Freiston Shore managed realignment site

Information sheet no.1 (April 2008)
Strategic & Development Planning, Shoreline Management Group

Photo: Creek at Freiston Shore realignment (courtesy of Dr Sue Brown)

Introduction to Freiston

Freiston shore is located on the north-western bank of The Wash and is one of the largest managed realignment sites in the UK. The aim of the scheme was to enhance the coastal defence through set back of the primary defence and the establishment of fronting salt marsh, also to create a new wetland habitat, supporting a salt marsh community plus a brackish lagoon landward of the embankment.

In 1983 the HM Prison Service (HMP) reclaimed a 66 ha area of The Wash to be cultivated as arable farmland. The embankment built to enclose the area protruded into The Wash and was exposed to erosion, resulting in the bank being at risk of failure during the 1990s. The Environment Agency decided that repairing and strengthening the existing landward defence, to bring the bank into alignment with the adjacent defences was the best option. The Royal Society for the Protection of Birds (RSPB) was keen to use this opportunity to create a new wetland habitat and purchased the land from HMP. Defra provided funding to the scheme which allowed for a five year monitoring programme. Following an Environmental Action Plan, due to the considerations involved in working around a designated area, the Environment Agency then strengthened the existing landward sea defence and worked with Defra, RSPB and coastal partners in the realignment scheme that started in 2001. The seaward bank was then breached at 3 points in 2002 and the site has been naturally regenerating since.

Replacing a coastal defence in this way is known as 'managed realignment', it is used to reclaim land or allow a tidal flow into an enclosed space to create salt marsh and mudflat areas through silt deposition. The problem at Freiston was that, unlike most of The Wash embayment, salt marsh was being eroded and the embankment was exposed to high wave energy, especially during storms. The creation of a buffer zone of soft salt marsh serves to absorb the energy of breaking waves. The stalks and stems of the plants will also interrupt the motion of the waves through frictional resistance so that wave energy is slowly dissipated as it rolls over the marsh and does not impact on the embankment wall behind.

The enhanced Freiston defence now provides a 1 in 200 year standard of defence for 80,000 ha of land including the town of Boston. The site is an example of how improved flood defences can be sustainable and bring economic and ecological benefits at the same time.

A six year monitoring programme undertaken in conjunction with the scheme by the Centre for Ecology and Hydrology (CEH) (Brown *et al*. 2007) started in September 2001 to assess development of the site and ensure there were no adverse affects from the scheme on the surrounding marsh. The monitoring programme was completed in February 2008 and demonstrated that in addition to providing an 1:200 year sea defence, the project allowed salt tolerant salt marsh plants such as samphire *(Salicornia europaea)* and sea-blite (*Suaeda maritima*) to colonise the area. The site biodiversity is now close to matching the surrounding marsh land. The monitoring results also concluded the site provides a habitat for many species of wildfowl and waders such as brent geese *(Branta bernicla)* and redshank (*Tringa totanus*), and is a valuable nursery habit for juvenile fish. The nationally significant species of birds and wildlife that can be seen at the site and adjacent lagoon and has made Freiston popular with visitors, and the RSPB hope to see 60,000 people visit the site every year.

Photo: Waders on the lagoon. (courtesy of Neill Smith)

Freiston facts

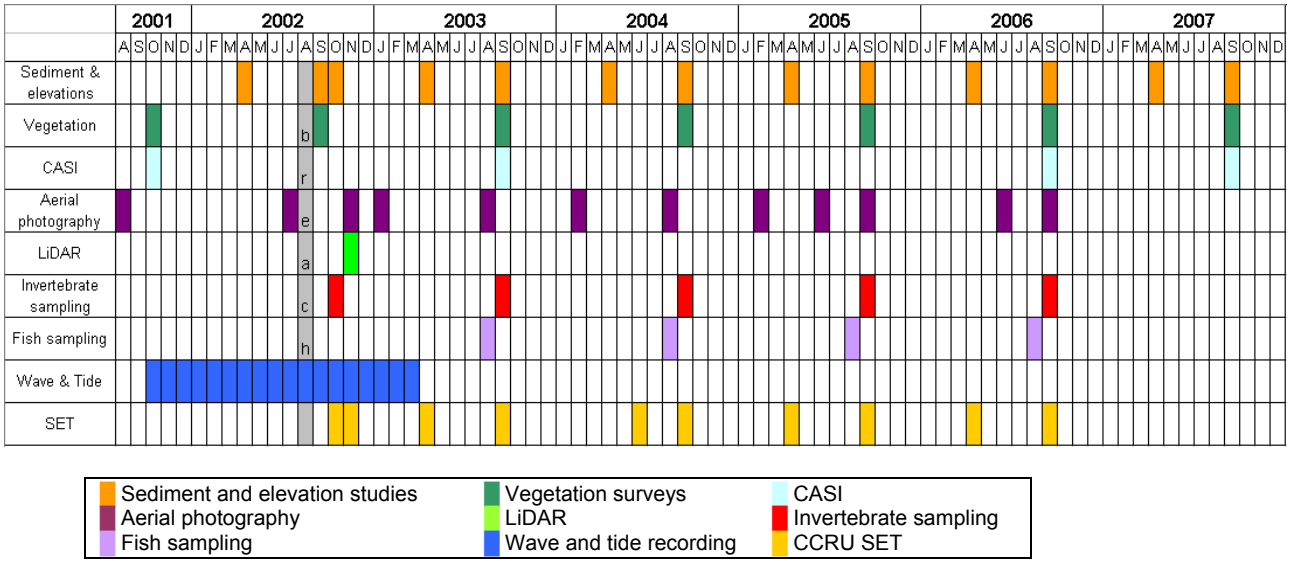
Date of breaches:	Summer 2002
Realignment area:	66 Ha
Number of breaches:	3
Elevation (m):	2.76-3.26 OD; 0.8-1.6 MHWN
Tidal range (m):	6.4
Grid reference:	TF 540658 342926
Longitude & latitude:	52.964659 0.092394
Common bird species:	To date include golden plovers, avocets, dunlins, dark-bellied brent geese and redshanks
Site access:	The site is open to the public with free parking facilities.

Photo: Freiston managed realignment site and lagoon, looking north-east (Environment Agency)

Our role

The Environment Agency, Regional Strategic and Development Planning, Shoreline Management Group (SMG) acted as project co-ordinator for the pre and post breach monitoring project that started in 2001. This involved obtaining funds from Defra, plus paying additional monitoring costs, overseeing the site monitoring and reporting, liaising with coastal partners, organising steering group meetings and acting as a data source and contact point for members of the public and academia.

Monitoring



Available data

- **Fish sampling** data from micromesh seine and fyke net count taken inside and outside of the realignment site in August months from 2003 – 2006.
- **Invertebrate sampling** from pitfall traps, sediment scrapes, and sweep net surveys, October 2002 then subsequent Septembers from 2002 – 2006.
- **Sediment and elevation studies**, transect survey data from surveys in April and September 2002 - 2007.
- **Vegetation surveys -** 5 x 5m, 5 x 1m and 1 x 1m quadrat ground data, of surveys from 2001 - 2007.
- **Wave and tide study** data from two wave/tide instruments deployed outside the site in October 2001 through to early September 2002 then at two locations within the realignment area from September 2002 through to March 2003.
- **Aerial photography** Oblique and vertical aerial photography of the site since 1992. This includes photographs from the annual strategic coastline survey carried out every summer by the SMG as part of the Anglian Coastal Monitoring Programme.

In addition to data held by the SMG, Cambridge Coastal Research Unit (CCRU) carried out 'SET' accretion monitoring surveys in conjunction with the monitoring by CEH (Freiss *et al*. 2006).The RSPB undertake ongoing monthly bird surveys of breeding and water birds, and passerines. Various LiDAR and CASI surveys were flown by Environment Agency Geomatics and NERC CEH respectively. This data is not available from the Environment Agency, SMG.

Monitoring summary

The results of the ecological monitoring programme can be found in the two monitoring reports by Brown (2007), see 'Output papers to date'.

Accretion

The elevation levels of Freiston have been identified as key to the successful and rapid development of the realignment site and vegetation establishment. Sediment accretion rates within the site are nearly equivalent to the adjacent salt marsh at a comparable elevation range. Mean annual accretion rates (excluding outliers and breach sites) has varied from 5.7mm – 8.4mm since 2002.

Vegetation

Vegetation establishment has been highly successful with the exception of areas with standing water. Mean total vegetation cover is approaching that of outside the realignment. Estimates from the monitoring show equivalent cover to the surrounding marsh by around 2010. Mean species diversity is currently very similar, with all species found outside the site, being identified in the managed realignment site at expected elevations. Pioneer annuals colonised the area in 2003, and have since been replaced by a succession of expected perennial species, particularly at higher elevations. All common and expected species are now widespread at Freiston. The successful vegetation establishment has been mainly attributed to the suitable site elevations, an abundant source of propagules and the shelter afforded by the former sea walls.

Invertebrates

Invertebrate fauna has increased in abundance and diversity within the site and most taxa found in the surrounding marsh was identified within the site by 2006.

Fish

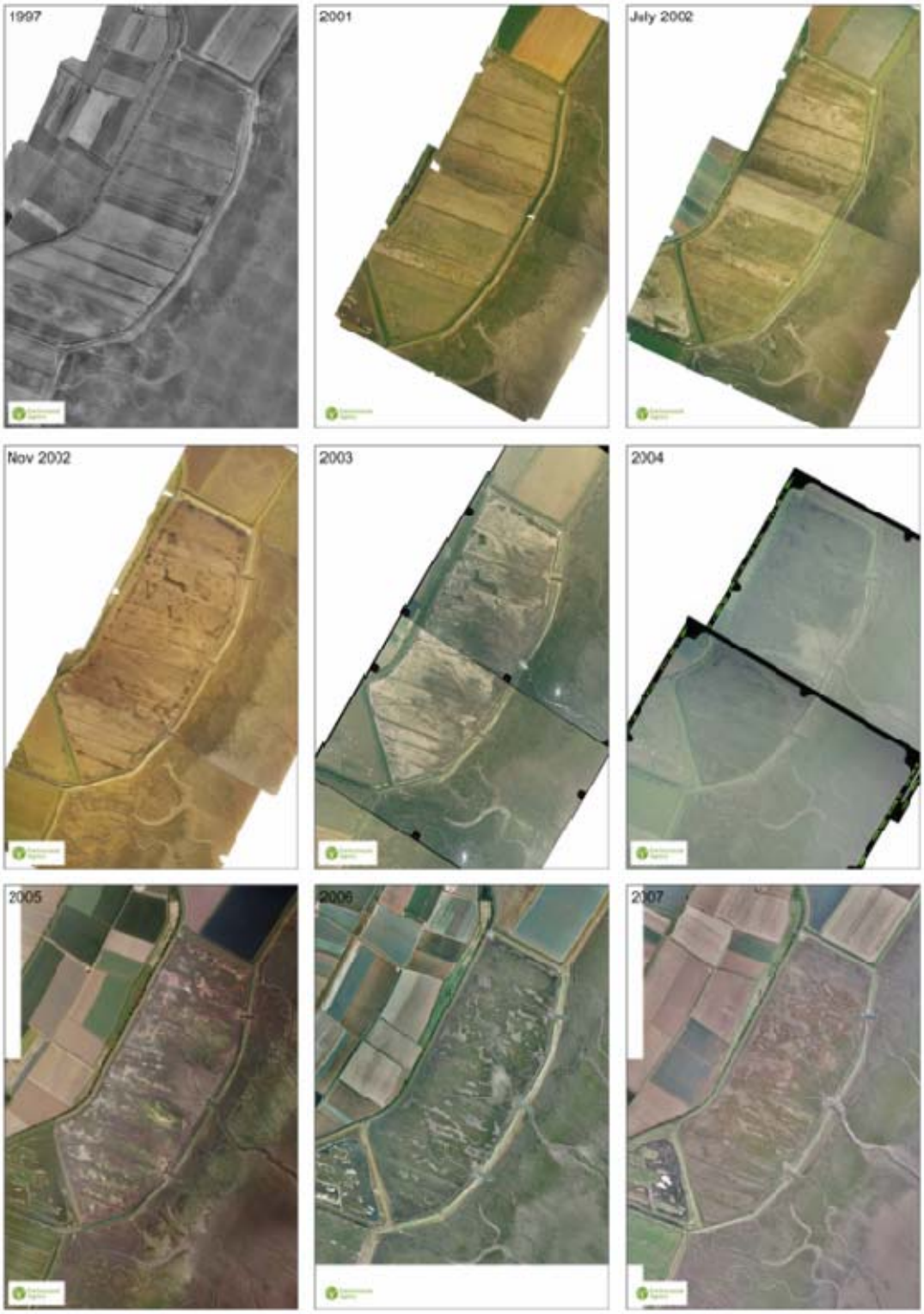
Fish surveys have showed that the site is functioning as a valuable nursery habitat for juvenile fish throughout the entire tidal cycle. This includes commercially important species such as bass (*Dicentrarchus labrax*), sprat (*Sprattus sprattus*), and herring (*Clupea harengus*). These fish are feeding at the site and have been able to exploit the permanently flooded channels and pools and food resources within these water bodies. The research suggests that incorporating pond areas and modification to the current creek design for future realignment sites elsewhere could enhance the quality of this type of habitat for juvenile fish.

Creeks

Channels were initially cut into the agricultural soil based on the location of the original creek system, identified in aerial photography. A complex creek system has developed since the breaching with extensive widening, eroding and cutting back of channels. Conclusions from the monitoring report suggest that more research is needed to achieve optimum breach design, site gradient and design of starter creek systems (profiles, pattern and density) to achieve sustainable salt marsh areas through this technique. Parts of the Freiston realignment site are not fully draining after the tide has receded, which is beneficial to birds but reduces sediment stability and hinders the development of salt marsh vegetation which helps stabilise the sediment.

The managed realignment at Freiston has created a valuable coastal defence to the area, in addition to successfully developing salt marsh habitat. This was achieved through a close working partnership that included the Environment Agency, Defra, RSPB, Natural England, HMP plus contractors and researchers. It is hoped that Freiston proves to be a model for future realignment and future designs and objectives can be taken from the lessons that have been learnt through the extensive monitoring programme.

Aerial photography surveys



(Environment Agency)

More information

For further information and data from us regarding Freiston Shore, please send an email to philip.staley@environment-agency.gov.uk
For general data requests including topographic surveys, aerial photography and other information packs please contact David Welsh at david.welsh@environment-agency.gov.uk

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Useful links

Environment Agency -
http://www.environmagency.gov.uk/subjects/recreation/1344579/1384407/1384415/1384547/1746980/?lang=_e

RSPB reserve information - http://www.rspb.org.uk/reserves/guide/f/freistonshore/index.asp

ABPmer, 'The online managed realignment guide' featuring Freiston -
http://www.abpmer.net/omreg/index.php?option=com_wrapper&Itemid=8

Output papers to date

Badley, J., and Allcorn, R. I. 2006. The creation of a new saline lagoon as part of a flood defence scheme at RSPB Freiston Shore nature Reserve, Lincolnshire, England. *Conservation Evidence*, **3**, 99-101.

Badley J., and Allcorn R.I. 2006. Changes in bird use following the managed realignment at Freiston Shore RSPB Reserve, Lincolnshire, England. *Conservation Evidence*, **3**, 102-105. http://www.conservationevidence.com/Attachments/PDF465.pdf

Brown, S.L., Cotton J., Staley, P., Murby, P. and Badley J. 2008. Future monitoring at coastal realignment sites: Lessons learnt from the Freiston flood defence scheme. Proceedings of Flood and Coastal Risk Management 2008, 1-3 July, Manchester, U.K.

Brown, S. L., 2007. Wash Banks Flood Defence Scheme Freiston Environmental Monitoring 2007. Final year report to the Environment Agency. NERC Centre for Ecology and Hydrology, Wallingford, UK.

Brown, S.L., Pinder, A., Scott, L., Bass, J., Rispin, E., Brown, S., Garbutt, A., Thomson, A., Spencer, T., Moller, I., Brooks, S.M. 2007. Wash Banks Flood Defence Scheme, Freiston Environmental Monitoring 2002-2006. Four year report to the Environment Agency. NERC Centre for Ecology and Hydrology, Dorset

French J.R. and Spencer T. 1993. Dynamics of Sedimentation in a Tide-dominated Backbarrier Salt Marsh, Norfolk, UK. *Marine Geology* **110**: 315-331

French J. R., Spencer T., Murray A. L., and Arnold N. S. 1995. Geostatistical Analysis of Sedimentation in Two Small Tidal Wetlands, North Norfolk, UK. *Journal of Coastal Research* **11**: 308-321

Friess D. A., Spencer T., Smith G. M., Moller I. and Thomson A. G. 2006. Thinking Outside the Box: Visualising the External Impacts of Managed Realignment. *Proceedings of Eurocoast-Littoral 2006*, Gdansk, Poland. Vol 6. p.35-40

Rawson, J., Brown, S., Collins, M. and Hamer, B. (2004). Frieston Shore – Lessons learnt for realignment design and habitat creation. *Littoral 2004, 20-22 September, Aberdeen, Scotland U.K*. Cambridge Publications Ltd., p.502-507

Rotman R., Naylor L., McDonnell R. and MacNiocaill C. in press. Sediment Transport on the Freiston Shore Managed Realignment Site: an Investigation using Environmental Magnetism. Geomorphology

Symonds, A.M. 2006 Impacts of coastal realignment on intertidal sediment dynamics: Freiston Shore, the Wash. University of Southampton, Faculty of Engineering Science and Mathematics, School of Ocean and Earth Sciences, PhD *Thesis*, 246pp

Symonds, A. and Collins, M., 2007. The development of artificially created breaches in an embankment as part of a managed realignment, Freiston Shore, UK. *Journal of Coastal Research*, SI 50 (Proceedings of the 9th International Coastal Symposium), 130 – 134. Gold Coast, Australia, ISSN 0749.0208

Symonds A. M. and Collins M. B. 2007. The Establishment and Degeneration of a Temporary Creek System in Response to Managed Coastal Realignment: The Wash, UK. *Earth Surface Processes and Landforms* 32(**12**): 1783-1796

Thomson, A. G., Smith, G. M., Brown, S. L. and Garbutt, A. 2004. Changes observed with airborne remote sensing in vicinity of the Wash Banks Managed Realignment Site, Boston, Lincolnshire, *UK. Littoral 2004, 20-22 September, Aberdeen, Scotland U.K*. Cambridge Publications Ltd., p.680-681

Photo: Aerial photography of Freiston and The Wash 2005 (Environment Agency)