Summary of TR311 Synthesis Report 1 June 2021

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Sizewell coast in geomorphological context

The 70 km-long Suffolk coast between Harwich and Lowestoft consists of alongshore alternations of topographic highs and lows (Burningham and French, 2018). The highs consist of headlands of soft, erodible Quaternary sediments where cliffs are fronted by gravel and sand beaches. There are local outcrops of consolidated pre-Quaternary lithologies (e.g. Coralline Crag). The lows comprise wetlands impounded by mixed gravel and sand barriers. Both types of coast exhibit distinctive behaviour. The cliffs exhibit historic retreat via progressive (and likely episodic) erosion, punctuated by periods when sediment supply enables frontal beach accretion and shoreline stability or advance. The barriers retreat through erosion and landward rollover (Pye and Blott, 2006) but may also experience periods of vertical aggradation and/or seaward accretion. Alternations between shoreline retreat, stability and advance at any given location depend partly on the rate of sediment supply from alongshore and from cliff erosion but are also influenced by longshore gradients in wave energy, and the surrounding geomorphology and underlying geological framework. Sites of progressive accumulation over several decades and longer are marked by nesses. The cliff and barrier systems are linked inasmuch as the topographic highs provide anchors for development of the barrier planforms and yield sediment for beach and barrier construction. Furthermore, changes in one part of the system affect areas downdrift. Human intervention in the coastal landscape has involved construction of artificial headlands in the form of jetties and sea defences that stabilise cliffs and reduce/eliminate the rate of sediment input from cliff sources.

Nearshore sandbanks form in the lee of headlands and appear to act both as long-term sediment sinks and as modifiers of incident wave conditions. As such, they from an additional component of the coastal system. They interact with the other onshore components via complex and, as yet poorly understood, feedback relationships. At historic timescales, losses of sediment from onshore have been found to be broadly equivalent to accumulation rates on offshore banks, although a straightforward erosion-accumulation relationship between the two was regarded as unlikely (Carr, 1979).

Main shortcomings in the coastal geomorphology and hydrodynamics study

The construction of the proposed Sizewell C power station and its associated infrastructure has the potential to significantly alter coastal behaviour in both the short and long term and is potentially at risk from coastal processes and shoreline change. This commentary on the coastal geomorphology and hydrodynamics element of the Environmental Statement (TR311 and supporting documents) identifies important errors and omissions in methodology, deductions and content in the assessment of past and future shoreline change. Chief among these are the following:

- *Inadequate future timescale*. Consideration of shoreline change (and mitigation activities) in this report does not extend beyond 2080 whereas the site requires protection until 100 years post-decommissioning (ca. 2200). Since the proposed work is intended as a permanent intervention, it will have implications for the coast in perpetuity;

- *Insufficient spatial scale.* The entire 70 km-long Suffolk coast and adjacent seabed comprises a single large-scale coastal system within which geomorphic changes are intimately interlinked. The geomorphology of this system operates spatially from deep water (far seaward of the Dunwich Banks) involving wave shoaling (energy loss) in water depths down to 30m, to the back beach and beyond. The study only considers the 3 km coastal stretch centred on the site of the proposed Sizewell C development. Although this has been argued to be a discrete cell, it is geomorphologically linked to areas both north and south that form part of the same larger coastal system; changes in the Sizewell area have the potential to affect adjacent areas and vice versa. Any change in morphology of the anchoring headland at Thorpeness, for example, would have large implications for the shoreline planform. This spatial restriction flies in the face of current dogma regarding large scale coastal behaviour and system dynamics. Linked to this is at best a lack of acknowledgement (and at worst a denial) of the long-range impacts (10s of km at century timescales) of both soft and hard coastal defences;

- *Inadequate consideration of the dynamics of nearshore banks*. Significant surface morphological changes have been documented on adjacent banks and their relationship to shoreline behaviour has been shown to be complex. Their decadal scale behaviour and longer-term response to sea-level rise are crucial to predicting future shoreline configuration but these have not been considered.

- *No consideration of complex system behaviour* - i.e. beyond straightforward process-response geomorphology. Contemporary geomorphology recognises that system linkages and resulting feedbacks can lead to “emergent behaviour” unrelated to immediate forcing mechanisms. This possibility is not considered;

- *Use of false assumptions underlying the Expert Geomorphological Analysis*. These relate to, *inter alia*, stability of the offshore Dunwich and Sizewell Banks, consistency of inshore wave climate, limited alongshore impact of the defence structures, explicit exclusion from consideration of high-magnitude/low frequency events and assumption of similar future shoreline sinuosity to the present.

These and other issues are described in the main report following the order in which they arise in BEEMS Technical Report TR311.