Case study 59. Hightown Sand Dune Restoration

Author: Graham Lymbery

Main driver: Improved defences

Project stage: Constructed 2011

Photo 1: Hightown Sand Dunes (source: Sefton Council)

Project summary:

The sand dunes at Hightown north of Liverpool (Photo 1 and Map 1) were eroding at a rate of 0.5–1m per year. The structure protecting Blundellsands Sailing Club had less than a 10 year life span remaining, and 125 properties and the sailing club were at risk from coastal erosion. Using Section 106 money, a scheme was developed to buy more time by reinstating the dunes to the position they were in 30 years ago.

Key facts:

Prior to the project this section of coast was losing, on average, 1,000m^3 of sand a year. Post project it is losing the same amount, so by moving 28,000m^3 of sand 28 years of time has been bought back.

Map 1: Hightown Sand Dunes, north of Liverpool (source: Sefton Council)

1. Contact details

Contact details	
Names:	Graham Lymbery
Lead organisation:	Sefton Metropolitan Borough Council
Partners:	
e-mail address:	Graham.lymbery@sefton.gov.uk

2. Location and coastal/estuarine water body description

Coastal/estuarine water body summary	
National Grid Reference:	SD2860603932
Town, County, Country:	Hightown, Merseyside, UK
Regional Flood and Coastal Committee (RFCC) region:	North West
Water Framework Directive water body reference:	GB531206908300
Land use, geology, substrate, tidal range:	Sand dune coast with a 10m tidal range

3. Background summary of the coastal/estuarine water body

Socioeconomic/historic context

The Hightown Dunes frontage is the most northerly part of a 3km long section of largely undeveloped and undefended frontage located between Blundellsands and Hightown to the north of Liverpool (Map 1). Up until the early 20th century, the shoreline all the way from Southport to Liverpool comprised a natural dune belt. Today the shoreline across the southern half of the area is essentially the original dune frontage that was artificially reinforced with demolition rubble from the 1940s to the 1970s. Across the northern half of the area this gives way to the remains of the natural sand. At Hightown, the River Alt discharges onto the foreshore and meanders southwards for ~2km before being turned south-westerly by a training bank that was constructed in 1936.

North of Hightown to the southerly boundary of Southport, the shoreline comprises the largest remaining section of the original dune belt (Formby Point), while to the south of Blundellsands the frontage is defended by a series of concrete revetments and sea walls.

The frontage is located within the boundaries of the following internationally and nationally designated sites of conservation interest:

- Ribble and Alt Estuaries Special Protection Area (SPA)
- Sefton Coast Special Area of Conservation (SAC)
- Altcar Sand Dunes and Foreshore Ramsar site
- Altcar Sand Dunes and Foreshore Site of Special Scientific Interest (SSSI)

In addition the dunes across this section of frontage are within the boundaries of the Hightown Dunes and Meadows Site of Local Biological Interest. The principal interests associated with the SAC designation within the dunes are sand lizards and the nationally rare Natterjack toad (*Bufo calamita*).

Flood and coastal erosion risk management problem(s)

The coast at Hightown is eroding and in the long term this continued erosion will affect the local community and development through flooding and further encroachment of the sea. In the short term, Blundellsands Sailing Club would be lost. Under current government funding arrangements, protection to this area would not be considered for at least a further 15–20 years. At which point, a variety of options could be considered using government criteria that would take into account the increased risk of erosion to the housing development. As money (Section 106 funding currently £1.57 million) has been made available from the developers of the nearby Broseley Estate, it was possible to propose an earlier intervention to the problem that was less invasive to the environment, heritage and amenity of the area.

Photo 2 shows how the dunes have changed on this area of coast between 1979 and 2010, while Photo 3 shows the area of dune reinstatement.

Other environmental problems

- Constraints on the manner and timing of work imposed by working with internationally designated sites
- Transporting sand over made ground which is contaminated with asbestos
- Avoiding damage to the remains of a Neolithic forest on the beach

4. Defining the problem(s) and developing the solution

What evidence is there to define the flood and coastal erosion risk management problem(s) and solution(s)

The evidence relates to coastal monitoring and aerial photos going back to the 1940s. This has provided both the understanding of the problem in relation to erosion and the guidance for the solution in terms of placing the sand to the extent where the sand dunes were 30 years ago.

What was the design rationale?

The design rationale can be split into 3 elements.

Sand dune restoration

As it was not possible to undertake a traditional beach recharge because of the remains of the Neolithic forest, it was decided to reinstate the sand dunes to their previous extent in the late 1970s. Over time, it is anticipated that this would merge with the existing sand dunes with some dispersal of material over the beach with a typical net loss to the system of 1,000m3 per year. This would buy time and maintain the future option of working with natural processes.

Sailing club defences

The existing hard defence for this structure had a vertical face that was leading to drawdown of the beach. This was rebuilt as a sloped revetment which would have less impact on the natural beach processes.

The outfall

The vertical face of the side of the outfall was reflecting wave energy against the dunes and causing localised erosion. A rock groyne was placed alongside the outfall to dissipate the wave energy.

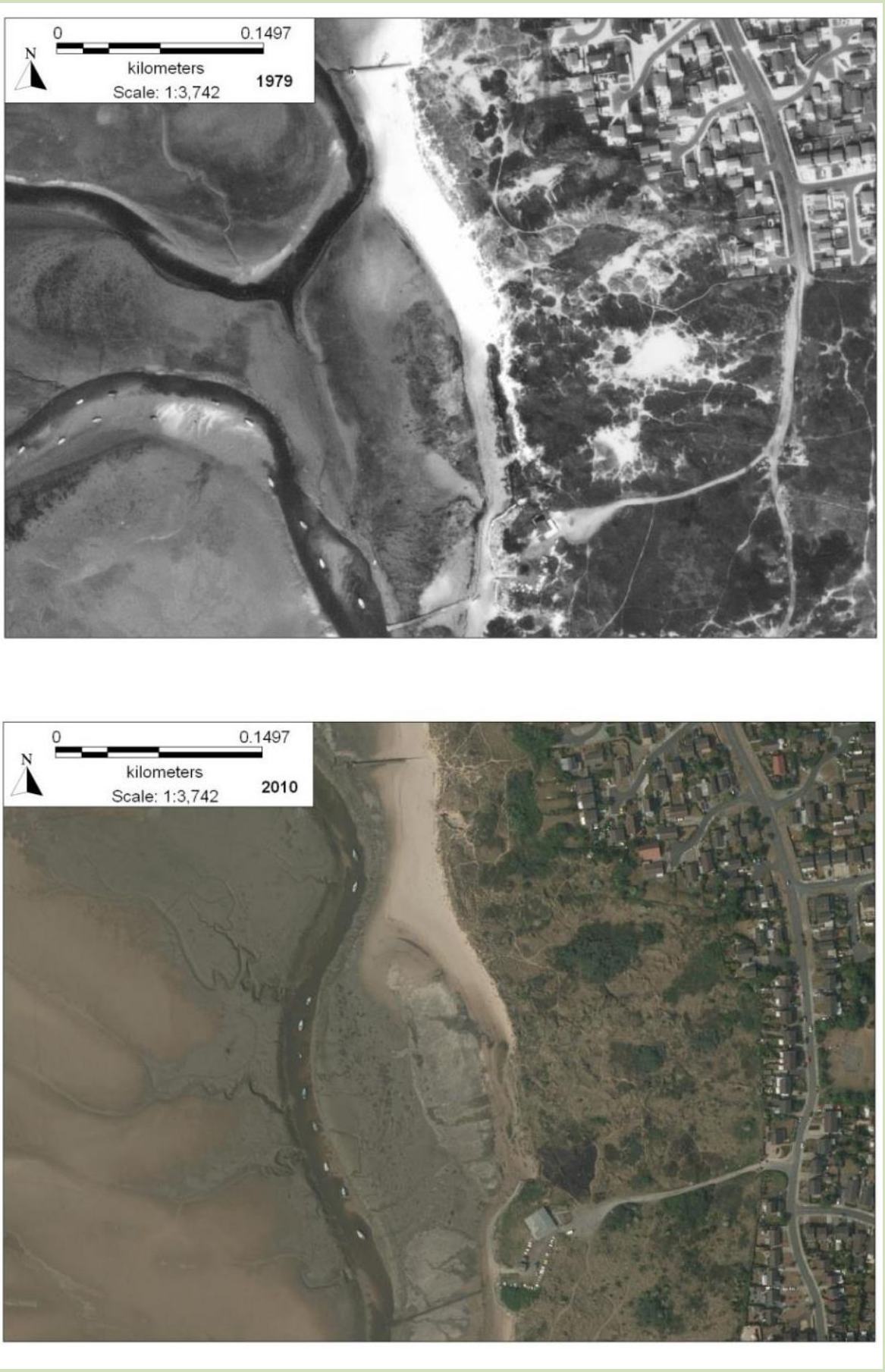


Photo 2: Changes in the dune extension between 1979 (top panel) and 2010 (bottom panel)

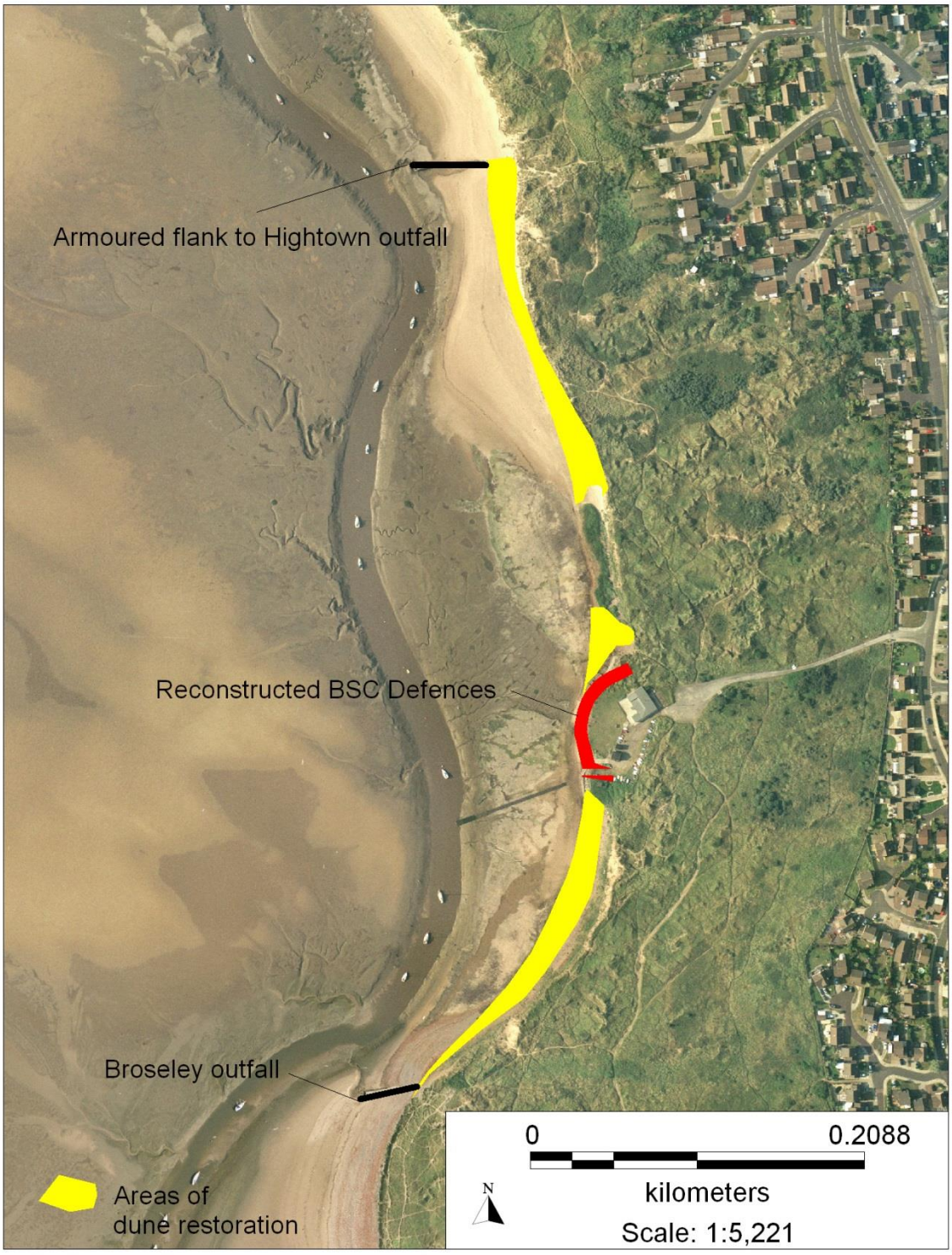


Photo 3: Area of dune reinstatement and where flood walls were repaired (source: Sefton Council)

BSC = Blundellsands Sailing Club

Project summary	
Area of transitional and coastal water body or length benefiting from project:	Hightown
Types of measures/interventions used (Water Framework Directive and traditional):	Sand dune restoration, rock groyne, seawall
Numbers of measures/interventions used (Water Framework Directive and traditional):	3
Standard of protection for project as a whole:	The standard of protection is phrased in terms of time bought rather than level of protection as this is primarily a coastal erosion scheme – though in the longer term the erosion would lead to flooding. The scheme has bought approximately 30 years of protection. This is substantially due to the sand dune works with the rock groyne being secondary. The defence to the sailing club is specific to this building and buys a limited amount of time for it.
Estimated number of properties protected:	Sailing club clubhouse and 125 residential properties

How effective has the project been?

The project has been monitored using laser scanning to quantify the amount of sediment in the system. This has indicated an average loss of slightly less than a 1,000m^3 per year. The sand has been redistributed predominantly onto the beach, increasing the overall beach levels. Some sand has blown back into the dune system and some has drifted onto the beach north of the outfall.

The area of dunes protected by the rock groyne has benefited both in terms of being protected from the reflected wave energy and through increased beach levels.

The interface between the seawall and the dunes has been problematic and required remedial works to ensure that they work together.

5. Project construction

How were individual measures constructed?

Sand was sourced from behind the promenade at Crosby from the Marine Lake up to Crosby Swimming Baths. A quantity of 28,000m^3 was moved. The sand was transported by large off-road trucks that operated in a convoy. The route was along the beach to a point just north of the Coast Guard Station at Hall Road West, where it then ran above the beach and to the seaward side of the cycle track. Just past the point where the cycle track turns inland, the route would run through the dunes to a compound area near the sailing club. This route avoided the need to transport the sand by road.

The sand was placed in front of the existing sand dunes to their position in the late 1970s. Management measures were applied to stabilise the dunes, such as marram grass planting.

The outfall to the north of the sailing club had rock armour placed against it to stop the sand drifting north and to reduce reflected wave energy on the sand dunes. Rock was brought in by road and placed by tracked excavators. The sailing club had its old defences removed and replaced with a sloped revetment which will dissipate wave energy rather than reflect it. This was constructed in concrete.

Photo 4 shows sand being brought to the beach.

Photo 4: Sand being brought to the beach (source: Sefton Council)

How long were measures designed to last?

30 years

Were there any landowner or legal requirements which needed consideration?

Habitats designation

6. Funding

In the 1970s money was set aside by the developer of Broseley Estate and put in a high interest account. This money grew to £1.5 million, but could only to be used for a coast protection scheme to protect this area.

Funding summary for Working with Natural Processes (WWNP)/Natural Flood Management (NFM) measures	
Year project was undertaken/completed:	2011
How was the project funded:	Section 106 contribution from the housing developer of the housing estate immediately behind the scheme.
Total cash cost of project (£):	• Overall cost including all fees and preparatory works: £1.4 million • Total cost for contract for works: £1,149,779 • Cost for seawall: £257,454 • Total budget available: £1.5 million
Overall cost and cost breakdown for WWNP/NFM measures (£):	~£800,000 for the sand dune restoration works
WWNP/NFM costs as a % of overall project costs:	Total contract cost was £1.15 million £250,000 fees associated with design, habitat surveys and reports, site investigation and so on
Unit breakdown of costs for WWNP/NFM measures:	
Cost–benefit ratio (and timescale in years over which it has been estimated):	Given that so many of the benefits would have been realised much later in time, the application of the discount factor substantially reduces the current day benefits. Describing it in monetary terms the protection is costing about £45,000 per year. In non-tangible terms this was something the community wanted and it avoids losing the sand dunes and forcing the adoption of man-made defences.

7. Wider benefits

What wider benefits has the project achieved?

Habitat works were carried out as part of the project. Some of the species that it was feared would be damaged have benefited from the disturbance such as Isle of Man cabbage.

How much habitat has been created, improved or restored?

Not applicable

8. Maintenance, monitoring and adaptive management

Some large storms have eroded the dunes (Photo 5). Much of the sand had been redistributed on to the beach raising the beach levels; this is part of the natural system adjusting to the new position of the dunes.

Photo 5: Dune erosion during a storm (source: Sefton Council)

Are maintenance activities planned?

Dune management works

Is the project being monitored?

Laser scanning and inspections have been undertaken. Beach topographic surveys were undertaken before and after the works to measure the height of the beach (Photo 6).

Photo 6: Area being monitored (source: Sefton Council)

Figure 1 shows the beach heights before and immediately after construction. Beach level comparisons are given in the appendix.

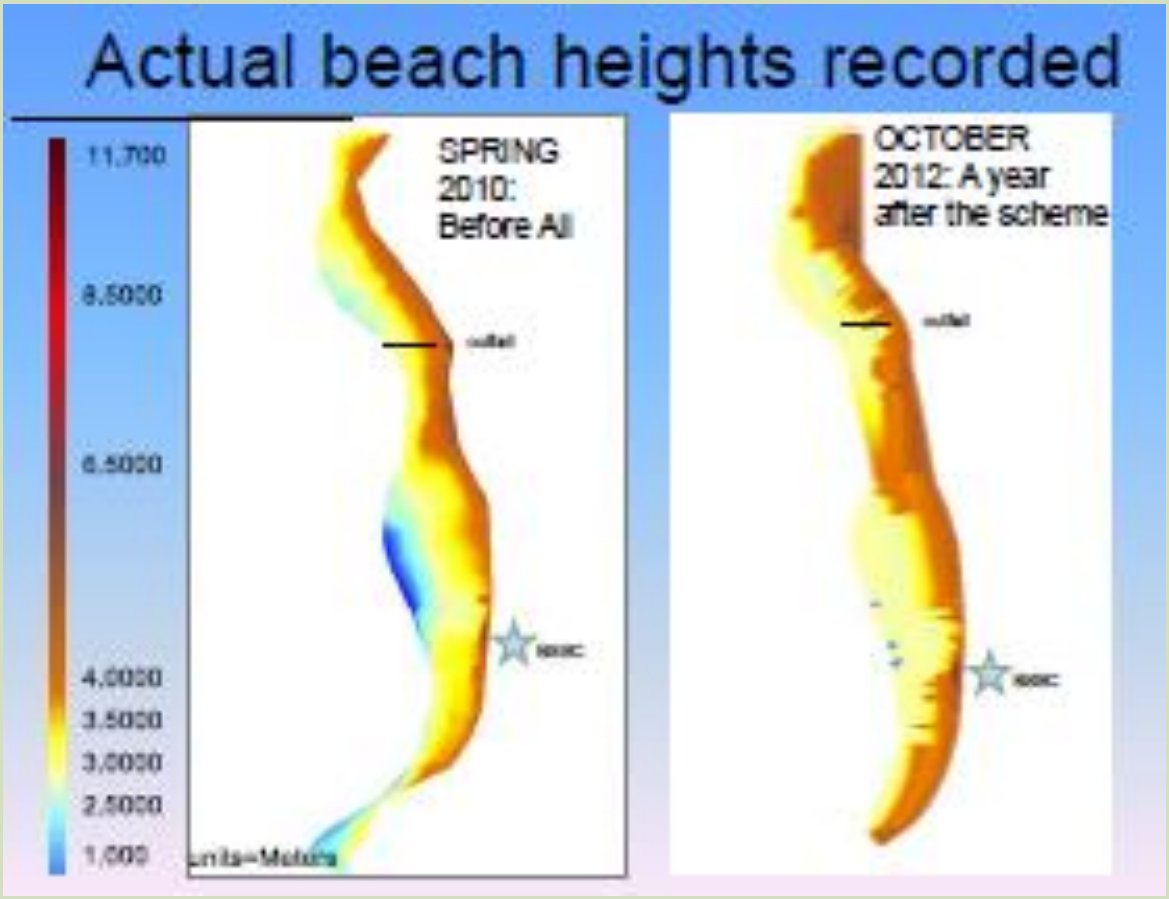


Figure 1: Recorded beach heights before and after construction work

In the future, it is planned to continue to:

- monitor the beach levels and the position of the dunes
- monitor the erosion north of the outfall
- monitor the wave action to the northern end of the sea wall where some cliffing has occurred and do maintenance work where necessary
- continue to monitor the ecological impacts of the works
- monitor the movement of the River Alt

Has adaptive management been needed?

The interface between the sand dunes and the seawall has needed adapting.

Action is being taken to resolve issues at Crosby where the sand was removed.

9. Lessons learnt

What was learnt and how could it be applied elsewhere?

Early contractor involvement was critical to the success of the project, as was extensive public engagement.

Having long monitoring datasets is important to support the understanding of the geomorphology and the design of any scheme.

- Overall works went well.
- The dunes are acting as expected.
- Habitats are thriving and mitigation works have been successful.
- Beach levels have increased, reducing the impact of the waves.

Photo 7 shows an aerial view of the sand dunes today.

Photo 7: Aerial view of Hightown and Sefton Dunes (source: Sefton Council)

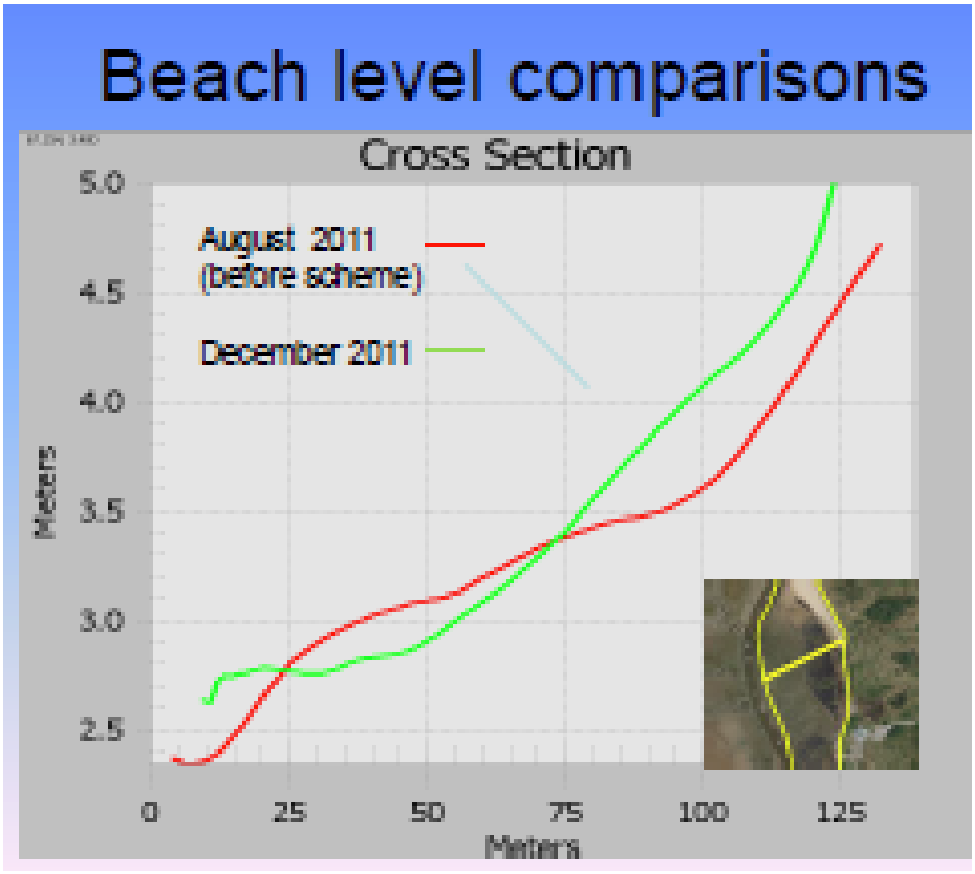
10. Bibliography

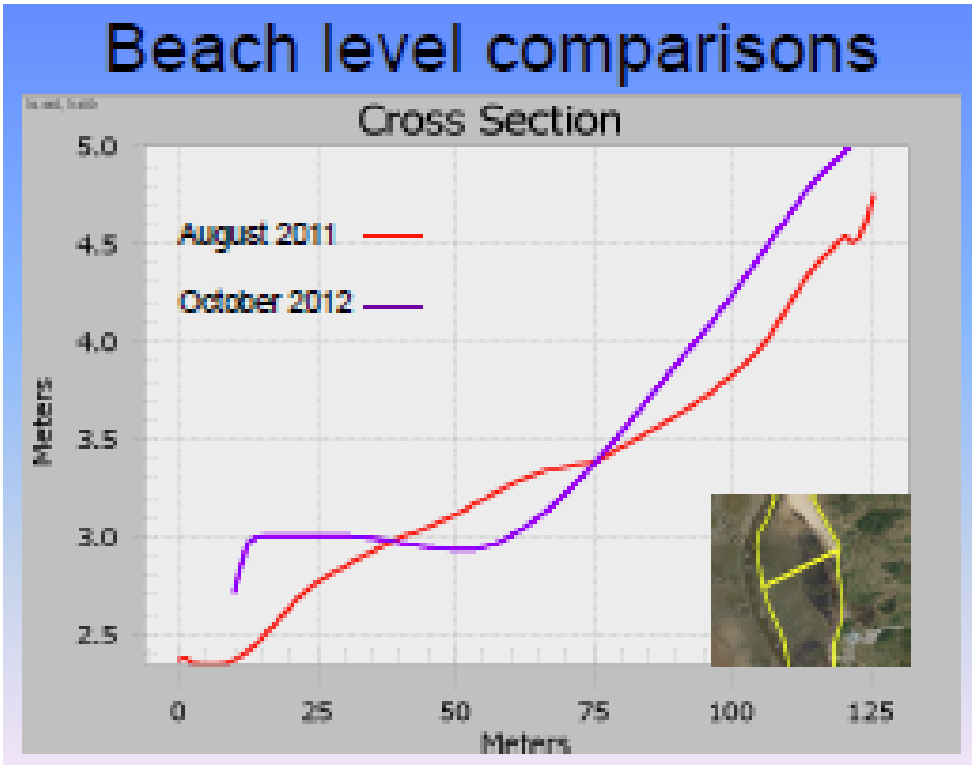
Not applicable

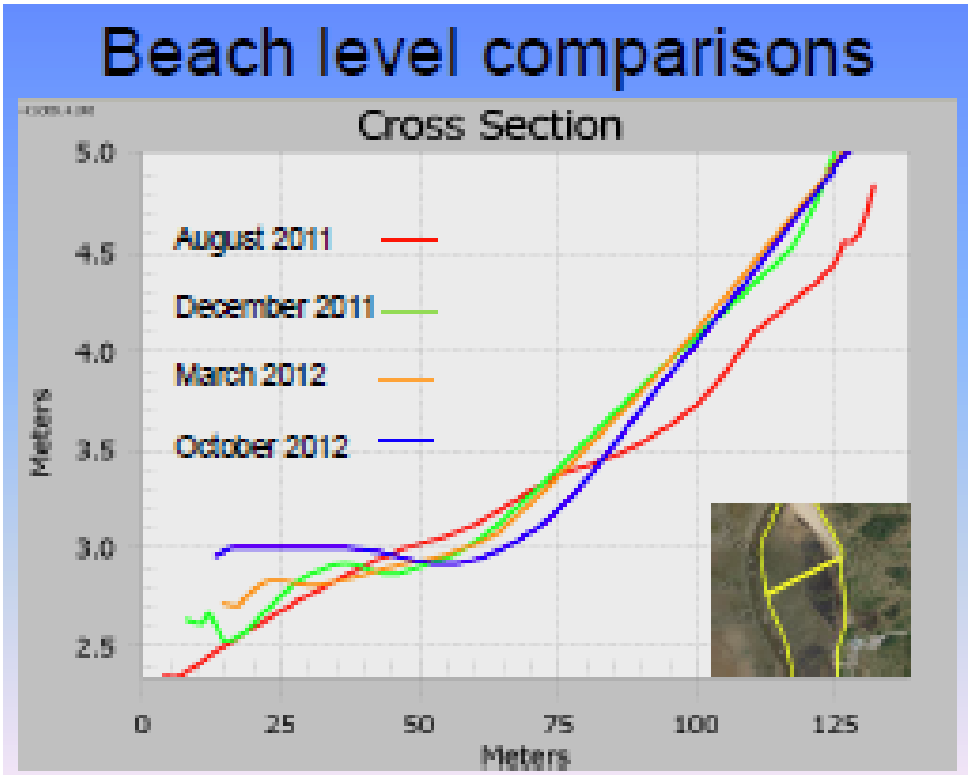
Project background

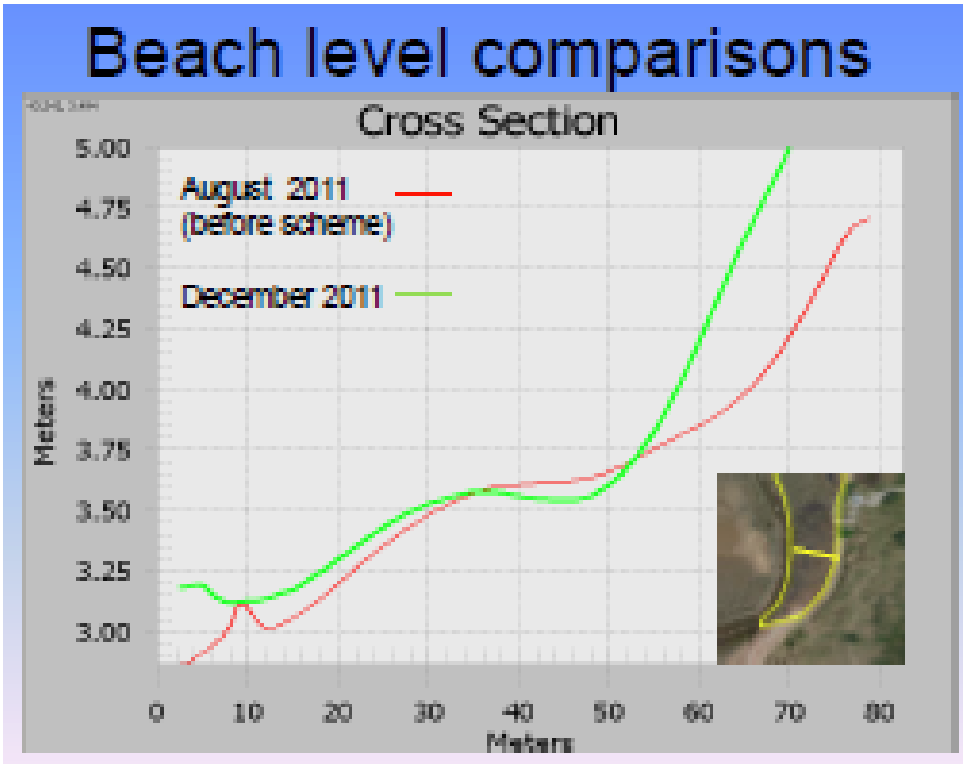
This case study relates to project SC150005 'Working with Natural Flood Management: Evidence Directory'. It was commissioned by Defra and the Environment Agency's Joint Flood and Coastal Erosion Risk Management Research and Development Programme.

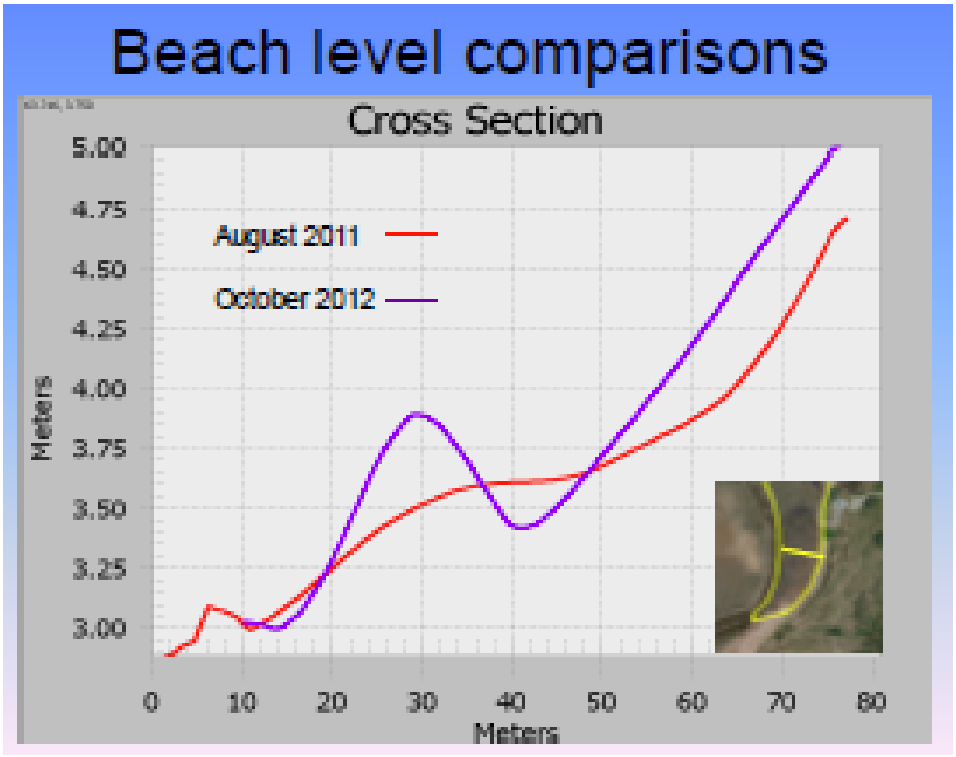
Appendix 1: Beach level comparisons

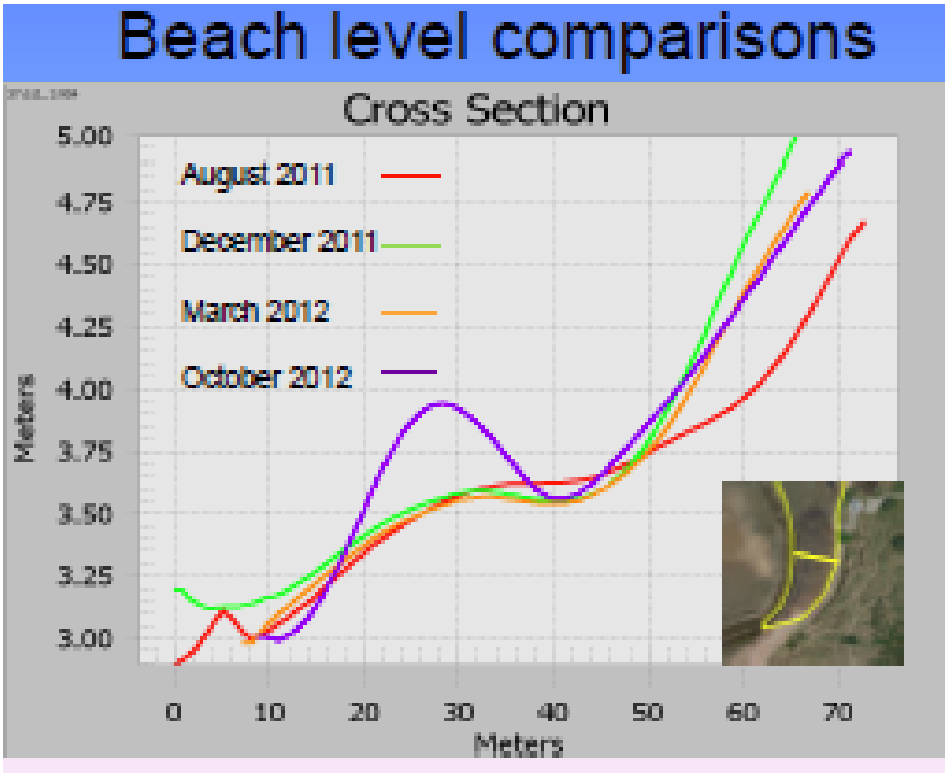





Beach level comparisons
Cross Section
August 2011
December 2011
March 2012
October 2012
Meters
5.0
4.5
4.0
3.5
3.0
2.5
0
25
50
75
100
125
Meters


Beach level comparisons
Cross Section
August 2011
(before scheme)
December 2011
Meters
5.00
4.75
4.50
4.25
4.00
3.75
3.50
3.25
3.00
0
10
20
30
40
50
60
70
80
Meters


Beach level comparisons
Cross Section
August 2011
October 2012
Meters
5.00
4.75
4.50
4.25
4.00
3.75
3.50
3.25
3.00
0
10
20
30
40
50
60
70
80
Meters


Beach level comparisons
Cross Section
August 2011
December 2011
March 2012
October 2012
Meters
5.00
4.75
4.50
4.25
4.00
3.75
3.50
3.25
3.00
0
10
20
30
40
50
60
70
Meters