Jacobs

Unit C Initial Assessment
Non-technical summary report on findings

Environment Agency

Unit C Initial Assessment
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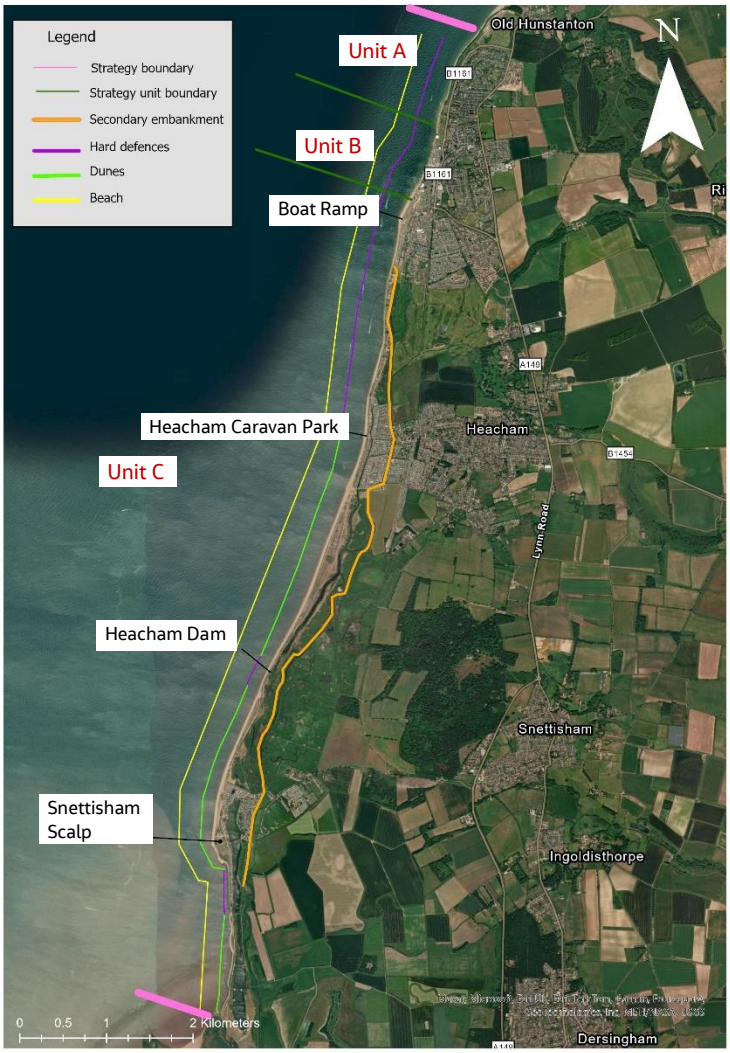
Introduction

The Wash East Coastal Management Strategy (WECMS), published in 2015, identified the preferred strategic coastal management approach for the frontage between Hunstanton Cliffs and Wolferton Creek on the Norfolk coast of The Wash. For management purposes, WECMS defined three management units. Units A and B covered the Hunstanton frontages to the north which are managed by the Borough Council of King's Lynn & West Norfolk (BCKLWN). Unit C, managed by the Environment Agency (EA), covers the frontages from Hunstanton Power Boat Ramp onwards to the south.

The area covered by this initial assessment is a section of the shoreline within Unit C between the end of the seawall at Heacham down to Snettisham Scalp (the Scalp). Flood risk has been managed here through a combination of hard defences (seawalls) and soft defences (sand/ shingle ridge). The beach ridge has been maintained through annual recycling of sand and shingle recovered from Snettisham Scalp. Beach recharge has also been carried out twice in the past, with offshore dredged material placed onto the foreshore.



WECMS had confirmed this approach to flood risk management to be sustainable from a social, environmental and economic perspective, but only as long as those key requirements continued to be met. A need to change that approach could therefore be triggered by one of three developments:

- if funding (from any source) for continued defence management becomes insufficient,
- if the environmental impacts of defence management become unacceptable, or
- if the frequency of flood evacuations becomes unacceptable.

To date, the Precautionary Evacuation Notice (PEN) has been issued once since the WECMS was produced. It is unlikely that this is considered unacceptable by any stakeholders.

In the most recent report on the 5 yearly cycle of environmental monitoring (2021-2022) concerns are raised over the potential future impacts to the natural flora and fauna of the dune and Scalp. The need to adapt beach management work to accommodate local-regional environmental change has become ever clearer over time. However, this latest monitoring also confirms that there is no direct evidence of any significant direct ecological impacts from the annual beach recycling activities yet.

The focus of this assessment therefore is whether the first (financial) condition might now be at risk of being reached, and in that context, whether recent changes to the physical environment have changed the necessity and requirements for any associated operations.

Basis for this assessment

The management activities identified to deliver the preferred option in WECMS along this section of shoreline were supported by a Business Case covering a 15-year period to 2031 (EA, 2016). This included beach recycling on an annual basis and a single small additional beach recharge at some point between 2023 and 2030. There has been some concern over the availability of sufficient beach material from Snettisham Scalp each year and, anecdotally, recycled beach material appears to be rapidly lost from the points of placement. These observations may indicate that the proposed recharge needs to be implemented.

Recent quotes for implementing the "mini-recharge" now indicate that this will cost three to four times the cost estimated in the 2016 Business Case and would now fall outside of the overall financial approval for the project of £5.4 million to cover both the 15 years of recycling and the recharge. A new appraisal process would need to be undertaken and initial assessments indicate that the necessary funding would not be eligible through the Flood Defence Grant in Aid[1] process.

Consequently, questions arise over how to proceed, whether changes to existing practices may now need to be considered if a beach recharge is not affordable, and whether a recharge is needed. To support the answers to these questions, the behaviour of the beach needs to be considered, , perceptions over the rate of change in recent years, as well as the approach to, and effectiveness of, the current recycling operations as set out in the Beach Management Manual (BMM)[2].

One further issue that required consideration is the landward migration of sand encroaching upon shorefront properties at the south end of Heacham. This movement was not accounted for in WECMS nor any management actions stated in the Business Case or BMM.

Characteristics and current risk management practice

Frontages within Unit C are referenced by a series of zones for monitoring purposes and identifying management actions, each having slightly different characteristics. These are shown in the following figure, together with a brief description of how risk is currently managed within each.

[1] This funding is obtained through government and uses nationally consistent Treasury Green Book Guidance

[2] The Beach Management Manual details the operations by which flood risk is currently managed along this coast. It describes the beach profile to be provided by recycling activities, together with appropriate levels of monitoring of the beach and ecology.


N
Zones 1-4: Power Boat Ramp to Jubilee Road
Concrete seawall built along the former dune line, now gone. EA maintains this frontage under its permissive powers. Annual recycling undertaken here in the past, but not required in recent years unless extreme exposure of sheet piling at defence toe.
Zone 5: Heacham Jubilee Road to South Beach Road
Wider and higher beach than that to the north, with a 'narrow' upper ridge/dune at the top. Cliffing of the ridge occurs from the northern end towards the centre; this is addressed through placement of recycled beach material on an annual basis.
Zones 6/7: South Beach Road to 100m south of the last holiday home
Mostly sand dunes behind a wide beach. Main issues are migration of dunes onto properties and local lowering of the dunes by some property owners to open up the view to the sea. Zones 5, 6 and 7 received over half of the material during the last recharge in2005. Recycling however rarely occurs.
Secondary embankment
Behind these frontages, a grassed earth embankment extends from Zone 2 to Zone 13 (and further beyond). This forms a secondary defence against flood risk to land and property landward of this structure. The EA maintains this under its permissive powers.
1
2
3
4
5
67
8
0 0.25 0.5 1 Km
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
N
Zone 8a
Wide upper beach and wide dune system behind. Little sign of any risk of breach along this zone and recycling has not been required.
Zone 9 (plus Zones 8b and 10a)
Heacham Dam (large embankment armoured with concrete block mattress) was possibly constructed over a previous timber structure at a former low spot in the dunes where the now re-routed river may have previously discharged.
This protrudes some distance seaward of the natural dune line either side, with very little sand or shingle able to stabilise and form a beach in front of it. This contributes to erosion of the natural dunes either side; this has become the main focus of recycling operations in recent years to prevent outflanking and breaching. Significant cliffing occurs, in part due to the height of the material placed during recycling which is subsequently cut back by wave action.
Zone 10b
Natural frontage, although the dunes are low and flat. As there is little evidence of cliffing, recycling is not currently required, although it benefits from some of the updrift operations (placement of material Zones 8b, 9 and 10a).
Zone 11: North of beach access at Shepherd's Port
High and narrow shingle beach ridge approx. 400m fronting the beach car park, largely unvegetated (except on its landward side). It protrudes seaward of what might now be the natural shore alignment. As extensive cliffing occurs, this zone receives beach recycling on an annual basis.
Zone 13: Snettisham Scalp
Beach material typically accumulates as part of a sand and shingle spit formation and is the source of the annual beach recycling. Some concerns in recent years whether sufficient material is reaching this area to be removed and thus enable the annual recycling to take place.
Zone 12: Shepherd's Port
Lower but wide beach, backshore and low dunes. This zone has not required recycling other than one occasion in the past decade, although it likely benefits from material placed updrift in Zone11. Zones 11 and 12 received a sizeable portion of the 2005 beach recharge.
67
8
Zone 8a
Zone 8b
9
Zone 10a
10
Zone 10b
11
12
13
14
0 0.25 0.5 1 Km
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

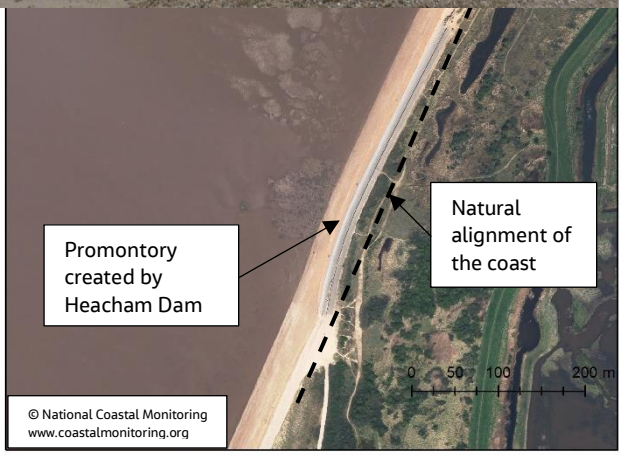
Analysis of recent beach change

Measured beach profile, waves and surge data from the regional monitoring programme has been used to analyse how the beach has changed since 2019, when beach losses have reportedly increased. These changes were compared to variations observed between 2014 and 2019 (i.e. since the updates on the BMM in 2014).

Overall, the analysis found that beach profiles and volumes are not significantly different since 2019 than they were in previous years for most of frontages. Whilst beaches in zones 5 and 11 have seen some reduction in volume since 2019, this was less than was actually observed between 2014 and 2018.

The process of beach material movement remains similar, but recycled material is moving off the upper beach ridge (where it is placed) sooner in places. This material is not being 'lost' offshore, but is being drawn down the beach slope, showing that cross-shore[3] sediment transport (as well as longshore[4] transport) plays an important role in shaping the beaches along this frontage. This has always been so, but more recently this appears to occur faster due to the coincidental incidence of larger storms events soon after beach recycling operations. These recent changes therefore seem to be a change in general timing between material placement and subsequent movement, but not a change in terms of sediment transport processes or beach volume along the shoreline. The period each year during which these works can take place is restricted so as to limit the impact on environmentally designated species and habitats. Therefore, changing the timings of the work is not as simple as it might seem.

The 2014 BMM identified minimum beach profile width, elevation and slope criteria. Beach monitoring profiles indicate that achieving these criteria has not been a recent issue as beach profiles are already exceeding those requirements in most locations before recycling is carried out. Works to address cliffing in Zones 5 and 11 will have helped maintain the ridge, although this has not necessarily been essential to achieve those minimum criteria. Most intensive activity now occurs alongside Heacham Dam (Zones 8b, 9 and 10a), but as this legacy construction now creates a promontory from the adjacent shoreline it will be difficult for any additional material to build up and stabilise seaward of the natural alignment. Although short in length, Heacham Dam illustrates how hard structures can adversely impact upon the wider coastline by interrupting coastal processes and the naturally sustaining adjustments that will occur in the beach profile. By preventing the coastline to react to natural movement, the result is ever increasing maintenance requirements with associated financial and environmental consequences. Overall, the beach currently appears to be meeting the performance expectations of WECMS. Although WECMS did suggest that stopping recycling could result in the rapid failure of the shingle ridge within 3 to 5 years, further assessment of recent data



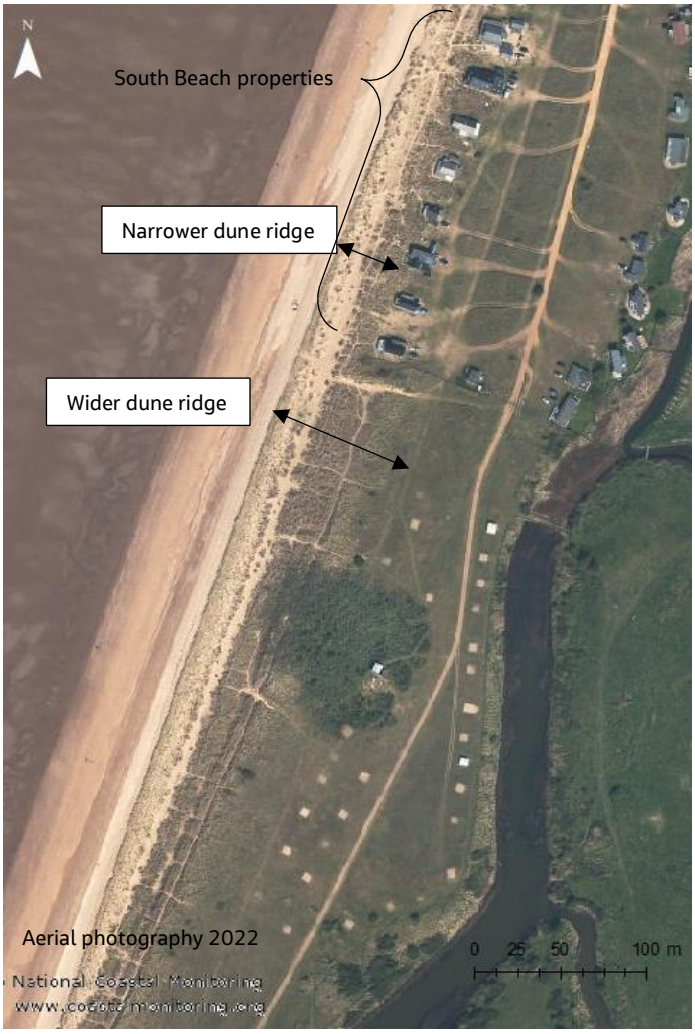
[3] Cross-shore sediment transport refers to beach material moving up and down the beach.

[4] Longshore sediment transport refers to beach material moving along the coast.

would now be warranted to determine if this remains an accurate reflection of present risk or if that risk is now lower.

The amount of beach material reaching Snettisham Scalp seems to be constant, recovering from previous sediment removal and have slightly increasing over time. This reinforces the fact that longshore drift is still effective in transporting the recycled material southwards. The shape of material deposited at the Scalp has however changed, making the annual extraction of sand and shingle more problematic. Some material now has to be skimmed off the mudflat area on the lower beach and is likely to be a finer sized grading which could result in increased mobility of the recycled material or lead to more cliffing.

Unlike most other areas, in Zones 6 and 7 sand is accumulating and encroaching upon shorefront properties that have been built within the natural footprint of the dunes. Despite some fluctuations over time, the seaward edge of the dune appears to have remained in a relatively similar position, but the dune has increased in elevation and in width on the landward side. Some changes can be linked to the beach recharge of 2005, which increased overall beach and ridge volume but is also a result of natural shoreline movement. The gradual 'rollback' of these dunes is not unique to this frontage and will also be evident in other zones and elsewhere around the country but is noticed here because of the position of those properties. This is demonstrated through aerial photography of the area directly south of the South Beach properties where the natural dune ridge is wider, with its rear extent further landward than the ridge directly in front of the South Beach properties.



Beach recharge

Is a beach recharge still required?

The approved financial 2016 Business Case for works to cover the 15 years to 2031 included for a potential small recharge (50,000m^3), where additional sand/shingle would be sourced from offshore dredging to top up the beach at some time between years 2023 and 2030. The works were provisionally scheduled for delivery in 2024/25.

Based upon the present size of the beaches and level of risks already discussed, there is little to suggest that the planned recharge is necessary at this time. The only other driver for any recharge in the coming years might be as a more sustainable and potentially environmentally preferable alternative to sourcing material from Snettisham Scalp for annual recycling.

Further considerations

Although not necessary at present, the question remains over the approach if a recharge is required before 2031. A review of past campaigns in 1991 and 2005 (400,000m^3 and 195,000m^3 respectively) has been undertaken to provide insights to the potential effectiveness of the works.

Previous experience suggests that if a recharge takes place, then a sizeable proportion of that material will likely stay at the shoreline, although some losses (25% based upon previous campaigns) might be expected to occur quite quickly.

In previous recharge campaigns, remaining material has not necessarily stabilised at the top of the ridge where it is required but has been drawn down onto the lower part of the slope. This material would have improved the resilience of the beach as a whole in those places but did not necessarily make much difference to the achievement of the minimum beach profile criteria at the top of the ridge. It is therefore likely that a coarser material would be required that would be less susceptible to rapid drawdown. The environmental and recreational impacts of using a coarser material may, however, be considered unacceptable so would need further assessment.

It is also very possible that the recharge material may be less stable in those areas that experience volume losses (Zones 5, 8b, 9, 10a and 11) moving alongshore to other zones where it is not actually required. This is because the issue in those areas does not appear to be lack of supply (as they have been recipients of recycling), but an increasing inability for those same areas to accumulate more material than is already there at those locations. A much greater volume might be needed to build a 'buffer' at those locations, i.e. building an accumulation at these points which would take more than a single year to be fully dispersed.

How effective a 50,000m^3 recharge could be is therefore debateable.

If a recharge campaign were to still be contemplated, and was affordable, then to be effective a full re-design should be carried out rather than simply replicating previous campaigns. Re-evaluation of the design profile should be based upon more recent methods and knowledge. More analysis and modelling would be required to design and predict shoreline response throughout the whole frontage with confidence, particularly if any changes to the sediment type and profile were to be introduced. This redesign process would be at additional cost to the quotes already obtained and further increases the funding gap.

Consideration would also need to be given to the technical challenges of undertaking a beach recharge along this frontage. The shallow foreshore is a constraint on marine equipment delivering material directly to the beach without pipelines or barges, therefore creating potential for environmental impacts on designated sites. Delivery by land is challenging due to inadequate roads for land-based equipment along the whole frontage. The lack of locations where suitable beach recharge material can be sourced is another issue that would need consideration.

Financial considerations

Background

The approved funding was based upon specific operations to be carried out over a 15-year period from 2016 to 2031, which included for annual recycling together with a one-off small scale beach recharge. Costs of recharge have escalated significantly and this assessment seeks to reassess the affordability of works going forward and establish whether the financial trigger in the WECMS may have been reached.

Up-to-date estimates for the beach recharge were sought in 2022 from two leading contractors well experienced in providing this type of works. These show that the costs of recharge will now be between £5-8 million, compared with £2.4 million assumed in the Business Case.

Updated economics for present day 2024

New options have not been developed within this assessment, but the 2016 assessment has been updated with latest information to establish how that affects those baseline assumptions, and then re-calculated the economics for the present day to assess affordability of flood risk management activities going forward for the remainder of the appraisal period. Updating the costs and benefits to 2024 prices, the overall Grant in Aid (GiA) eligibility would now be unlikely to exceed£2.6 million.

Based upon present size of the beaches, performance of the present recycling campaigns and risks already discussed, the technical assessment does now suggest that planned recharge is not likely to be required. However, if that were not the case, then the financial trigger stated in WECMS would have been reached as the works would need at least £5.2 million in external contributions.

In terms of what is affordable, it is possible to continue with the present annual recycling operations through to 2031, potentially increasing expenditure in any given year should circumstances require as to date, annual beach recycling costs have been lower than predicted. As already discussed, the technical effectiveness and suitability of continued removal of material from Snettisham Scalp may however be questionable.

If further “one-off” works over and above the beach recycling were required in the coming years, the maximum GiA expenditure would be approximately £2.2 million (including beach recycling) in addition to any external contributions. Whilst a beach recharge is unaffordable, alternative approaches to provide the same level of flood risk management may be viable.

Further application for GiA funding would require a full review of all damages and benefits and an updated assessment of the standards of protection then being afforded to the area. Any re-consideration at this time would most likely now also extend beyond 2031, for example up to 2045 when WECMS notes that the seawalls north of Heacham are also expected to need replacement and a more substantial economic decision point is reached.

Annual beach management

Effectiveness and sustainability of annual recycling

Beach recycling can certainly continue to be an effective approach to flood risk management for Unit C although there are signs that removing material from Snettisham Scalp could become less sustainable with time. Therefore, consideration needs to be given to whether the application of the beach recycling could be improved and refocussed, potentially in conjunction with other measures to contribute to flood risk management to Heacham and Shepherd's Port in particular. This might include considering ways to reduce the need for recycling each and every year.

The sustainability of the practices at Snettisham Scalp are perhaps more critical due to the short working window available to extract material and the fact that material is now reaching the Scalp at different periods of the year and redistributed over a larger area within the Scalp itself. Concerns have been somewhat mitigated most recently by the relative health of the beaches meaning the quantities to be extracted have not been as high as they had been in past years, but this may not continue to be so. If the magnitude and frequency of recycling could be reduced, that would also provide more time and opportunity for material to build up at Snettisham Scalp and in turn might ensure sufficient availability when it is needed.

Snettisham Scalp, February 2024. Beach material is now redistributed over a larger area within the Scalp itself.

Further considerations

Based upon this initial assessment, some suggestions are made on potential modifications that might be considered to the management of flood risk within the area. These are purely conceptual at this stage and included for further consideration and later development if appropriate, as all components would need to be subject to more detailed assessment.

Central section (Zones 8 to 11)

In addition to maintaining the secondary embankment, the concept of cross-banks could be given further consideration as part of modifying the annual beach recycling requirements, also improving the technical and environmental sustainability of the present approach of taking material from Snettisham Scalp. Introducing cross-banks as a one-off activity that extend from the present shoreline back to tie in with the secondary embankment south of Heacham and north Shepherd's Port, would negate the need for recycling along Zones 8 to 11, which is where the greatest amount of recycling presently takes place.

There would be no need to continue the considerable annual recycling to prevent outflanking of Heacham Dam. This activity is already considered to be unsustainable due to the unnatural alignment of the shoreline created by this structure. Whilst sea level rise and impacts of climate change are not being assessed in this

report, it is expected that the impacts of these will further increase the difficulty of attempting to maintain this in the coming years.

In Zone 11, the beach ridge could benefit from some assistance to become a more self-sustaining, which could be better achieved building up the rear face of this ridge as a one-off activity, i.e. along the edge of the car park, and allow the seaward face to naturally reshape without breaching to form a more robust natural barrier.

If cross-banks were built to ensure that any future breach anywhere along Zones 8 to 11 could not result in "back-door" flooding at Heacham or Shepherd's Port, where most built assets are located, then no future actions along these particular frontages should then be necessary in the future. There is also a substantial reservoir of beach building material stored within the dunes in this zone, so any erosion that did occur would have a potential beneficial effect in supplying beaches downdrift and potentially further reducing flood risk to Shepherd's Port in particular. Zone 8 might also form an alternative source for recycling material to other zones if and when required, instead of removal from Snettisham Scalp.

Heacham (Zone 5) and Shepherds Port (Zone 12)

Beach recycling operations appear to have remained reasonable effective up until now at both of these locations, so it is likely to remain appropriate to continue with some version of that if and when required rather than any more significant interventions.

In Zone 12, the alternative approaches presented for other zones to the north, and the potential build up at Snettisham Scalp to the south, could result in increased beach volumes here and further reduce direct flood risk.

Snettisham Scalp (Zone 13)

Through the above approaches, it would be expected that the annual recycling requirement reduces substantially, and more material is thus able to accumulate at the scalp and enable the spit formation to evolve more naturally. The lesser removal from the scalp would also enable a larger reservoir of sand and shingle to build up if ever needed for a more substantial campaign in critical areas following any significant storm event in the future (subject to the existing consents, funding and approvals still being continued).

This could have wider beneficial influences by further sheltering/enabling more material to reach, downdrift Zones 14 and 15. Growth of the spit could also help to promote further growth of the beaches and dune vegetation immediately to the north, in Zone 12.

Heacham South (Zones 6 and 7)

The issue of sand blowing over onto properties could be reduced by active dune restoration and management as described below, and in particular preventing trampling of the dunes by people. The extent of footpaths through these dunes has significantly depleted vegetation, which in turn results in more erosion and wind-blown sand moving back onto properties instead of being trapped within the dunes. The recommended approach to dune management here would be to help re-establish vegetation and improve the dunes by fencing them off restricting public access to just a few selected locations, facilitated by raised boardwalks at those points. A second recommendation, where the dune is currently in poor health, is to encourage growth through placing additional sand from recycling seaward of the existing main dune ridges to help them to widen and by doing so further bolster the resistance to breaching.

It is important that these dunes are able to reprofile naturally of their own accord if they are to provide a healthy natural flood defence to Heacham. In the future, if/when the dune system migrates inland it is then possible that the number of evacuations would increase and/or amounts of sand entering properties become unmanageable. But this approach may offer a transitional solution in the meantime.

Summary and conclusions

In respect of the questions posed for this initial assessment, the main findings are as follows:

- Environmental and evacuation triggers, as set out in the WECMS for review of the current management approach, have not been reached to date.
- The current state of the beaches means that recharge is not required at present. However, this situation remains contingent on the beach remaining healthy, and also that no storms occur that exceed the standard of protection being provided and result in a breach. Therefore, should circumstances arise that could require beach recharge in the coming years, this would now fall short of the approved funding limits, so the financial trigger will have been reached and reconsideration of management approach would then be necessary. The potential effectiveness of the scale of that planned recharge is also questioned.
- Beach recycling has now altered in nature from that anticipated at the time of the BMM in 2014, with some shift in focus onto different areas as much of the frontage already meeting the minimum profile requirements. The effectiveness and sustainability of some of those current practices is however now questioned, particularly around Heacham Dam. Elsewhere, it is not evident that the recycling operation is required every year.
- Overall, the beaches are not diminishing in volume, although they are reprofiling with some of the placed material being drawn down from the upper to lower beach area a little more rapidly due to recent changes in storm activity. In addition, Snettisham Scalp is not smaller in volume but the material has become spread over a larger area. If the recycling operation was not undertaken every year it is also possible that Snettisham Scalp better recovers and more material accumulation results.
- To mitigate against the possibility of other triggers being reached, i.e., the environmental sustainability of present practices and potential for flooding, it could be worth considering amending the current approach to flood risk management along the frontage through a series of measures that reduce the annual requirement for recycling.
- Elsewhere, directly to the south of Heacham, sand has continued to accumulate behind the crest of the ridge towards the line of properties situated there and will likely continue to do so. Again, measures to better manage that particular frontage (by stopping pedestrian trampling and installing raised boardwalks) could help alleviate that issue in the immediate term.

It is recommended that the following steps are now considered:

- Re-calculate the actual standards of protection now being provided by the shingle ridges, noting the calculations and estimates in WECMS are now based upon the state and profile of the beach over 10 years ago and have since changed.
- Consider and develop the recommendations for changes to flood risk management, including updated economic costs and benefits assessments which may also extend beyond the present 2031 date. This may form part of a wider strategic assessment.
- In line with the above recommendation, revisit the decision points and any triggers for change, including the BMM criteria for the operational beach profile and any modifications to be made to material sourcing, placement and remedial works.