kind, the applicant does **not** specify in the ES or Appendices the depth of penetration into the sand from this data, and App. 14. 2 Section 2.3.4 states "*The SBP (boomer) data have been rated as 'Average' using the above criteria. In general the data were of good quality, although some lines exhibited noise such as large amounts of swell due to weather conditions experienced during the survey. The shallow water depths also proved detrimental to the data, as it resulted in the sea bed multiples being present at very shallow depth in some areas making*

interpretation difficult. However, these did not detrimentally affect the data to a significant degree and it was deemed suitable for archaeological interpretation." In App. 14.2 Geophysical Data of 'Average Quality' - i.e. the status of the SBP (boomer) data referred to above – is described as "*Data which are affected by weather conditions and sea state to a slight or moderate degree. The dataset is suitable for the identification and partial interpretation of standing and partially buried metal wrecks, and the larger elements of their debris fields. Wooden wrecks may be visible in the data, but their identification as such is likely to be difficult.*" (ref. Section 2.3.1).

Thus it is evident from the Environmental Statement that the technologies used to establish the existence of archaeological material (wrecks of ships and aircrafts) have had limited effectiveness in determining the existence of buried material. The only archaeological material whose existence has been clearly established is that which lies on the surface or is partially buried (has some of its structure above the seabed's surface). The existence of other archaeological remains is conjectural – termed "anomalies" in the reports, i.e. readings on the sonar which suggest the presence of "something", but its actual nature is undetermined – and in the case of other archaeological material which is wholly buried it is distinctly probable that this material has been wholly undetected by the applicant's surveys.

The evidence which supports this conclusion is present in the applicant's Appendix 14.1 (Archaeological Desk Based Assessment). In the case of ships the ES Appendix states, ref. 6.2.2.

"*The potential for preservation within the study area is highest where the sand is deepest. Within the proposed dredge area the geophysics data has shown that the depth of sediment is thickest in the north of the area and along the eastern edge. The isopach map shown in (Figure 6.4) shows that sediment in these areas, along the edge of the bank is approximately 10 to 15m with isolated pockets of 15-20m depth. The thickness rapidly decreases towards the bank margins with only 0-2m of sand overlying the chalk along the western edge.*

"*The two as yet undiscovered 20th century steel ships, for example, were both lost on the south sands head to the south of the proposed dredge area. The sediment cover is lowest at this southern end of the area. This, together with the low number of iron/steel vessels recorded as lost indicates that the potential for the substantial remains of intact metal wrecks within the proposed dredge area is low. Most of the wrecks on Goodwin Sands are of wooden vessels that have not remained intact (Wessex Archaeology, 2014). The potential for wooden wrecks, or parts of them, which account for the majority of documented losses is considered to be high."*

Thus it is evident that ships of wooden construction (and parts thereof) are very likely to have been wholly undetected by the applicant's archaeological surveys throughout the proposed dredge area. Moreover, wooden wrecks account for the majority of the archaeological material in this class.

When it comes to aircraft, similar criteria relating to non-detection apply i.e. many aircraft were largely made of non-ferrous material and far more skeletal in construction than ships. Appendix 14.1 states, ref. 6.3.2.

"There are two records of aircraft located c. 700m to the north of the proposed dredge area. The first is recorded by the NRHE (831719) and the UKHO (15048) as a wreck thought to be the remains of a Second World War American bomber, located in the Gull Stream among the Goodwin Sands. The second is an NRHE record (1398705) of a B26 Marauder (an American bomber) reported by divers lying on top of an old shipwreck in Kellett Gut. Given that these two records are c. 250m apart it is likely that they represent the same wreck.

"There are no further losses of aircraft recorded within the area searched. This is unlikely, however, to be a realistic reflection of the potential for aircraft to be present.

"In Kent, Manston was an important navigational point for allied aircraft returning from night raids during this period and the increase in traffic, and construction of anti-aircraft batteries along the coast, indicates the high potential for losses to have occurred over the study area (Wessex

Archaeology, 2013b). Numbers of aircraft lost at sea are also indicated by records of Air/Sea Rescue services. Maps of Second World War RAF Air/Sea Rescue records indicate a high concentration of losses, particularly off the east and south coasts of Kent throughout the War (Wessex Archaeology 2008).

"Despite the low number of documented losses from the study area, the potential for aircraft remains to be present should be considered to be high. The locations of many of the aircraft losses may not have been recorded accurately, particularly during wartime, while many others may have been lost without record. As for maritime remains (Section 6.2.2), geophysical survey, the geomorphology of the proposed dredging area and historic dredging activities suggest that, while the survival of an intact aircraft within the study area is possible, discoveries of disarticulated aircraft remains are more likely to occur."

Therefore the significant question for this EIA is: will dredging for sand cause damage to undiscovered, undetected archaeological remains of ships and aircraft in the dredge site ?

The applicant's ES, Appendix 14.1, ref. 7.3.1 is clear on this point:

"Direct impacts to potential archaeological material may occur if previously undiscovered heritage assets are buried within the target aggregate and if they are impacted by the drag head during dredging. As set out in Section 6 above, the archaeological value of potential archaeological material is considered to be ***high****.*

"The sensitivity of in situ maritime or aviation material to impacts from the dredger's drag head should also be considered to be ***high****. All damage to archaeological receptors will be permanent and cannot be reversed. It will not be possible to assess the capacity of an impacted receptor to accommodate change until impacts have occurred and the receptor has been identified. A precautionary (worst case) approach is recommended which assumes that impacted receptors will have no capacity to accommodate change.*

"Similarly, the magnitude of the effect cannot be fully assessed until an impact to in situ maritime or aviation material has occurred. It is possible that the impact may result in the total loss of an archaeological receptor, or partial loss of, or damage to, key characteristics, features or elements. If present within the path of the dredger's drag head, damage is likely to occur and this change will be permanent. The potential magnitude of effect is, therefore, also judged to be ***high****.*

"In accordance with the matrix in Table 4.6, direct impacts to potential in situ maritime and aviation heritage assets are assessed as being of possible ***major adverse significance****."*
[Note: Bold emphasis in the original text].

With regard to aircraft wrecks it further needs to be noted that the Military Remains Act 1986 applies to the discovery during dredging of any previous undiscovered, undetected remains. The applicant's ES App. 14.1 ref. 6.3.3. is very clear on this point:

"All aircraft that have crashed whilst in military service are automatically protected under the Protection of Military Remains Act 1986. As such, all military aircraft should be considered to be of ***high*** *value.*

"Due to the high potential for associated loss of life associated with aircraft crashes, and due to the potential for remains of high archaeological value to be present, all non-military aircraft should also be regarded as ***high*** *value as a precautionary measure."*
[Note: Bold emphasis in the original text].

Thus it is incontrovertibly clear that:

1. Undiscovered, undetected maritime and aviation heritage assets may exist with the dredge site, and the probability for such remains is very real based on knowledge of historical records.

2. Dredging may occur on site to the depth of 4 metres, so they is a real chance that such remains may be encountered if present.

3. If the drag head of the dredger encounters such remains the probability of irreversible damage to the remains is almost certain.

4. In environmental assessment terms, the above situation is registered as being of "major adverse significance".

5. In environmental assessment terms, if the above situation occurs then key paragraphs of the National Planning Policy Framework and Marine Policy Statement (cited earlier) are triggered, as are the Protection of Wrecks Act 1973 and Military Remains Act 1986.

In the distinct likelihood of the foregoing being triggered, there is a clear obligation, in our opinion, for the Marine Management Organisation to be in consultation with Historic England on the significance of these matters.

The question now arises for this EIA : can a sufficient mitigation strategy be designed in order to overcome these obstacles ?

However before addressing this question, it is essential to address a footnote to the above matters which centres on the assessment of the morphology of the Goodwin Sands – a matter to be considered later in the context of the recommended Marine Conservation Zone for the Goodwin Sands, along with the impact on fisheries and adjacent coastal areas. This issue is whether dredging (removal of sand) influences the morphology of the Goodwin Sands (the overall physical and hydrodynamic character of the sandbanks).

The Environmental Statement, in conjunction with its consultant HR Wallingford Limited, believe that sand moving into and leaving the Goodwin Sands is essentially minimal – there is no significant input or output of sand to/from the external sand sediment transport system in the English Channel and the North Sea. In other words the Goodwin Sands are stable and largely self-sustaining, and rely on a clockwise circulatory system to maintain the sandbanks and their essential features over time. The Environmental Statement expresses this: (ref. 6.5.7)

Sediment is likely to be supplied to Goodwin Sands from the southern North Sea, along a south-westerly directed sediment transport pathway to the Straits of Dover and along a north-easterly directed pathway from the English Channel. Hence, the banks are located at a sediment transport convergence where there would be no overall (net) bed load transport. Suggested losses from the banks include those along a transport pathway to the north and into the Thames Estuary, and a local transfer to the west towards the east Kent coast (HR Wallingford, 2002; Halcrow, 2010).

"There is significant potential sediment transport around Goodwin Sands (HR Wallingford, 2015d). During ebb tides, sediment transport is to the north, while during flood tides sediment transport is to the south in deeper areas, with very little transport in the shallower parts between the sand banks and the coast. The peak sediment transport rates are about 0.002m2s-1 (Figure 6.16) with the highest residual rates of 0.0002m2s-1 (10% of peak transport rates) averaged over a spring-neap tidal cycle (Figure 6.17).

"The pattern of residual sediment transport describes a clockwise circulation around the sand bank system with northward transport to the west and southward transport to the east of the banks (HR Wallingford, 2015d). The sediment transport modelling results suggest that there is a small northward sediment transport pathway from the Straits of Dover, which might feed Goodwin Sands with additional sand, although the amount of sand available for transport there is very limited. To the north of the study area, the residual transport vectors are very small. This finding suggests that there

is a little loss of sediment to the northwest of the banks, and potentially a small gain from the northeast. Accordingly, the volume of the banks is expected to be stable, perhaps even growing at a very slow rate. This view of a generally stable bank volume is confirmation of earlier work (HR Wallingford, 2008) that concluded that the volume of the sandbanks is constant or fractionally increasing."

The Environmental Statement and its consultant, HR Wallingford, go further and state (ref. 6.5.9):

"DHB has previously dredged material from South Goodwin Sands for port development. The last dredging carried out was in Area 342 (shown in Figure 6.19) in April 1998, when 244,060m3 of sand was extracted. The bathymetry comparison between 1995-1998 and 2006, suggests that despite this extraction, the change in bank levels in Area 342 has been small. This means that the extraction did not lead to a long-term lowering of the bank and bank levels have recovered since that extraction (HR Wallingford, 2008)."

The Environmental Statement uses this evidence to support an argument that the proposed dredging will be equally negligible in its impact on the morphology of the sand banks. The argument and evidence advanced – which we challenge below – is recorded in the Environmental Statement, ref. 6.6.6:

"HR Wallingford (2008) also showed that the volume of the entire South Goodwin Sands between 1995-1998 and 2006 above the -10m CD contour reduced by 0.9% of the total volume of the bank (1.6M m3 of the bank's 178.8M m3) (Table 6.7). This would equate to a 6cm vertical change spread equally across South Goodwin Sands, which is within the expected accuracy of the bathymetric survey. This estimate was based on an arbitrary boundary placed around the bank at the time of the latest snap-shot (2006), which does not include the proposed dredge area (this area is immediately west of the previously defined boundary). It is not possible with the data available to determine whether the majority of the bank still remains within this arbitrary boundary or whether the bank has moved or spread to locations outside the boundary. However, it is possible to ascertain that the change in bank volume within that defined boundary was very small (less than 1% of the total volume), and the general lack of mobile sand on exposed bedrock beyond the bank indicates that it is a self-contained feature with sand transported around and across the bank by the clockwise circulatory tidal current system (Section 6.5.2).

"The proposed dredging scheme will remove 2.5M m3 of sand from the edge of the bank. This volume is a greater volume then the 'natural' change in volume of the bank recorded between 1995-1998 and 2006 (within the defined arbitrary limits at the time). However, numerical modelling shows that removal of this volume will not change the existing sedimentary processes and, therefore, will not have any significant effect on the morphology of the much larger-scale bank. Although it is difficult to predict how the proposed dredge area will infill after aggregate extraction, the bank will continue to evolve within bounds of its current patterns of erosion and accretion.

"The removal of 2.5M m3 will not change the nature of the seabed substrate as a minimum of 0.5m depth of sediment capping layer will be left in situ (ES Section 2.4) and dredging will not discernibly change the sedimentary processes (i.e. accretion and erosion). Therefore, post-dredge morphological evolution should not affect the re-colonisation and recovery of benthic communities.

"*The removal of 2.5M m3 of sand at South Goodwin Sands will not have a post-dredge morphological evolution effect at the coast because the sand within the bank is being transported in a circular path around the bank and towards its crest, without any sediment transport connection (e.g. supply) to the coast."*

The important issues overlooked in the applicant's Environmental Statement, both with regard to the future morphology of the sandbanks and the integrity of the archaeological remains, are as follows:

1. Whilst the Goodwin Sands overall (north and south) are stable in terms of the volume of sedimentary material (sand) available to maintain their morphology, the South Goodwin Sands have, between 1995-1998 and 2006 reduced by 0.9% [1%] in the total volume of their bank – namely, 1.6M cubic metres of the bank's 178.8M cubic metres. [Note: the ES and its consultant offer no explanation for this.]

2. The proposed dredging scheme will remove 2.5M cubic metres of sand from South Goodwin Sands. This amount is roughly one an a half times larger than the "natural loss" that occurred from the South Goodwin Sands during 1995-1998 and 2006, a period when the Goodwin Sands overall was stable or slightly increasing.

3. In our opinion, it is not plausible therefore to assert that the removal of 2.5M cubic metres of sand from South Goodwin Sands is insignificant, or of negligible impact. **Firstly**, it is an amount greater than the "natural loss" that is occurring at the present time – a natural loss which is unexplained by the ES. **Secondly**, the impact of the removal of 2.5M cubic metres in conjunction with the current process resulting in "natural loss" of 1.6M cubic metres over the period 1995-1998 to 2006 [Note: the trend since 2006 – 10 years to the present time – is unknown, so "natural loss" could be greater] is unassessed by the applicant and its consultant, HR Wallingford. **Thirdly**, the removal of 0.24M cubic metres in 1998 by the Dover Harbour Board from Area 342 is significantly smaller by an order of 10 times compared with the present proposal, and is thus not strictly comparable. **Fourthly**, Area 342 lies to the north of South Goodwin Sands and the proposed site. The morphology of Area 342 and its loss of sand have, the applicant and its consultant assert, largely been restored – however, the question arises: has the sand to restore Area 342 come from South Goodwin Sands (the sediment movement in the Goodwin Sands overall is clockwise), and does this therefore account for why South Goodwin Sands has declined by nearly 1% in the volume of sand in the period 1995-1998 to 2006, and possibly more since then ? This question is wholly unassessed in the applicant's Environmental Statement and is regarded by us as **significant**. **Fifthly**, if excavated sand in the proposed dredged area in the South Goodwin Sands can only be replenished from sand within the Goodwin Sands' overall clockwise circulatory system, what is the morphological impact of the present dredging proposal on the whole morphology of the Goodwin Sands ? The question has not been addressed in the Environmental Statement. It is, in our opinion, **significant**.

4. In the archaeological context, if the proposed dredging area is likely to disrupt the sand circulatory system in the Goodwin Sands overall, and thus the morphology of the Goodwin Sands, this has implications for the maritime and aviation heritage assets in the area. Under the National Planning Policy Framework this would trigger Policies 128 and 139 with regard to the setting of heritage assets, and may have wider implications. In our opinion, this is a matter requiring assessment which has not been provided in the applicant's Environmental Statement, and requires assessment by the MMO in conjunction with Historic England.

And so, our assessment now returns to the question for this EIA: can a sufficient mitigation strategy be designed in order to overcome these obstacles ?

In the case of damage to the setting of heritage assets (NPPF 129 and 139, MPS 2.6.6.7), there is really no mitigation that can be offered – other than not to dredge or to surrender the licence should significant heritage assets be encountered once the licence has commenced.

In the case of heritage assets encountered during dredging (NPPF 128, 129, 132, 135, 139 and 141, MPS 2.6.6.3, 2.6.6.5, 2.6.6.7, 2.6.6.8 and 2.6.6.9) the applicant is proposing to have an archaeologist on board the dredger – although the strategy for on board monitoring is not outlined in

the Environmental Statement other than to say that future consultations will be held with Historic England and the MMO, and therefore the efficacy and integrity of this mitigation measure is **undetermined**. In addition, the applicant is proposing archaeological monitoring during discharge of the dredged material at the Harbour Board's Western Dock – yet once again the implementation of this mitigation strategy is not outlined in the Environmental Statement other than to say that future consultations will be held with Historic England and the MMO, and therefore the efficacy and integrity of this mitigation measure is **undetermined**.

The applicant proposes to mitigate potential archaeological impacts by requiring the dredging operator to observe an industry code of practice for marine aggregate dredging and the historic environment. This requires discoveries to be reported by staff to an implementation service [Note: this "service" is not clearly defined in the ES] which advises on the necessary measures to address discoveries, such as first aid conservation, recording and temporary exclusion zones, if required. The protocol which encapsulates this 'code of practice' involves the implementation of an awareness programme which trains staff in the identification of archaeological material (ref. App. 14.1, 7.4.4. and 7.4.5).

There are a number of problems with this mitigation strategy.

Firstly, it is acknowledged that when the dredger's drag head encounters heritage assets these will be permanently damaged.

Secondly, given that maritime and heritage assets in the dredge area have been largely undiscovered and undetected by the applicant's prior surveys, these heritage assets will be inevitably and irreversibly damaged.

Thirdly, in the case of aviation heritage assets, all encountered assets must be automatically classed as of **high value**, and so dredging in the vicinity will have to cease pending their evaluation. Given that these particular heritage assets will likely involve the death of aircraft personnel, this would be a war grave under the Military Remains Act 1986, and dredging in the vicinity could not be recommenced under any circumstances.

Fourthly, in the case of maritime heritage assets, all encountered assets must be assumed to be of **high value** until assessed, and therefore this will likely require the enforcement of an exclusion zone whilst further exploration and evaluation takes place. If the heritage asset proves significant, the exclusion zone will very probably become permanent.

Fifthly, if the aviation or maritime asset is not discovered at the time of dredging but rather only during discharge of the dredged material into the Harbour Board's Western Dock, then the exclusion zone will not be able to be applied to a specific locality. Rather, it will require the whole dredging area during that specific dredging period to be made a temporary exclusion zone until further exploration and assessment can determine the precise location and significance of the heritage asset.

Sixthly, whilst establishing exclusion zones in order to protect a heritage asset discovered by a dredger may appear a reasonable mitigation measure, this is not necessarily a viable course of action as noted by The Crown Estate in its advice on marine archaeology - see its publication *Aggregate Dredging and the Marine Environment, Chapter 4, p. 67, published 2013*. Here it is noted that whilst avoiding historic assets is a commendable approach to mitigation, the establishment of exclusion zones (temporary or permanent) beyond the heritage asset's immediate footprint can impede seriously the ability to dredge, especially if these exclusion zones are numerous or clustered – which could easily prove to be case with this site in South Goodwin Sands. The alternative is investigation, which

has the benefit of revealing the full value of the heritage asset for the benefit of the public (NPPF 141 and MPS 2.6.6.3). However the undertaking of such on-site investigation is costly in financial terms, and may require closure of the dredging site for practical reasons.

As a result, it has to be recognised that there is serious pressure on a licence holder to "understate" its encounter with heritage assets because they can seriously impede the delivery of the aggregate (sand) and incur substantial additional financial costs.

Whilst one would not wish to question the integrity of the applicant in this instance, it has to be noted that the dredging schedule is exceptional. It involves three trips by the dredging vessel(s) per day to the dredging site (three 8 hours "shifts" every 24 hours) over three 4 month periods (the 4 months are consecutive in each instance) between 2017 and 2019 in order to meet commitments with a construction schedule at the Western Docks. One can therefore foresee that any encounter with significant heritage assets which have been undiscovered and undetected by prior surveys – admitted by the applicant to be a distinctly probable risk due to the inability to "see" aircraft crash sites and wooden shipwrecks by using geophysics [Note: an issue confirmed in The Crown Estate publication 2013, Op cit, Chapter 4, p. 64] – will place exceptional pressure on this tight and precise dredging schedule. In short, the discovery of heritage assets will threaten the viability, both practically and financially, of the construction project.

If this reality were to materialise, the proposed mitigation strategy and its principles become completely **unviable.**

In conclusion therefore, we observe that there is a strong likelihood of the existence of heritage assets in the dredge area. This is accompanied by the admitted inability of expert opinion to predict their existence by prior geophysical surveys, allied to the almost inevitable and irreversible damage to these heritage assets once encountered by a dredger's drag head, and the highly questionable ability to devise a mitigation strategy which takes account of all these complications. Therefore to dredge the proposed site is a **major adverse risk** in archaeological terms. From a licensing perspective, the proposal clearly threatens to trigger exclusion of the site from planning consent under NPPF and MPS legal requirements. It challenges compliance with The Protection of Wrecks Act 1973; and, it challenges compliance with The Military Remains Act 1986 under whose terms the Goodwin Sands, both specifically in the proposed dredge site and overall, should be considered to be a war grave.

Accordingly, we recommend **refusal** of the application on archaeological grounds.

<u>Impact on Goodwin Sands rMCZ</u>.

Whilst the non-designated status of the Goodwin Sands Marine Conservation Zone (MCZ) means that if does not require an official assessment under the legal requirements of the Marine and Coastal Access Act 2009, the MCZ's recommended status for designation is strong and it has been assessed in these terms by the UK government (Defra) – as earlier detailed in this submission.

As a result of this Defra assessment, two Broad Scale Habitat features possessed by this rMCZ warrant further assessment, as recognised by the applicant's ES, ref.8.5.2. These are:

Subtidal coarse sediment, and
Subtidal sand.

The impact of the proposed dredging on the integrity of these two rMCZ Broad Scale Habitat features within the context of the rMCZ as a whole needs evaluative comment additional to that provided by the applicant in the ES, but before addressing that matter it is necessary to first consider the impact of the proposed dredging on the fauna to be found in these rMCZ Broad Scale habitats located within the proposed dredge site.

The ES observes, ref. 8.5.1 :

"As described in Section 8.4, the species diversity within the proposed dredge area is low compared with the wider Goodwin Sands area. Abundant species recorded in the proposed dredge area and considered in this assessment include G. spinifer [Gastrosaccus spinfer, a shrimp-like crustacean]*, U. brevicornis* [Urothoe brevicomis, an amphipod crustacean]*, N. cirrosa* [Nephtys cirrosa, a worm]*, and Philocheras spp* [a decapod crustacean]. *A number of species were found to be unique to samples collected within the proposed dredge area and not found elsewhere in the survey area and are also considered in this assessment; these species include Magelona sp.* [a worm]*, S. armiger* [Scoloplos armiger, a bristle worm]*, S. goniocephala* [Spio goniocephala, an annelid worm]*, G. triangularis* [Goodallia triangularis, bivalve mollusc]*, and Idotea spp* [an isopod crustacean e.g. a marine woodlouse]. *The species C. allmanni* [Crangon allmanni, a shrimp]. *L. vulgaris* [Loligo vulgaris, the European squid] *and S. atlantica* [Sepiola atlantica, a bobtail squid] *are also considered in this assessment due to their potential commercial importance. Overall, the species within the proposed dredge footprint are of negligible value as they are of low importance and rarity, and are not designated.*

"The Marine Life Information Network (MarLIN) website provides a review of available information regarding the sensitivity of a number of species to various impacts. Table 8.8 provides an overview of available sensitivity information in relation to substratum loss for key species recorded within the proposed dredge area. Where information is not available, closely related proxy species are used (e.g. species of the same genius and similar habitat preferences).

"Table 8.9 provides a comparison between the MarLIN sensitivity definitions and classifications with those outlined in Table 8.1. There is limited available information for some of the species that were recorded within the proposed dredge area. However, based on the available information and taking into account the low species richness within the proposed dredge area and their potential to be easily replaced during recovery / recolonisation, the sensitivity of the benthic and epibenthic species that will be lost due to the proposed dredging scheme is considered to be negligible. Given the magnitude of loss and value and sensitivity of the species, and the high probability that loss will occur, the impact associated with direct loss of these species is considered to be of ***minor adverse*** *significance.*

"The species within the proposed dredge area are of negligible value as they are of low importance and rarity, and are not designated. Therefore, receptor value does not affect the concluded impact assessment."

[Note: bold emphasis in the original text].

There is a matter of significance which the Environmental Statement has not addressed.

The ES asserts that both Broad Scale rMCZ habitats in the proposed dredge site will readily recover physically (ref. 8.5.2.) and that therefore the species of fauna that characterise these specific habitats will similarly do so because these habitats are 'high energy' environments which are largely colonised by 'opportunistic species' adapted to life in a 'high energy' environment.

Whilst this is a true statement in relation to 'high energy' marine environments in general, the ES observes with respect to the rMCZ habitats in the dredge site : "*A number of species were found to be unique to samples collected within the proposed dredge area and not found elsewhere in the survey*

area and are also considered in this assessment; these species include Magelona sp., S. armiger, S. goniocephala, G. triangularis, and Idotea spp."

It is generally accepted that dredging the top layers of the seabed results in near 100% death of the species present. Therefore given the same situation in this instance, one needs to ask how the dredge site is going to be readily re-colonised, either in the short-term or the longer term, by *Magelona sp., S. armiger, S. goniocephala, G. triangularis, and Idotea spp.* when these species were not found elsewhere in the survey area ?

This point is <u>not</u> evaluated in the ES. If re-colonisation by the full range of resident species is compromised in this way, then the restoration of the rMCZ Broad Scale habitat will be equally compromised. Further one has to observe from Table 8.8 in the ES (*Summary of sensitivity information from MarLIN in relation to substratum loss*) that in evaluating the "sensitivity" of nearly all the resident species to severe disturbance (dredging), the ES states that there was "insufficient information" – i.e. the evaluation relating to these species in these Broad Scale habitats could <u>not</u> be undertaken on the basis of existing scientific knowledge.

Indeed the significance of this goes further still, for if the ecological structure of these Broad Scale habitats is damaged, then so is what ecologists term the "critical order" of the wider ecological structure. In other words, a profound disturbance has taken place which upsets the general ecological structure in the area.

The ES observes that "*Overall, the species within the proposed dredge footprint are of negligible value as they are of low importance and rarity, and are not designated."* However their rarity value is not the issue. Rather, the issue is the role they play in the overall ecological structure, and what happens to that ecological structure when their presence is absent or severely compromised.

In these circumstances, not only are the rMCZ Broad Scale habitats (subtidal coarse sediment, and subtidal sand) in the dredge area challenged adversely first by the dredging impact and then by their reduced ability to recover, but also by the fact that the species in the food chain that depend on these benthic species will be similarly challenged adversely e.g. these benthic species are the food of fish and sand eels, and fish and sand eels will be the food of seals and sea birds – many are protected species and constituents of a wider conservation network (SPAs and SACs).

The ES has undertaken <u>no</u> evaluation of the impact in such terms. One must therefore suggest, in the absence of this ecological evaluation, that the impact on the benthic fauna of the dredge site, and thus of the broad scale rMCZ habitats in the dredge site, may be **major adverse** and not minor adverse as the ES states.

We must now return to our earlier statement : The impact of the proposed dredging on the integrity of these two rMCZ Broad Scale Habitat features within the context of the rMCZ as a whole needs evaluative comment additional to that provided by the applicant in the ES.

The issue here is as follows.

Whilst considering the archaeological issues, we drew attention to the fact that the amount of sand to be extracted from the proposed dredge site is 2.5M cubic metres whereas the volume of the entire South Goodwin Sands between 1995-1998 and 2006 (above the -10m CD contour) reduced by 0.9% of the total volume of the bank (1.6M m3 of the bank's 178.8M m3) – ref. HR Wallingford. Further, we noted that in 1998 the Dover Harbour Board had dredged Area 342 for 0.24M cubic metres of sand (an amount small by an order of 10 times compared with the present proposal) and that

Area 342, which lies to the north of the proposed new site, may well have been re-charged with sand by erosion of sand from South Goodwin Sands – given that the dynamic of the Goodwin Sands is largely self-sustaining and not connected to any significant internal/external dynamic with regard to the supply of sand, and that circulation of sand within the Goodwin Sands system is clockwise.

We noted the failure of the ES to evaluate this matter.

The importance with regard to the rMCZ Broad Scale habitats (subtidal coarse sediment and subtidal sand) as a whole is that this possible interaction between the re-charge of Area 342 and South Goodwin Sands raises the possibility that to dredge 2.5M cubic metres from the South Goodwin Sands could result in removal of sand from elsewhere in the Goodwin Sands system if, as the ES proposes, the dredge site is re-charged over time with new sand. This sand would, given the largely closed system of the Goodwin Sands, come from the subtidal coarse sediment and subtidal sand rMCZ habitats elsewhere in the Goodwin Sands, thus leading to wider damage and degradation to these rMCZ habitats elsewhere with the Goodwin Sands.

This issue has <u>not</u> been addressed in the ES.

If this damage and degradation to the rMCZ habitats in the wider system were to occur it would be a serious issue, and we would regard this risk and possible consequence as **major adverse.**

Accordingly we recommend **refusal** of this application on the grounds of the potential **major adverse** impact which has **not** been properly assessed on the rMCZ and its Broad Scale habitats of subtidal coarse sediment subtidal sand.

<u>Impact on Sandeels</u>.

Sandeels, of which five sub-species may be present in the location of the proposed dredge site, are a key species for assessment. This is because sandeels are a primary food of other fish, seals and seabirds which, in their turn, are classed in many cases as protected species of national and international importance. Sandeels are a species central to the "critical order" of the area's ecosystem.

The importance of sandeels has been made clear to the applicant from the outset. The Minutes of the Regulatory Advisory Group, May 2015 (contained in the EIA Scoping Report, July 2015) state, ref. 4.11 "***NE*** [Natural England] *explained that, due to the particle size and slope on the western flank of South Goodwin Sands, the area has the potential to be ideal sandeel habitat. It was recommended that epibenthic trawl surveys are conducted along the bank edge on the western side of the prospecting area.* ***NE*** *explained that these could potentially be important areas for birds foraging for sand eel. The* ***MMO*** *highlighted that any limitations associated with the survey gear used to monitor the sandeels will need to be caveated in the final report. It was recommended that trawls should be carried out at night when the sandeel are likely to be found at the seabed and that RHDHV should consult MESL regarding survey timing and methods.*"

The Applicant reports on the presence of sandeels in ES 9.4.4. and Appendix 8.1, D.3.1.

In these reports there is no clear evidence that the applicant has:

○ either, undertaken epibentihc trawl surveys along the bank edge on the western side of the prospecting area – note: trawl surveys were conducted which revealed the presence of sandeels, but the precise location of these trawls is unclear and not clearly specified in either Figure 9.2 (ES) or

Figure 22 (App. 8.1). Further, the ES states, ref. 9.4.4 "*It can be seen that no sandeel where identified within the proposed dredge area or within the SIZ* [secondary impact zone]". This statement does not makes sense as sandeels were detected, so they must have been either in the primary impact zone (dredge area) of the secondary impact zone, and indeed App 8.1, D.3.1 states "*The greatest abundance (66 individuals) was recorded in the PIZ.*"

○ nor, undertaken the epibenthic trawls at night. Sandeels are most likely to be found on the seabed at night, and daytime trawls will fail to reveal their true presence and abundance. This failure to conduct trawls at night is a significant failure of sampling procedure.

The purpose of conducting a survey that has met with the above requirements is in order to test whether the edge of the western bank is a sandeel breeding area, as Natural England requested should be determined. No evidence is presented in the ES on this specific point, other than an oblique statement by the ES that in the 2015 epibenthic survey 83% were of the individuals caught were under 14cm in length, thus indicating they were juveniles. From this fact it may be inferred that the western bank may be a breeding site, but this question is <u>not</u> examined by the ES or in the related Appendix.

The sandeel survey undertaken by the applicant must therefore be considered as **seriously deficient**, having not complied with the sampling regime that was requested.

There is evidence to suggest that the western bank of the dredge area **is** significant breeding habitat for sandeels, and thus a key area and food resource for fish, seal and seabirds in the Goodwin Sands and further afield.

Therefore there are grounds for believing that, despite the avoidancen by the applicant of the requirements to properly evaluate this issue, the impact of dredging on sandeels in the proposed area would be **major adverse.**

Accordingly we recommend **refusal** of the application on the grounds of clearly probable adverse impact on sandeels.

<u>Impact on the adjacent Coastline</u>.

The ES and its consultant, HR Wallingord Ltd., ES Section 16 and Appendix 16.1, predict no fundamental change in either the wave or the tidal current regime which would lead to increased pressure (erosion) on the adjacent coastline (East Kent).

The Conclusion (Section 8) of Appendix 16.1 states:

"Our wave modelling has indicated that there will be no noticeable changes in wave conditions close to any part of the coastline. This is despite the fact that exceptionally severe wave conditions have been simulated and examining changes caused by the extraction at different tidal levels. Of particular concern in this study were any changes in nearshore wave heights at high tide when coastal defences would be most at risk and the shelter provided by the Godwin Sands was least. At the low tide level considered, the proportional increase in depth caused by the dredging will be greatest, hence maximising the changes to waves travelling over the extraction area. In both cases, however, the modelling showed changes in wave heights would be limited to within and very close to the limits of the extraction area, and not extend more than a small proportion of the distance to the nearest point on the coastline. We conclude the dredging will have no effect on wave conditions along the coastline of Kent.

"The next two bulleted concerns listed above [note: see Section 8] *relate to the potential for tidal flows to be affected by aggregate dredging, thus also affecting the movement of sediment over the seabed in and around the dredging area. These possible changes were examined by tidal flow and sediment transport modelling, as explained in Sections 6 and 7.*

"Over some parts of the study area, tidal flows and the associated sediment transport rates are predicted to alter as a result of the lowering of seabed levels in the proposed dredging area. However, none of the modelling has indicated that there will be any significant changes in tidal currents or sediment transport rates along or close to any coastline. This is despite the fact that the modelling has taken a conservative approach to simulating such changes, by considering a large tidal range and by substantially exaggerating the amount of sand that would be removed.

"Local to the proposed dredging area, there will be changes to the hydrodynamic and hence the sediment transport regime, so that bed levels close to the dredging area will alter. The main concern is that as a consequence the height of the crest of the South Goodwin bank may reduce, hence reducing the shelter from waves that it presently provides to the eastern coast of Kent. We have examined this possibility using the results of past monitoring of the Goodwin Banks following similar aggregate dredging campaigns, and by considering the processes that have maintained these banks in much the same position and with much the same crest levels over the last few thousand years (in Section above).

"Based on these considerations, we have concluded that the proposed dredging will not alter the crest level of the South Goodwin bank.

"However, as is standard best practice for marine aggregate licences, we do recommend monitoring of the dredging area before, during and after the extraction.

"Having completed our consideration of all the standard concerns regarding the possible impacts of the proposed aggregate dredging from the South Goodwin Sands, we have therefore concluded that there will be no effects along the eastern Kent shoreline, and therefore no significant coastal impacts. However, as is standard best practice for marine aggregate licences, we recommend monitoring of the dredging area before, during and after the extraction."

In addition, with regard to the threat of beach drawdown the ES, ref 16.5.4 states:

"*Expert judgement on the potential for beach drawdown suggested that there is no potential for a change to baseline conditions due the proposed dredging. This can be explained by the fact that the water between the study area's beaches (i.e. between South Foreland and Ramsgate) and the dredging area is deeper than the water will be in the sea bed depressions at the dredging areas after dredging. Hence, there is no change in the potential for waves to move beach material into deeper water from where it cannot be returned to the beach. This means that deepening the dredging area will not influence the potential for beach drawdown. This expert judgement is supported by the modelling results that suggested no potential erosion at the shoreline.*"

The maintenance of the integrity of the East Kent coastline to enable it to retain its present position and morphology is important for a wide range of social, economic and environmental reasons.

We therefore agree with the ES and its consultant that it is essential that, were dredging to occur at Goodwin Sands, that monitoring of the dredging area before, during and after extraction must take place, that this be a condition of any licence, and that the results of this monitoring must be **publicly published** on a regular basis**.**

We further note the following point regarding the influence on the coastal wave regime of offshore sand banks, ref. App. 16.1 section 2.2 :

"Offshore from this whole coastline there are numerous banks and channels that modify deep water wave conditions before they reach the shoreline. The most striking of these sandbanks are the

Goodwin Sands which stretch from as far south as St Margaret's Bay and as far north as Ramsgate. Various parts of the Goodwin Sands and the smaller Brake Bank, which lies about 2 to 3 km directly offshore of Sandwich Bay Estate, all dry at low tide. Even at higher tidal levels, however, these banks form a natural low-crested breakwater and provide partial shelter to the coastline between Dover and Pegwell Bay. The Goodwin Sands, in particular, are constantly moving altering both their plan shape and profiles; in doing so, they must alter the nearshore wave conditions and hence the movements of beach sediment leading to variations in the plan shape of the coastline. This variability, however, does not seem to have been of sufficient concern to lead to any past studies of the effects on the coastline of historical changes in these sandbanks. Further discussion of the processes and changes in Goodwin Sands is presented later in this report.

"In addition to these drying banks, there are other less dramatic seabed features that will affect waves before they reach the coastline. These include Deal Bank, offshore and to the east-south-east of Deal Castle, and Cross Ledge north of Brake Bank. The former was cited by Halcrow (2010) as influential in altering waves reaching the Deal frontage and the Cross Ledge also occasionally dries, so also acting as a natural low crested breakwater for Pegwell Bay.

"As a consequence, wave conditions along the coastline are both substantially smaller than those offshore and likely to vary both along the shoreline and over time as the various sandbanks alter."

The important point here is that the Goodwin Sands are not the only offshore sand bank system affecting the wave regime governing the East Kent coast. Almost equally significant are the smaller, closer to shore sand banks – namely Brake Bank affecting the Sandwich Bay area and Cross Ledge north of Brake Bank, along with Deal Bank affecting the Deal area.

The question therefore, given the strong influence of these close inshore sand banks, is whether dredging at Goodwin Sands may affect these sand banks, particularly in terms of their crest height and general alignment to the coast. If this were to occur, this could lead to an altered wave regime along the coast and increased erosive forces.

There is nothing in the ES and the HR Wallingford study to lead to this conclusion but, at the same time, it is a specific point which the ES appears not to have considered. Accordingly, there is an **unassessed risk** here.

We recommend that the applicant give further consideration to this specific question prior to determination by the MMO, and any decision on the application is **conditional** on this matter being resolved. In addition it is essential that, were dredging to occur at Goodwin Sands, that monitoring of these inshore sand banks before, during and after extraction take place and that this be a condition of any licence, and that the results of this monitoring must be **publicly published** on a regular basis**.**

It is also to be noted that there is an existing problem of beach erosion along the East Kent coast, and that this is being addressed by the practice of "beach recharge". The ES reports on this as follows, ref. 16.4.3:

"*Techniques to complement the hard engineering approaches outlined above include beach management in the form of shingle recharge and recycling. Table 16.2 outlines past beach recharge works in the study area. These beach recharge works address a long running concern about beach erosion, especially at St. Margaret's Bay and Kingsdown. Discussion of the sediment transport processes leading to beach lowering is provided in Appendix 16.1 - Coastal Impact Study, but it is important to note that this is a long-running and persistent characteristic of the physical environment under present-day (baseline) conditions, especially at St. Margaret's Bay and Kingsdown*.

Table 16.2 Past beach recharge works in the study area

Location	*Date*	*Beach Recharge Work*
Kingsdown	*1995*	*58,000m3 of shingle recharge*
Kingsdown	*1998*	*80,000m3 of shingle recharge*
Kingsdown	*2003/04*	*47,000m3 of shingle recharge*
Oldstairs Bay	*2004*	*45,000m3 of shingle recharge and regular recycling*
Deal Castle to Sandown Castle	*1974*	*9,000m3 of shingle recharge*

The ES and Appendix 16.1 explain that this erosion is, in their estimation, essentially a "natural process" caused by the nature of the northerly longshore drift along this coastline and the low quantities of sediment within this movement available to replenish the beaches and coastline. This is expressed in Appendix 16.1, section 2.4:

"*Longshore drift along this coastline was investigated using tracers in a study undertaken by Hydraulics Research Ltd. (1961) and this study indicated the drift varied seasonally with sediment moving northwards in summer and southwards in winter. Over the long-term, however, the net drift along the whole frontage from Dover Harbour to Pegwell Bay is northwards.*

"There is little fresh sand or gravel being added to the beaches either from the south or from erosion of the chalk cliffs and nearshore seabed. It is therefore not surprising that the beaches in St Margaret's Bay and near Kingsdown are suffering from erosion. A recent report by the Channel Coastal Observatory (2013) has analysed beach changes along three cross-sections in St Margaret's Bay. Their analysis shows a loss of 20% of the sediment from the northern profile in this Bay, and a gain of 9% in its southern part, between 2004 and 2013. While this analysis is not comprehensive in the sense of calculating changes in the total volume of beach sediment, it does suggest a long-term problem of beach lowering in this bay.

"There are also problems retaining beaches near Kingsdown located immediately north of St Margaret's Bay. Here too beach lowering is being caused by the northward longshore drift not being replaced by sediment arriving from further south. This problem has been countered by beach recharges and continuing beach material recycling operations, resulting in very variable beach widths from south of Kingsdown to as far north as Walmer Castle."

The argument being advanced here is that coastal erosion along the East Kent coast is occurring independently of the sediment flows, and tidal current regime and wave regime engendered along the East Kent coast by Goodwin Sands. The evidence presented in the ES to support this argument is strongly based in professional and statistical terms and demonstrates an empirical base.

However, as mentioned earlier the maintenance of the integrity of the East Kent coastline to enable it to retain its present location and morphology is important for a wide range of social, economic and environmental reasons.

Therefore we recommend that, as an essential precaution, continued monitoring of erosion patterns, including any beach recharge actions along the coast, are undertaken as an condition of any dredging licence were it to be granted, and that this monitoring be undertaken on a specified regular basis as a condition of any licence, and that the results of this monitoring must be **publicly published** on a regular basis**.**

Alternative Sources of Aggregate.

Alternative sources of aggregate do exist. They exist in terrestrial quarries (4 within 35km and a further 3 within 60 km, ref. App. 2.2, Table 2) and in marine sites (7 within 100km, a further 5 within 130km, and a further 4 within 170 km, ref. App. 2.2, Table 2).

The applicant has dismissed all of these alternative sources on the grounds that Goodwin Sands is the closest source, and thus the fuel costs are the lowest. This would be an important factor if the other adverse consequences, both actual and potential, recorded in this submission were not an overriding factor. They are an overriding factor, in our opinion.

Against this background it has to be noted that the applicant in its assessment of the availability of alternative sources of marine aggregate has taken no action to verify the availability from the other marine sources, ref. App 2.2. Section 4.2.2:

"*Alternative marine sources of supply could potentially replace the aggregate sought from the Goodwin Sands. The resources currently extracted from the licensed areas to the north and south of Dover comprise fine aggregate (coarse sand or fine sand) or aggregate suitable for fill, and are used as construction aggregate and for concrete products (Bide et al, 2013). These areas have the supply pressures from existing customers with specific requirements that cannot be met from other areas, and it cannot be confirmed whether they could sufficiently supply the DWDR scheme with the required aggregates. Nevertheless, as a conservative assessment scenario, the South Hastings site is the closest aggregate extraction area to Dover Harbour and has been used to inform the assessment of environmental sustainability in relation to the energy consumed due to the transport of aggregates (see Table 4).*"

Thus these alternative marine sources of aggregate (sand) have **not** been properly assessed.

With respect to terrestrial quarries (7 within 60 km) there is no evidence in the ES that these quarries have been approached to verify whether they could supply, singly or in combination, the quantity of sand required.

Moreover, there has been no assessment in the ES of the "manufactured sand" process – which now supplies the overwhelming bulk of sand in Japan for the type of sand required by the Dover Harbour Board. This manufactured sand is produced from quarry waste, so its environmental impact is very low, see http://www.marinet.org.uk/campaign-article/marine-aggregate-extraction-the-need-to-dredge-fact-or-fiction . This process can be applied in the Kent quarries within the 60km radius. Furthermore, the British Marine Aggregate Producers Association is fully conversant with this technology and its availability, so the applicant has no reason for the failure to assess its application.

Accordingly, there are **serious deficiencies** in the applicant's assessment of the alternative sources of marine and terrestrial sand. These are reasons of sufficient seriousness to warrant **refusal.**

Summary.

Archaeological assessment: we observe that there is a strong likelihood of the existence of heritage assets in the dredge area. This is accompanied by the admitted inability of expert opinion to predict their existence by prior geophysical surveys, allied to the almost inevitable and irreversible damage to these heritage assets once encountered by a dredger's drag head, and the highly questionable ability to devise a mitigation strategy which takes account of all these complications. Therefore to dredge the proposed site is a **major adverse risk** in archaeological terms.

From a licensing perspective, the proposal clearly threatens to trigger exclusion of the site from planning consent under NPPF and MPS legal requirements. It challenges compliance with The Protection of Wrecks Act 1973; and, it challenges compliance with The Military Remains Act 1986

under whose terms the Goodwin Sands, both specifically in the proposed dredge site and overall, should be considered to be a war grave.

Accordingly, we recommend **refusal** of the application on archaeological grounds.

rMCZ assessment: we recommend **refusal** of this application on the grounds of the potential **major adverse** impact, which has **not** been properly assessed, on the rMCZ and its Broad Scale habitats of subtidal coarse sediment subtidal sand.

Sandeel assessment: we observe that the sandeel survey must be considered as **seriously deficient**, having not complied with the sampling regime that was requested. There is evidence to suggest that the western bank of the dredge area **is** significant breeding habitat for sandeels, and so a key area and food resource for fish, seal and seabirds in the Goodwin Sands and further afield. Therefore there are grounds for believing that, despite the avoidance of the requirements by the applicant to properly evaluate this issue, the impact of dredging on sandeels in the proposed area would be **major adverse.**

Accordingly we recommend **refusal** of the application on the grounds of clearly probable **major adverse** impact on sandeels.

Impact on adjacent coastline: we believe there are **unassessed risks** which require continued monitoring and **prior** assessment should a licence be granted, and that this monitoring requires to be regular and **publicly published.**

Alternative sources of aggregate: there are **serious deficiencies** in the applicant's assessment of the alternative sources of aggregate. These are reasons of sufficient seriousness to warrant **refusal.**

S. D. Eades
Director, Marinet Limited.