Deadline D10 response, The Applicant's later assessment of the role of the Sizewell-Dunwich banks.

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This paper is a response to the Applicant's changing narrative regarding the importance of the Sizewell-Dunwich banks.

My papers REP5-253 and REP7-219 cover the changing approach of the Applicant to the role of the Sizewell-Dunwich banks which can be briefly summarised as 'critical importance' pre-DCO, 'incuriosity' in the DCO FRA to 'dismissal' in the initial DCO Q&A process. The Applicant has now moved a stage further in late DCO Q&A by claiming that the loss of the Dunwich bank would be in fact, *beneficial* to Sizewell C.

The Applicant's current position:

1. The Applicant considers that a fixed, immutable offshore bathymetry, which includes the Sizewell-Dunwich banks, results in a *higher* inshore wave climate and hence represents '*conservative' (precautionary) modelling for all scenarios and epochs.*
 (This was made clear by the Applicant at ISH11 in response to enquiries from my papers and confirmed in ExQ2 REP7-052 epage 130)

2. EDF's late DCO assessment is that the loss of the Dunwich bank would *benefit* Sizewell by *reducing* erosion and is made clear by the Applicant in ExQ3:

   "If Dunwich Bank were lost or substantially reduced (in extent or elevation) there is a greater potential for erosion of the shoreline around Dunwich and, importantly, the Minsmere – Dunwich Cliffs, resulting in a local increase in the supply of sand and pebbles (i.e., beach shingle) from the cliffs. This sediment would move south and could reduce erosion rates. Reduced erosion rates could tend to increase resistance to flooding over the Minsmere and Sizewell frontages." Responses to the ExA's Third Written Questions (ExQ3) Volume 1 - SZC Co. Responses epage 68.

   The Applicant's position is now that *the loss of Dunwich Bank is not expected to worsen impacts on Sizewell C—it is likely to lessen them.*

This 'particular' appraisal, however, is tending to overlook historical precedent, empirical evidence and accredited academic work; mainly the accredited academic work of the Applicant itself in BEEMS. These are listed as follows:

1.1 EDF, BEEMS TR311 2.3.2.2.3 "*Sizewell nearshore waves… are substantially lowered before arriving at the shore due to dissipation across the GSB's three positive relief features; the Sizewell – Dunwich Bank and the two longshore bars. Coastal sandbanks and longshore bars dissipate wave energy"*

- EDF, BEEMS TR058 p.45 *"…1) the inner longshore bar which will cause wave breaking during almost all wave conditions; 2) the deeper outer longshore bar which will cause wave breaking during moderate and large storms; and 3) the Sizewell bank, which will cause only the largest waves (e.g., Figure 17) to break. In large storms all three will cause breaking and progressively lower the wave energy propagating toward the shoreline. Together they are likely to be a key factor explaining the comparative stability of Sizewell shorelines."*

1.2 EDF: Sizewell C Scoping Report, April 2014, Page, 150. "*The Sizewell Dunwich bank forms an integral component of the shore defence and provides stability for the Sizewell coastal system".*

1.3 EDF BEEMS TR139, Page 5 "…*The size, depth and position of this 'saddle' [of the Dunwich bank] is therefore* ***of critical importance*** *with regard to the risk of erosion and flooding between the proposed Sizewell 'C' site and Minsmere Sluice."*

1.4 EDF: BEEMS TR500 Page 11. "*With continued lowering and reduction in the northern extent of Dunwich Bank, the section of shoreline subject to the impacts of storm waves from the northeast sector would be expected to migrate south accordingly."* i.e., towards Sizewell C.

1.5 EDF: BEEMS TR058, Page 45. *"**Rapid changes in bank form are thought to be linked to downstream bank-to-bank interactions in a sand bank complex** (Dolphin et al., 2007 and Thurston et al., 2009). **This model may have application at Sizewell-Dunwich [bank] as it is feasible that changes at Dunwich bank could have knock-on effects at Sizewell.***

1.6 EDF's BEEMS TR139, explains that even moderate storms will produce notable erosion and flooding of the low-lying areas faced by the proposed location for Sizewell C:

"Very extreme tide plus surge conditions, or tide plus surge plus waves, are not necessary to cause significant erosion and flooding of low-lying areas. ***Studies to the north [the South Minsmere Levels] and south of Sizewell have shown that even moderate storms, with estimated return periods of 1 in 5 to 1 in 10 years, have caused significant flooding*** *as a result of breaching of shingle ridges, narrow dunes and earth embankments (e.g. Pye & Blott, 2006, 2009). The outer defence at the northern end of the Minsmere frontage was breached, and the inner defence partially overtopped, during moderate storms in 2006 and 2007.* ***These events also caused significant dune erosion between Sizewell B and Minsmere Sluice but*** *had relatively little effect on the beach and dunes in front of the 'A' and 'B' power stations**. The main reason for this long-shore variation in storm susceptibility appears to be the morphology of the Sizewell-Dunwich Bank. Waves from the NNE are refracted across the northern end of Dunwich Bank and focused towards the shore at the northern end of the Minsmere frontage. Refracted north-easterly waves also pass through the saddle between Dunwich Bank and Sizewell Bank. The size, depth and position of this 'saddle' is therefore of critical importance with regard to the risk of erosion and flooding between the proposed Sizewell 'C' site and Minsmere Sluice."***

1.7 The loss of the Dunwich bank would reasonably result in the depletion and loss of the nearshore, longshore bars, themselves a part of the 'soft and erodible' coast recently accreted after 1836.
EDF in TR545 (REP5-149) Page 25 *"… in reality storm conditions will alter the inner and outer longshore bars along the Sizewell frontage".*
The loss of the nearshore longshore bars would then make the coastline vulnerable to accelerated erosion for all storm strengths (See 1.1 above).

Therefore, it is reasonable to conclude that the loss of the Dunwich bank is likely to result in a less felicitous outcome for the Sizewell and Minsmere shoreline than is now being presented at this somewhat late stage by the Applicant.

To accept the Applicant's view that the loss of the Dunwich bank would *benefit* Sizewell by *reducing* erosional impacts it would seemingly be necessary to accept the following:

i. Ignore, or declare invalid, points 1.1 to 1.7 above even though these points are the Applicant's own research pre-DCO and conform to independent academic research.

ii. Accept that the Applicant's modelling is relying on immutable, unchanging offshore geomorphology—the Sizewell-Dunwich banks and the inner and outer longshore bars— as permanent wave relief features even though it is indisputable that the offshore banks are changing now, will keep changing, that the scale and timing of future changes are unknowable, and those change will almost certainly affect the inner bars. EDF: BEEMS TR500, Page 32. *"Dunwich Bank exhibited large-scale erosion across its northern third."* (Between 2007-2017 – no data appears to be available beyond 2017).

iii. Accept that the FRA narrative in the DCO describing the modelling methodology and its use of the Sizewell Dunwich banks as permanent features for all scenarios and epochs was clearly explained.

iv. Accept that the inshore wave climate is greater with the *presence* of the banks for all scenarios and epochs.

v. Accept that if the Dunwich bank were lost or removed it would *benefit* the safety and security of Sizewell C by *reducing* impacts.

vi. Accept that loss of the Dunwich bank would primarily release sediment from Dunwich Minsmere cliffs that would settle at Sizewell. See the map on Page 5 of this document.

vii. Accept that the period of acute erosion that ended in 1836 and became a period of accretion occurred for some other reason than the development of the Sizewell-Dunwich banks northwards. See comment below.

I fail to understand how points (i) to (vii) above can be accepted. They are each untenable in my view.

Reference to point (iv) above:

- The Applicant validates the unorthodox approach of basing its modelling on a higher inshore wave climate with the Sizewell-Dunwich banks in situ— an approach that opposes academic and empirical studies including the Applicant's own work pre-DCO (see Point 1.1, page 1)— by reference to BEEMS TR319. However, BEEMS TR319, even if we were to accept it, does not provide this validation for all scenarios and epochs. See TR319 Page 55.

Reference to point (vii) above:

The Applicant has suggested in ExQ3 that the period of erosion ended coincident with the building of the Minsmere sluice and that the drainage of the area was different.
I have responded to this in my document REP8-248 and in summary:

- There is no documentary evidence that the drainage of the Sizewell belts occurred to the south at Sizewell Gap and therefore the wetlands to the north do not appear to have a clear link with the acute erosion experienced along the shoreline at Sizewell itself.

- The phase of severe erosion appears to have ended *prior to the building of the sluice* in 1810-30 as Hodskinson's map of 1783 indicates. Minsmere sluice may have aided the accretion period after 1836 but in my view the end of the acute erosion period and the start of the accretion period coincides, as stated, with the development of the Sizewell Dunwich banks as is shown in my paper REP2-393.

- There is, therefore, much merit in emphasising, not just the erosion period, but *each of the three main episodes of coastal change* that have occurred at Sizewell from 1736 to the present day; in my view a study that offers empirical validation of the indispensable role of the Sizewell-Dunwich banks to shoreline stability and security between Sizewell and Minsmere. This is covered in Section 2 of my paper REP2-393 which includes shoreline change contours.

It is also important to note that the sediment deposition from northern cliff erosion relied upon by the Applicant in the opening paragraph is not seemingly consistent with its own research:

- BEEMS TR223 Table 12 ***"The last 2 to 3 decades of strong erosion at Dunwich were not matched by ongoing accretion in the south"*** BEEMS TR223 Table 12, shows net erosion of the Sizewell C foreshore since 1993.

- Where then has the eroded material since 1993 deposited? It has not seemingly arrived at Sizewell.

This gives rise to important points:

- There is no basis to assume resilience of the Dunwich bank—it has no hard geology. This also applies to significant areas of the Sizewell bank:

  EDF: DCO Coastal Geomorphology Appendix 20A –Page 135. *"…the Dunwich Bank has no inherited stabilising hard geology (i.e., no headland no underpinning crag).*

- In my view there is no plausible mechanism that could justify the assumption for the maintenance and preservation of the Dunwich bank over the next two 100-year episodes of coastal processes, the uncertainties of which can only be increased by climate change sea-level rise and storm level change.

  - The Chatham House policy institute has just released a climate change study that makes extraordinary reading and challenges what is considered worst-case (conservative, precautionary) modelling. This report is available on the Planning Inspectorate website REP8-328 or at: https://www.chathamhouse.org/sites/default/files/2021-09/2021-09-14-climate-change-risk-assessment-quiggin-et-al.pdf

- The Environment Agency in a meeting on the 4/10/21, confirmed, as far as I understand it, its opinion of the 'critical importance of the banks'.

Supported by the evidence stated above in points 1.1 to 1.6, I disagree then with EDF's approach as defined in the opening paragraph. Should the Dunwich bank be lost, the inshore wave climate will increase. This will result almost certainly in the depletion of the nearshore, longshore bars, resulting in areas of the Sizewell-Minsmere shoreline now being vulnerable to all storm levels, low, moderate and high, from the North-North-east, Northeast and Easterly—*the directions that are responsible for the significant and sudden erosive activity on this stretch of coastline.*

Erosional stress and loss of wave relief features could overwhelm a limited area CPMMP policy, flood the Sizewell/Minsmere wetlands immediately to the north of Sizewell C both raising average water levels and reducing their effectiveness in wave mitigation. The loss of the Dunwich bank would also almost certainly have a knock-on effect at the Sizewell bank as explained by the Applicant in point 1.5 above prior to the DCO.

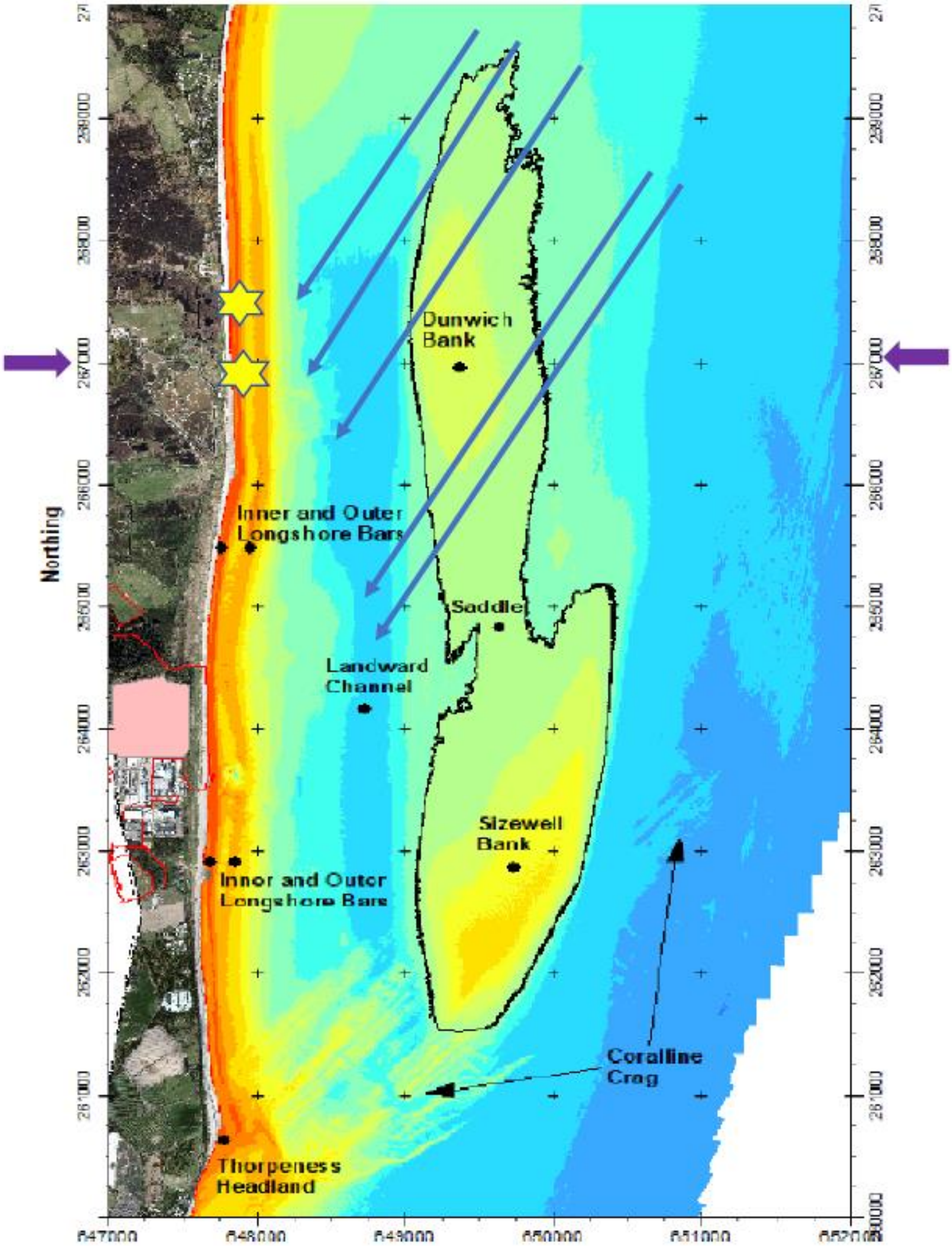
It is therefore clear that for a nuclear plant with a lifespan that extends to the end of the twenty second century it would be reasonable and correct for conservative, precautionary modelling of flood risk and shoreline change to assume the possibility of significant depletion or loss of at least the Dunwich bank and nearshore bars, particularly as both wave relief offshore features are outside the control of human agency.

In my view, the Applicant's 'conservative, precautionary modelling' *including a shoreline change assessment from Sizewell to at least Minsmere sluice,* should be considering these scenarios.

Papers REP2-393, REP5-253 and Summary paper REP7-219 cover these areas in more detail.
Paper REP8-248 is a response to EDF's later stage Q&A assessments of the Sizewell-Dunwich banks.
Paper REP7-220 covers TR544/TR545 modelling limitations.

REP8-328 is the Chatham House Climate Change report.

The chart below illustrates the Sizewell Dunwich banks and the longshore bars—the offshore wave energy relief features:



<u>The Sizewell-Dunwich Banks. The purple arrows mark 26700N— to the north of which the crest height of Dunwich bank is lowering.</u> Chart base format from BEEMS Technical Report TR500 'Sizewell-Dunwich Bank Morphology and Variability'. Page 14. Markup my addition.

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- Dunwich Cliffs are at the very Northern end of the Dunwich bank beyond 269000. Minsmere Cliffs approximately 268000, North of the yellow stars.

- The orange and red lines show the 'inner and outer' nearshore, longshore bars. The DCO provided detailed bathymetry of the inner and outer Longshore bars and not the Sizewell-Dunwich banks.

- The pink square shows the proposed location of Sizewell C.

- ***"Records over the last decade show…Dunwich Bank exhibited greater variability in both its morphology and position with erosion north of 267000N,*** [shown by the purple arrows] ***resulting in bank lowering of -0.5 to -1.5 m"*** DCO: Geomorphology Appendix 20A, op cit., Page 21. BEEMS Technical Report TR500).

- The five blue arrows show the direction of the most significant storm waves from the North/North-East— ***the largest and longest waves arrive from the N-NE sector. [1:100 wave heights 7.3m-7.8m***]. Waves from the NNE, NE and East are responsible for sudden and severe erosion on this stretch of coastline and are the most important to consider by far. The loss of the just the northern section of the bank could allow unbroken storm waves from these directions to break on the foreshore and increase water volumes in the South Minsmere levels in flood conditions.

- There has been net erosion of the foreshore in the area of the proposed Sizewell C since 1993 according to BEEMS Table 2. See BEEMS TR223 op cit., Page 119 and Table 12 on page 115.

- The two yellow stars show the locations of breaches - 267400 15/12/03 and 14/2/05 and 266900 14/2/05. *"This 200 m section is the most vulnerable stretch of coastline between Dunwich and Sizewell, and represents the most likely location of a major breach occurring during a future storm surge."* Pye and Blott 2005, Coastal evolution RSPB op. cit., page 154 of 160. Page 28/160