WORK IN PROGRESS AT SIZEWELL
- by the sea, by the dredging companies and by the Marinet Group of Friends of the Earth

Summary

Evidence is widespread that offshore dredging for building industry aggregate can cause coastal erosion, by draw down of beaches, by intensifying wave action, by altering tidal patterns and by removing sand banks which have previously protected coasts. While Sizewell beach is said to be stable at present, each one of these processes may cause serious destabilisation of the beach during the time span of Sizewell B, let alone that of any new nuclear stations on the Suffolk coast. It appears that environmental impact assessments made before licences are granted, and after dredging has been carried, out are inadequate to reveal damage to the seabed and increased likelihood of coastal erosion.

The Shut Down Sizewell Campaign is grateful to the Marinet Group of Friends of the Earth, who are primarily interested in these effects on the North Norfolk coast and the Eastern English Channel, for drawing these risks to our attention.

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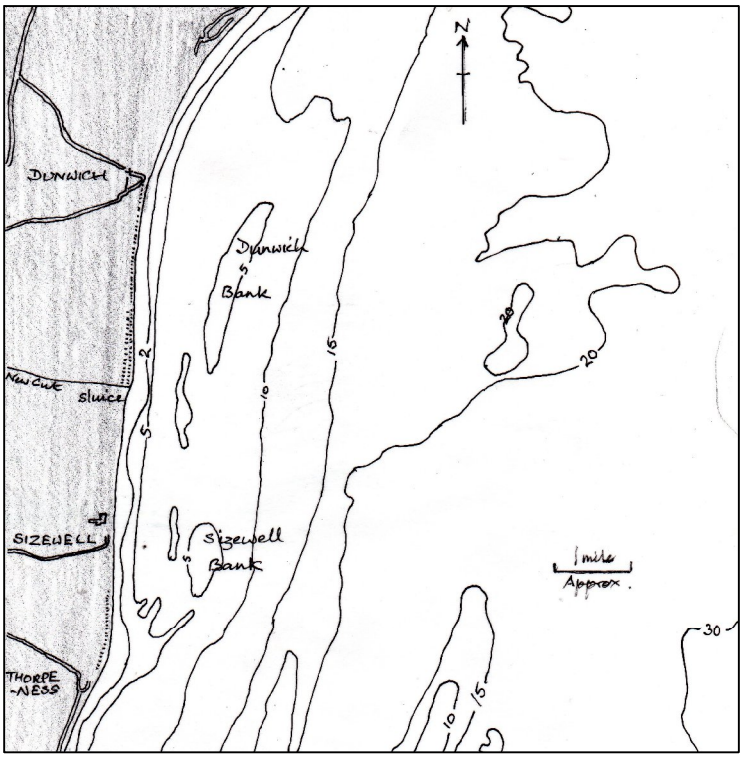
Professor Pethick's audience, at the Sizewell Stakeholder Group's Public Meeting in Saxmundham on 16 October 2006, may have been disappointed that he did not tell us one way or another whether Sizewell's coast was going to be stable enough in the face of coastal erosion for the safety of present and any future nuclear power stations there. An eminent coastal morphologist, he knew that no one knows what will happen. So the precautionary principle must give us pause.



Map 1
Part of the Suffolk Coast showing Dunwich and Sizewell sandbanks
(Traced from the Hydrographic Office's International Charts Series, Sheet 1504, Cromer – Orfordness, 1977)

What the Professor suggested is that at present the beach in front of the stations is stabilised as one of a number of swash bays along the Suffolk coast, this particular one formed by the outfall discharges at the Minsmere sluice. A question was raised at the meeting as to whether he had recorded the history of that outfall entirely correctly; but, whether that is so or not, he admitted that it was difficult to be sure where in the future such stable bays would form. Two other points he made were that the closing of the Minsmere estuary two hundred years ago had led to the loss of nearshore sand deposits, and that there was currently a loss of sand input from the north. Both of these are worrying, because it is the sedimentation from the north

that replenishes beaches during the summer months, and without it the beaches may be expected to suffer a net loss of sand in the winter months.

The Professor has also said elsewhere[1] that nearshore sand deposits "protect these beaches from further erosion. It is essential that we should preserve those banks. We shouldn't dredge them, we shouldn't take material from them. We shouldn't dump it on inshore beaches, because what that does is lower the banks and lets the waves in. Therefore this causes further erosion". So we should be very concerned about the two remaining sand deposits which protect Sizewell beach – the Dunwich and Sizewell sandbanks, shown in Map1.

Attention to the role of sandbanks in protecting beaches has been drawn by the Marinet Group of Friends of the Earth. Their work[2], which is in progress at the moment, is concentrated elsewhere along the East Anglian coast and the English Channel, but their research has thrown light on the vulnerability of sandbanks in general to offshore dredging. It is the application of this to the Dunwich and Sizewell sandbanks that I feel the Sizewell Stakeholder Group should consider most carefully.

The two sandbanks are about a mile offshore. They move about a bit from year to year, but Professor Pethick seemed confident that they are at present protecting the Sizewell beach. However, they are not being added to any longer by deposition from the Minsmere river, nor by sedimentation along the coast from the north. What is happening then up north, that may be reducing the supply of sediment to the sandbanks and to the beach?

Map 2 shows the massive extent of dredging off the Suffolk and East Norfolk coast. I chose the map because it is the most recent one I could obtain, correct as of January last year. And all that dredging is in the direction from which not only the sediment used to come, but also from which the tides and the wave energies affecting the Sizewell coast come. The pattern is for the energies and patterns of tide and waves to impact on the Sizewell coast from a north easterly direction.

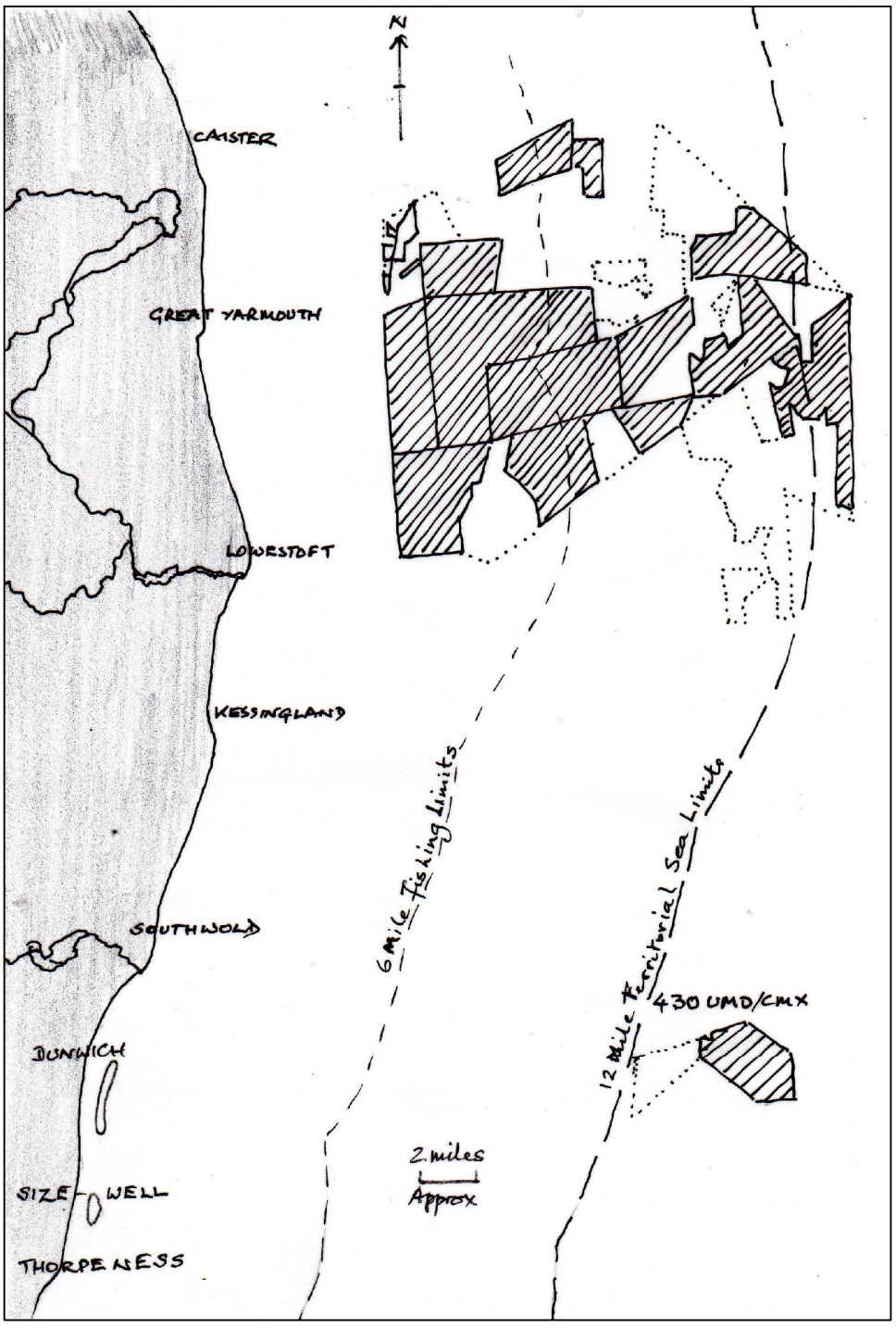
Speaking about this dredging and the erosion of the coast, Suffolk Coastal MP John Gummer has said: "I'm more concerned with the effect on the ways the tides work"[3]. And his point is that the tides and the waves exert their energy in pounding the coast wherever they are directed by the contours of the sea bed, including the sandbanks and shoals. And if one alters those contours by dredging, one will alter the places where the energy hits the shore and where, therefore, the coastal erosion occurs. The Dunwich and Sizewell sandbanks were formed by the energy of waves and tidal patterns working on the sediment carried to the sea by the Minsmere river before they closed it off. And the energy hitting the shore was directed by the contours of the North Sea in pre-dredging times. As we read this, and as the dredging industry obtains ever more licences from the Crown Estate to extend its work in altering those contours, Sizewell's defences may be literally washing away by changing wave and tidal energies.

The dredging offshore deepens the sea bed, creating closer, greater and more erosive waves. Furthermore, the steepened seabed enhances the gravitational run-off of sand from neighbouring areas, thus extending the effect on the overall contours of the sea floor. If that were not enough, the traditional way for the Sizewell beach to be replenished each summer is with southward sedimentary drift from the very areas that are now being dredged. Yet the removal by dredging of the material that might drift south along the coast to replenish Sizewell's beach, and the conversion of that material via the dredging companies into concrete in the built environment both at home and abroad – may be preventing it from reaching any beaches at all.

The evidence that this may be happening is manifold, though much of the research comes from abroad, for reasons that I shall explain in due course. An abstract of research done by the US Minerals Management Service in 2000[4], addressing the removal of sand shoals by dredging, states: "When a shoal is flattened (by dredging), the degree of wave energy concentration is likely to be reduced, resulting in greater wave energies hitting the coastal area. This may result in increased coastal erosion or unwanted, detrimental changes in longshore or nearshore current patterns. Significant coastal impacts could also be expected during storm events in that the increased wave energies which might have been somewhat dissipated by the presence of the shoal would now impact the coastal area with greater forces". Note that longshore and nearshore are where the Dunwich and Sizewell sandbanks are.

Between 1951 and 1979 the US Army Corps of Engineers dredged a channel almost 14 miles offshore of Canaveral Harbour, Florida.[5] Ostensibly for shipping, this dredging created a massive self-sustaining open pit mine offshore serving to denude the onshore coastline. The creation of the original channel caused the previously accreting shorelines to begin to erode over forty miles south of the dredging. Prior to the

dredging, the shoreline was accreting tens of feet per year, so for the shorelines to erode in some areas hundreds of feet the offshore had to experience enormous losses in its seabed sediment resources. The effect of the dredging was to bring about a steepened and deepened offshore profile, allowing greater storm energies to strike onshore. That the dredging took place 14 miles from the coast and yet brought about so much erosion of the coast 40 miles to the south is highly significant.



Map 2
Part of East Anglian Coast showing dredge areas
Cross-hatched: active dredge area. Dotted outline: licence area
(Traced from the Crown Estate's Active Dredge Areas for East Coast Region, 31/01/06)

Two recent papers show how this may happen. In one[6], the effect of dredging on sand waves is examined. Sand waves are sand dunes on the sea bed, which are moved gradually by the sea's energies in much the same way as dunes on land are moved by the wind. Under stable conditions this movement may be slow and fairly predictable, but under large-scale offshore sand extraction a previously stable seabed may become morphodynamically active, forming a phenomenon called a linear sand packet. I won't attempt to explain what this underwater demon is, except that – ominously – it can usurp the sea's energies, enabling itself to

expand and migrate. That such an event might occur in the area from which Sizewell's tides and waves emanate, bodes ill for the stability of the Sizewell beach.

The other paper[7] describes a variety of anthropogenic activities on coastlines: navigation and shore protection works, sand and gravel extraction and beach nourishment. The effects of these are described thus: "Although many of these activities have improved the quality of [human] life, they also have unintended effects on the coast … altering sediment transport processes, and accelerating sediment losses to the offshore". That could mean losses to such things as the Sizewell and Dunwich sandbanks. Note too the mention of navigation works. How sad if the Great Yarmouth Outer Harbour construction brought about the destabilisation of the Sizewell stations.

One might suppose that the Crown Estate would carefully monitor the effect of the dredging it licenses, to ensure that it is not countenancing the erosion of the Crown's own precious Estate. And so it ought, but the sad fact is that it does not. For the dredging area 430 (East of Southwold), it is true that a full bathymetric survey and wave model was conducted for the original Environmental Impact Assessment, prior to the granting of the first dredging licence. Common sense would dictate that, after the first dredging contract was completed and before a second or third licence were issued, a new bathymetric survey should have been carried out to check for any changes to the profiles of the coastline since the original licence was granted. However, the agents for the dredging company have argued that "a full record of changes to the profiles of the coastline since the original licence was granted is NOT a requirement of the current Government View Procedure and therefore will not be included in the scope of the IEA".[8]

Remarkably, it seems this gaping hole in the licensing requirements may still remain unresolved. Even more remarkably, current practice seems to fly in the face of the following high-sounding utterances of DEFRA:
"Human activities and demands that we place on the marine environment
1.16 Past management of our oceans and seas has often been fragmented, sectorally-based and driven by short-term economic gain through policies such as yield maximisation. Action was taken only when scientific evidence proved beyond reasonable doubt that there was a problem – with the effect that it was often too late to devise and implement a solution. And stakeholders were not always properly involved in policy-making and implementation. …..Where scientific evidence is not conclusive, we need sensibly to apply the precautionary principle. This means, for example, taking preventive measures where there are reasonable grounds for concern that direct or indirect inputs to the marine environment may harm human health, living resources and marine ecosystems or other legitimate uses of the sea, even when there is no conclusive evidence of a causal relationship between the inputs and the outputs."[9]

One might suppose from this statement, made in 2002, that the current licensing arrangements would require dredging companies to carry out every appropriate survey, before and after their work, to ensure that harm was not being done to the seabed and its animate and inanimate contents. Unfortunately, this is far from the case. Such surveys and such scientific research would cost money, so they are not engaged in readily and the authorities are reluctant to antagonise the dredging industry by imposing such requirements. The dredging companies therefore habitually trot out the disingenuous quip: "There is no evidence to prove that dredging is harmful", and continue to strip-mine the seabed of its resources, regardless of consequences. And the Crown Estate, which made £14 million the year before last out of dredging licences, is in no hurry to alter its own practices.

Even when such badly needed research is carried out, a 2005 paper entitled "Flawed studies assess dredge-and-fill programs to protect coastlines"[10] reports that, despite expensive, multidecadal monitoring, the majority of studies of ecological impacts of beach nourishment (with material, that is, obtained from dredging) are scientifically inadequate and suffer from critical flaws, improper analyses and unjustified interpretations. The authors conclude that reform of agency practices is urgently needed as evidence of the cumulative risk of severe ecological impacts grows. Their survey discovered that monitoring is typically conducted by project promoters with no independent peer review.

The Eurosion Project is contracted by the European Commission to a consortium led by the Dutch National Institute for Coastal and Marine Management (RIKZ) for the period 2002-2004. They are probably the world topmost authority on the problems of coastal erosion and their 2003 report[11] provides a revised draft outline of the policy recommendations for coastal erosion and coastal flood risk management. This records that erosion is exacerbated by human activities which are implemented in some cases hundreds of kilometres away from their zone of impact.

"This has proved to be particularly the case for aggregate extraction. Dredging of river and seabed for constructional purposes (e.g. sand and gravel mining) removes an important amount of sediments. This creates a sediment starvation which is in certain circumstances compensated by (re)activation erosion processes along the shore areas. This has proved to be the case in a significant number of cases including Cove do Vapor (Portugal), the Western Scheldt estuary (Netherlands and Belgium), Donegal (Ireland), Cavado (Portugal), and North Norfolk (UK). In some cases, dredging activities, by modifying the water depth in the near-shore area, induce wave refraction which in turn modifies the long-shore and cross-shore sediment transport patterns".

Conclusion

The sandbanks that protect Sizewell beach from the effects of climate change today may not be here tomorrow, because the stability of the nearshore may be threatened by extensive and continuing offshore dredging. No confidence therefore may be placed in the long term safety from the sea of the Sizewell power station site. As both Sizewell A and B were constructed of aggregate dredged from off Great Yarmouth, there may be poetic justice in the sea claiming back its own. Yet prudence dictates that the precautionary principle is observed, until more reliable evidence is obtained to decide one way or another about the longer term future of the site. These uncertainties must also be taken into account in decisions for interim storage of existing nuclear waste.

Let me finish by repeating that, as far as the Marinetza group is concerned, the developing picture presented here is work in progress, and I am their merely their unofficial but well-meaning raconteur, running beside them, trying to keep up. You, the members of the Sizewell Stakeholder Group, will greatly oblige if you will act as the peer reviewers of this effort. I submit it, on behalf of those local stakeholders the Shut Down Sizewell Campaign, for your information and comment.

Peter Lanyon,
Vice-Chairman, Shut Down Sizewell Campaign August 2007

Endnotes

1 Marinet DVD, "Marine Aggregate Dredging", 2006.
2 www.marinet.org.uk
3 Marinet DVD *ibid*
4 From a research abstract for the Minerals Management Service, 2000, quoted in Byrne J, "Beach Nourishment: A Starvation Diet", *Raleigh (North Carolina) Metro Magazine*, July 2004
5 Final Feasibility Report and Environmental Impact Statement – 81240, US Army Corps of Engineers, Canaveral Harbour Feasibility Study, August 1990
6 Roos CR et alia, "Linear Evolution of Sand Wave Packets and Relevance to Offshore Sand Extraction", Proceedings of the 29th. International Conference, Coastal Engineering, 2004
7 Magoon OT *et alia*, "Economic Impacts of Anthropogenic Activities on Coastlines of the United States", *Coastal Engineering*, 2004
8 Correspondence from Marinet and NSAG to Metoc plc, 2 April 2007
9 DEFRA, 'Safeguarding our Seas, a Strategy for the Conservation and Sustainable Development of our Marine Environment', 2002
10 Peterson CH and Bishop MJ, "Flawed studies assess dredge-and-fill programs to protect coastlines", *BioScience*, October 2005
11 "Living with Coastal Erosion - EUROSION Policy - Recommendations December 2003"..