

# Case study 55. Sandwich Tidal Defence Scheme

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**Main driver:** Improved defences and habitat creation

**Project stage:** Constructed, 2015



**Photo 1: Extent of flooding during tidal surge of 5 December 2013 and flood storage area in operation, saving 111 properties from flooding (source: Environment Agency Incident Room 2013)**

Discovery Park (Enterprise Zone) in foreground, previously at a 1 in 20 probability of flooding, was saved.

## Project summary:

Sandwich is a historic town and civil parish on the right bank of the River Stour in Kent (Map 1). A major inundation in the Sandwich and Deal area occurred in January 1953 when a North Sea surge – 4.7m Ordnance Datum (OD) at Pegwell Bay – caused the banks of the River Stour to overtop and breach, resulting in extensive flooding. A surge event occurred in 1976, estimated 1 in 25 (4% annual exceedance probability, AEP) and again in 1983, estimated 1 in 10 to 1 in 5 (10% to 20% AEP), causing flooding at Sandwich Quay with 16 properties suffering direct flooding. A scheme was constructed in 2015 to reduce the risk of flooding to the local community and businesses.

## Key facts:

The scheme provided a 1 in 200 standard of protection to both banks with 50 years of sea level rise included in the design. This protects 486 homes and 94 commercial properties in Sandwich (Photo 1). It cost £21.7 million, with £11.5 million provided in partnership funding from Kent Country Council and Pfizer.

The scheme consisted of 14.4km of strengthening and improving the existing tidal river defences, and creation of a 240ha tidal flood relief area between Sandwich and the mouth of the River Stour. Part of this enabled the creation of 20ha of new Biodiversity Action Plan (BAP) habitat, which includes a mosaic of wetland habitats.



## 1. Contact details

Contact details	
<b>Name:</b>	Environment Agency
<b>Lead organisation:</b>	Environment Agency
<b>Partners:</b>	Pfizer and Kent County Council
<b>e-mail address:</b>	SandwichTownTidal@environment-agency.gov.uk

## 2. Location and coastal/estuarine water body description

Coastal/estuarine water body summary	
<b>National Grid Reference:</b>	TR3518860787
<b>Town, County, Country:</b>	Sandwich, Kent, UK
<b>Regional Flood and Coastal Committee (RFCC) region:</b>	Southern
<b>Transitional and coastal water body name:</b>	Stour (Kent)
<b>Water Framework Directive water body reference:</b>	GB520704004700
<b>Land use, geology, substrate, tidal range:</b>	Town, golf course, farmland Beach and tidal flat deposits and seasonal wet clay. Spring tide height approx 1.95m

### 3. Background summary of the coastal/estuarine water body

#### Socioeconomic/historic context

Sandwich is a historic town and civil parish on the right bank of the River Stour. The study area comprises both banks of the river from Richborough Castle (about 10.5km upstream from the river mouth at Pegwell Bay) to the Stonar Cut (about 2km upstream of Pegwell Bay).

Pfizer Global Research and Development Centre (pharmaceutical industry), now renamed Discovery Park, is located within the Stonar Loop on the left bank of the river. The site is at significant flood risk. Pfizer announced in February 2011 that it intended to leave the site by 2012. A government task force is working with Pfizer to secure the future use of the site. This facility represents a large economic benefit to the region and the UK economy. Contributions have been agreed for the flood risk management scheme presented in this case study.

#### Flood and coastal erosion risk management problem(s)

Major inundation in the Sandwich and Deal region occurred in January 1953 when a North Sea surge (4.7m OD at Pegwell Bay) caused the banks of the River Stour to overtop and breach, resulting in extensive flooding within the study area. The breaches led to flooding of ~12km<sup>2</sup> of primarily agricultural land east of Sandwich, and within parts of Sandwich. There are no records of the number of properties flooded, although inspection of the flood record map indicates that there would have been ~20. In addition, there are reliable reports of a number of properties flooding in Strand Street (Sandwich) and people rescued from their houses by rowing boats. Flooding to the main urban areas was limited because flooding of the agricultural land nearer the sea acted as a buffer, effectively reducing the tidal river level further upstream. Since then, bank raising works on to the tidal embankments have increased water volumes in-channel and increased the risk of flooding to the upstream urban areas.

A surge event (4.1mOD at Pegwell Bay, estimated 4% AEP) occurred in 1976 but there is no record of property flooding. In 1983 a surge event caused flooding at Sandwich Quay with 16 properties suffering direct flooding. The water level on the quayside was recorded at 3.7mAOD (~0.2m deep). This is estimated to be equivalent to a 10–20% AEP event. Water levels just below 3.7mAOD have been experienced since 1983, but have not caused direct flooding.

The Sandwich Quay car park frontage experiences regular inundation. Minor flooding occurs nearly every year, causing a covering of silt on the car park.

#### Other environmental problems

Parts of the study area are subject to international and national nature conservation designations. The river corridor of the Stour from the coastline to the town centre forms part of the Thanet Coast Sandwich Bay Special Protection Area (SPA) and Ramsar site, the Sandwich Bay Special Area of Conservation (SAC) and the Thanet Coast to Hacklinge Bay Site of Special Scientific Interest (SSSI). There are also one national and 2 local nature reserves in the study area: Sandwich Bay National Nature Reserve, Gazen Salts Local Nature Reserve and Monk's Wall Local Nature Reserve.

The Sandwich Conservation Area straddles the River Stour, covering both banks in parts of the study area. This designation encompasses the historic core of the town of Sandwich and therefore the majority of the listed building designations within the town.

There are 3 Scheduled Monuments within the area of the proposed works:

- the later medieval Sandwich town walls (incorporating several sections of wall remaining throughout Sandwich)
- the site of the late medieval port of Stonar
- Fisher Gate on Sandwich Quayside

## 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 town of Sandwich falls within the Pegwell Bay to Kingsdown Flood and Erosion Risk Management Strategy. The strategy recommended reducing flood risk by making flood defence improvements to provide a standard of 0.5% AEP). This option consists of a range of embankment raising, new flood walls and associated landscaping and scour protection, together with a tidal flood relief area downstream of Sandwich using a spillway embankment next to the tidal river. Part of the tidal flood relief area would be used to create new BAP habitat.

Without intervention, the existing flood defences had a 1 in 2 (50%) probability of failure by 2020. With the deteriorating condition of defences, it was estimated that a 1 in 20 (5%) event now would cause breaches in the defence, flooding 409 residential properties and 94 commercial properties, including the Discovery Park site. This would increase to 864 and 185 respectively over the next 100 years.

The flood walls within Sandwich had been leaking during high spring tides in several locations over the past 10 years, increasing their risk of failure. The embankment at Stonar Lake (near the Discovery Park site) had been observed to leak during high spring tides and was considered to be a potential breach failure location. Had it failed, this would have led to a potentially life-threatening breach wave.

Assets at risk of flooding included:

- the railway line between Ramsgate and Dover
- the A256 main trunk road providing access between Deal/Sandwich and Thanet
- ~3km<sup>2</sup> of agricultural land
- Monks Wall Local Nature Reserve
- 3 Scheduled Monuments
- 24 listed structures in Sandwich

### What was the design rationale?

The Sandwich Town Tidal Defence Scheme is a partnership between the Environment Agency, Pfizer and Kent County Council. Some areas of Sandwich had a low standard of protection (only 1 in 20 chance of tidal flooding every year). Following the Pegwell Bay to Kingsdown coastal defence strategy in 2008, the Environment Agency developed a tidal flood defence scheme to provide a 1 in 200 standard of protection to 488 homes and 94 commercial properties in Sandwich with 50 years of sea level rise included in the design. Further work will be required in year 50 to raise the defences for the next 50 years.

The new tidal flood defence scheme will also protect:

- the neighbouring Discovery Park (Pfizer site)
- valuable infrastructure, such as the main coastal access routes
- important tourist and employment areas

The scheme comprised 14.4km of strengthening and improving the existing tidal river defences and creation of a 240ha tidal flood relief area between Sandwich and the mouth of the River Stour (Map 2). Part of the 240ha tidal flood relief area was used to win material for the new spillway, creating 20ha of new BAP habitat, which includes a mosaic of wetland habitats.

The scheme is the single largest flood defence scheme in Kent for 3 decades and the first of its kind in terms of being delivered in partnership with both public and private finance.



### Project summary

<b>Area of transitional and coastal water body or length benefiting from project:</b>	14.4km of watercourse length
<b>Types of measures/interventions used (Working with Natural Processes and traditional):</b>	<p>The scheme comprised:</p> <ul style="list-style-type: none"><li>• 14.4km of strengthening and improving existing tidal river defences</li><li>• creation of a 240ha tidal flood relief area between Sandwich and the mouth of the River Stour</li><li>• 20ha of new BAP habitat, including a mosaic of wetland habitats</li></ul>
<b>Numbers of measures/interventions used (Working with Natural Processes and traditional):</b>	2
<b>Standard of protection for project as a whole:</b>	1 in 200
<b>Estimated number of properties protected:</b>	582 properties – 488 homes and 94 commercial properties – in Sandwich

### How effective has the project been?

A tidal surge event hit the east coast of England on the night of 5– 6 December 2013 (Photo 1), during construction of the scheme. Approximately 40% of the scheme was already constructed, including the flood storage area. Had no works taken place prior to the storm surge, a total of 111 domestic properties would have flooded, with an estimated damage of £1.6 million.

The project created 20ha of wetland habitats on arable land, including 5km of reed-lined ditches and a new 6km public footpath on top of the flood defences. Within the first season after construction, the wetlands recorded the first ever breeding pair of avocets in east Kent and a breeding pair of little ringed plover – both a Schedule 1 species. During the winter, the larger wetland has significant numbers of migrant waders, including a large number of lapwing. The rapid establishment of the marginal vegetation and abundance of invertebrates within the new muddy margins of the ponds has been astonishing.

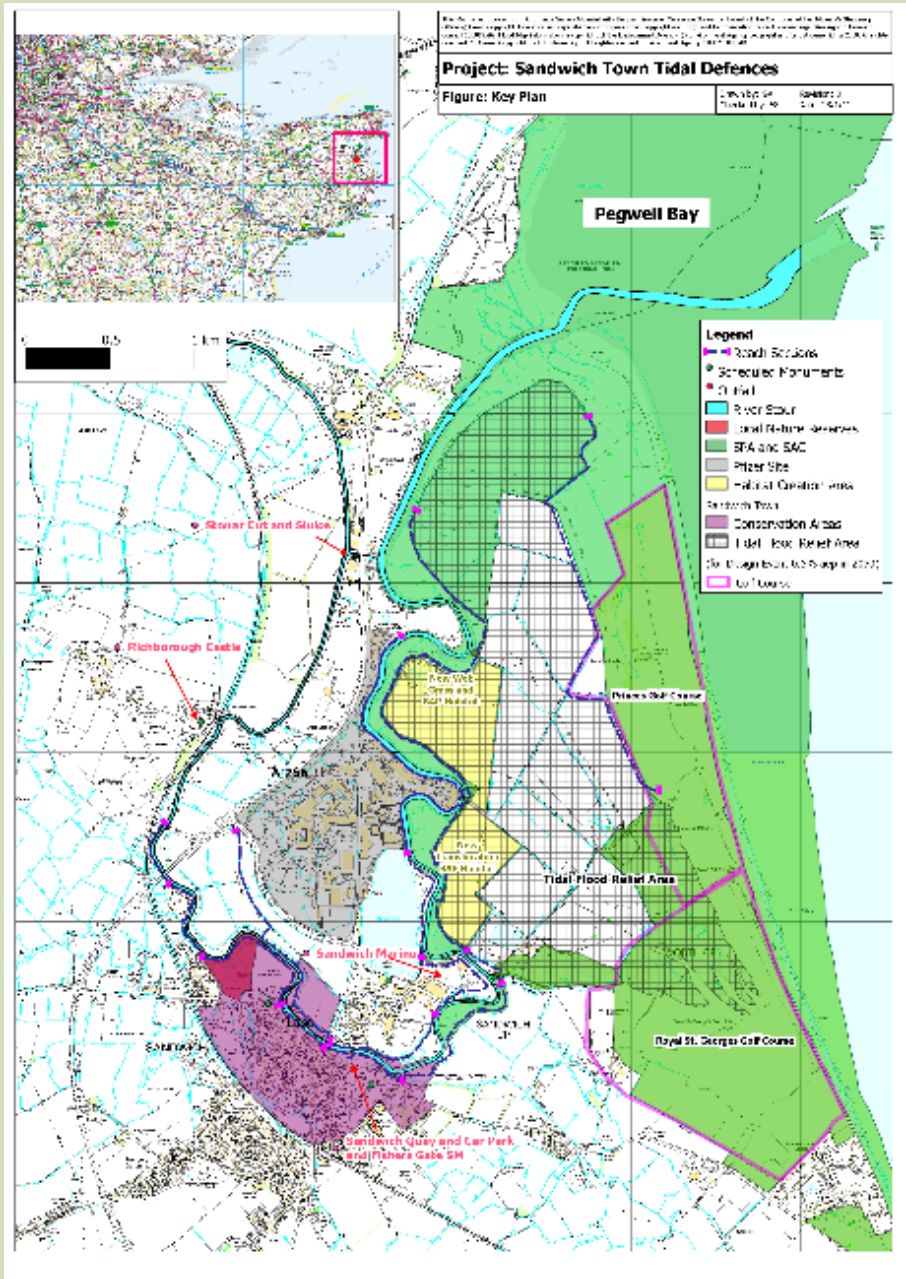
Photos 2 and 3 show the scheme during and after construction.



**Photo 2: Southern wetland area during (2013) (left) and after construction (2015) (right) (source: Environment Agency)**



Photo 3: Northern wetland area before construction (2013) (left) and after (2015) (right) (source: Environment Agency)



Map 2: Sandwich scheme (source: Environment Agency 2011)

## 5. Project construction

### How were individual measures constructed?

Excavation of the wetlands was carried out over 2 summer seasons. Their design and shape was dictated by the availability of the clay material for the flood defence embankments. The material was stockpiled and trucked to the required locations using temporary access tracks.

The final design was completed in 2014 to 2015 by 2 excavators, which shaped the breed/roosting bird islands and marginal habitats; these were designed to create seasonally wetted areas for roosting and feeding. The ditches and pond margins were planted with reeds by a company called Salix, which planted over 3km of coir rolls within the wetland and ditches to create the reedbed margin.

Water levels will be maintained year round by a fix crest weir to 0.5km north of the wetlands which drains into an outfall structure into the River Stour. The water levels are at 2.2m above OD for most of the year, except during the summer, where they are expected to drop to 1.2m above OD. It is planned to extend the Sandwich and Pegwell Bay National Nature Reserve to cover the new wetland in the future.

### How long were measures designed to last?

50 years – after which the tidal walls will need further raising

### Were there any landowner or legal requirements which needed consideration?

This scheme required:

- planning permission under the Town and Country Planning Act
- a Statutory Environmental Statement
- a licence under the Food and Environment Protection Act 1985 for excavation and construction within the intertidal zone
- Flood Defence consent from the Environment Agency under the Land Drainage Act 1991 for the changes to the drainage of watercourses
- Natural England support under Schedule 9 of the Wildlife and Countryside Act 1981 (as amended by the Countryside and Rights of Way Act 2000)
- a Water Framework Directive assessment
- Scheduled Monument consent.
- a Habitat Regulations assessment

## 6. Funding

### Funding summary for Working with Natural Processes (WWNP)/Natural Flood Management (NFM) measures

<b>Year project was undertaken/completed:</b>	2013 to 2015
<b>How was the project funded:</b>	Flood Defence Grant in Aid External contributions from Kent County Council and Pfizer
<b>Total cash cost of project (£):</b>	£21.7 million  £11.5 million of the total cost was secured through third party contributions towards capital and maintenance costs.



<b>Overall cost and cost breakdown for WWNP/NFM measures (£):</b>	£640,000 for environmental mitigation £12.2 million for construction £11.5 million for future maintenance
<b>WWNP/NFM costs as a % of overall project costs:</b>	5.2% of total cost spent on environmental mitigation
<b>Unit breakdown of costs for WWNP/NFM measures:</b>	Not available
<b>Cost–benefit ratio (and timescale in years over which it has been estimated):</b>	10.5

## 7. Wider benefits

### What wider benefits has the project achieved?

The project's main aim was to improve flood risk from a 1 in 20 to a 1 in 200 level of protection. A secondary aim was to create 20ha of new wetland habitats. However, 2 further opportunities arose to include amenity improvements during the detailed design of the scheme

The first came when Natural England asked if the new England Coast path could be accommodated on top and alongside the flood defences. A route was planned to open up access to the new wetlands for people to enjoy, but make sure the route did not increase disturbance to the bird species it was planned to attract. A total of 6km of newly surface footpath was created for locals and birdwatchers to enjoy.

The second opportunity presented itself when Sandwich Town Council indicated that a small car park could be used by the flood defence scheme. This offered the opportunity to enhance a key focal point of the medieval town by turning the car park into a viewpoint and seating area overlooking the River Stour (Photo 4). This was well received locally as illustrated by the following comments:

‘The architect/designer has done a marvellous job. What particularly impressed me was the decorative curved stonework on the bridge which was continued around the edge to the side of the quay – the curve has been echoed in the new stonework and it looks fantastic and will improve once it's blended with age into the original stonework. The attention to detail is excellent and your contractors have brought the plans to life and done a superb job’. A Sandwich resident

‘Just a quick message to say how nice I think the Quay looks now you have finished the work there. I walk over the tollbridge to work every day and I think that you have done a wonderful job. It was nice to see so many people there over the August Bank Holiday just enjoying the area or sitting eating their fish & chips from the takeaway’ Local business woman



**Photo 4: Sandwich Quay before and after construction (source: Environment Agency)**



### **How much habitat has been created, improved or restored?**

A total of 20ha of wetland habitat was created.

The scheme-specific Habitats Regulations assessment concluded that the scheme will have no likely significant effect on the integrity of the Natura 2000 sites.

A Water Framework Directive assessment concluded that the scheme was unlikely to have an adverse effect on the 4 environmental objectives of the River Basin Management Plan.

The reconnection of the river with the floodplain and the wetland BAP habitat creation in the tidal flood relief area are likely to have a beneficial effect on the future ecological potential of the watercourse.

## **8. Maintenance, monitoring and adaptive management**

### **Are maintenance activities planned?**

£11.5 million has been set aside for future maintenance.

### **Is the project being monitored?**

The project has a planning condition to implement and monitor the new habitats within reaches 8 to 11; this is being carried out by the Sandwich Bird Observatory, with the weed control and habitat maintenance being undertaken by a private contractor.

### **Has adaptive management been needed?**

In 50 years' time, the scheme will need to be revisited and walls raised further to take account of the impacts of sea level rise.

## **9. Lessons learnt**

### **What was learnt and how could it be applied elsewhere?**

When implementing environmental enhancement works alongside flood defence schemes that involve winning material, it is essential to secure the land early on (with use of a Compulsory Purchase Order if necessary) or by concluding the land negotiation early with the landowner.

## **10. Bibliography**

ENVIRONMENT AGENCY, 2011. *Sandwich town tidal defence scheme. Project Appraisal Report*. Worthing: Environment Agency.

### **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](#).