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Saltmarsh restoration through construction of sedimentation fields: controls on sediment delivery and hydrodynamics

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Saltmarshes provide important ecosystem services including habitat for wading and migratory birds, nursery grounds for commercial fish species, carbon storage, and flood defence through wave attenuation. Stimulating saltmarsh growth may improve the local level of flood protection, reducing the need for costly engineering works to sea walls and defences, whilst also enhancing the provision of other services. This is particularly important at locations where there is a need to restore and compensate for the loss of saltmarsh due to erosion caused by sea level rise, land claim, and a reduction in sediment supply. One method of encouraging marsh growth is through the construction of sedimentation fields or polders, typically out of brushwood fencing, to reduce current velocities and wave heights with the aim of increasing sedimentation rates. However, little is known of the impact polders have on the timing and rate of sediment delivery, or of saltmarsh response to changes in hydrodynamics. This is particularly the case for relatively exposed sites with a large tidal range, with most sedimentation fields constructed in sheltered locations with micro- to meso-tidal ranges such as the Wadden Sea.

Here, we present results from a study of a macro-tidal sedimentation field at Rumney Great Wharf, Severn Estuary, Wales, which was constructed between 1999 and 2005. Field investigations, conducted during May to June and November to December 2023, involved the deployment of sediment traps and measurements of the current velocity and suspended sediment concentration to assess spatial and temporal variations in sediment delivery. Results indicate increased sediment availability in areas of lower elevation, with sediment trap data suggesting a difference of up to 3.7 g / cm² / day due to elevation differences. Sediment cores were also collected and analysed from both inside and outside of the polders to assess the physical functioning of the marsh that has formed following polder construction.

Findings provide insights into the suitability of sedimentation fields as a form of saltmarsh restoration and coastal flood defence, which are discussed in terms of mitigating against sea level rise and increased storm magnitude and frequency. This study also provides an evaluation of the potential for wider implementation of sedimentation fields as part of shoreline management strategies. It is recommended that further assessment is conducted to evaluate the influence of fence design, including length, height, and orientation, on site evolution to maximise provision of

flood defence and wider ecosystem service delivery from these schemes.