

Case study 53. Rye Harbour Farm Regulated Tidal Exchange

Authors: Tom Cook and Anthony Bishop

Main drivers: Improved defences, protection of a SAC and habitat creation

Project stage: Construction complete 2006 (scheme), 2011 (habitat)



Photo 1: Rye Harbour Farm looking north-east towards River Rother (source: Environment Agency)

Project summary:

Regulated Tidal Exchange is the regulated exchange of seawater to an area behind fixed sea defences, through engineered structures (e.g. sluices, tide-gates or pipes) to create saline or brackish habitats. This regulated tidal exchange project involved a combination of Working with Natural Processes (WWNP) and traditional measures to manage flood risk and create/restore habitat on the Sussex coast at Rye Harbour (Map 1).

- A secondary defence bund to protect low-lying communities
- Non-intervention shingle primary defence within a Special Area of Conservation (SAC)
- Creation of a tidal exchange to provide an intertidal habitat area landward of the primary defence
- Creation of a large tidal creek into the site to provide an important area of saltmarsh, creeks and intertidal mud (Photo 1)
- Saline lagoons and vegetated shingle created
- Coastal grazing marsh and ponds created on landward of the secondary defence

Key facts:

In November 2013, a tidal surge entered the habitat creation area, providing a large area of tidal storage, which was then gradually released via the new creek. The habitats are robust enough to respond positively to tidal changes and also provide a large area where water can be harmlessly stored.

The shingle beach is part of the Dungeness SAC and is Europe's largest area of coastal vegetated shingle. The huge diversity of plants and invertebrates makes this one of the country's most important sites for wildlife.



Map 1: Rye Harbour Nature Reserve

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1. Contact details

Contact details

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2. Location and coastal/estuarine water body description

Coastal/estuarine water body summary

National Grid Reference:	TQ 94357 18509
Town, County, Country:	Rye Harbour village, Rye, East Sussex, UK
Regional Flood and Coastal Committee (RFCC) region:	Southern

Transitional and coastal water body size (km²):	Sussex East coastal water body: ~12,000ha Rother transitional water body: ~40ha
Transitional and coastal water body and location:	Rother Estuary
Water Framework Directive water body reference:	Sussex East (GB640704540002) Rother (GB540704016100)
Land use, geology, substrate, tidal range:	Nature reserve on shingle, sand, clay and mud. A maximum high tide recorded in the tide tables for Rye Harbour which is of 5.3 m and a minimum height of 0.1 m

3. Background summary of the coastal/estuarine water body

Socioeconomic/historic context

Rye Harbour Farm is a former arable farm of some 120ha located between the villages of Winchelsea Beach and Rye Harbour in East Sussex. Rye Harbour Farm had previously been embanked to keep out the tide. Rye Harbour Farm is situated within the Dungeness, Romney Marsh and Rye Bay Site of Special Scientific Interest (SSSI) and the Dungeness to Pett Special Protection Area (SPA). It is also adjacent to the Dungeness SAC and the Rye Harbour Nature Reserve, which cover the shingle ridges between the farm and the sea.

The Environment Agency bought Rye Harbour Farm in 2003 to provide a site for a secondary sea defence embankment and compensatory vegetated shingle habitat as part of the Pett Frontage Sea Defences Scheme. The scheme was designed so that it could provide an area of tidal storage, while the creation of a creek system directly linked to the Rother transitional water body provided improved management of storm events and additional habitat creation. The secondary defence offers better protection to a large number of low-lying properties at Winchelsea Beach and Rye Harbour village.

Planning consent for the Pett Frontage Sea Defences was granted in 2003 subject to the condition that an approved Land Use Agreement was entered into for the beneficial afteruse of the remaining areas of Rye Harbour Farm. The Environment Agency presented a Land Management Agreement for proposed nature conservation use of the farm to Rother District Council at that time. The implemented scheme completes the Agreement as per the original planning application and an important element in restoring this area of the Dungeness, Romney Marsh and Rye Bay Site SSSI to 'favourable condition'.

The site is now leased to Sussex Wildlife Trust as part of Rye Harbour Nature Reserve. It is a popular tourism attraction on the south coast and provides an important amenity for residents of Rye and Rye Harbour village.

Flood and coastal erosion risk management problem(s)

The Environment Agency's Folkestone to Cliff End Flood Risk Management Strategy set out plans to manage flood and erosion risks along that this stretch of the south coast over the next 100 years, taking the predicted impacts of climate change into account. Some of the existing defences are reaching the end of their design life, leaving areas at an increased risk of flooding. The Pett Frontage Sea Defences, Rother Tidal Walls West and Rye Harbour Farm are some of the schemes identified by the strategy (Environment Agency 2015). They not only protect local communities but also allow natural processes to take place within the Dungeness SAC to protect and mitigate for impacts on the drift line and perennial vegetated shingle.

Other environmental problems

Earlier farming at Rye Harbour Farm had led to a loss of coastal habitats, although the Environment Agency had ownership of the adjacent shingle beach (now an SAC) fronting the coast. In addition, Rye

Harbour Farm, which is within the Dungeness, Romney Marsh and Rye Bay SSSI, was not in favourable condition. Under the Countryside and Rights of Way Act 2000, the Environment Agency is required to have regard to the desirability of furthering the conservation of SSSIs in the conduct of its duties and to work towards their improved condition.

Two fields at Rye Harbour Farm (Fields 5 and 6) were reclaimed in about 1960 from their original saltmarsh and shingle ridge habitat for arable use; the scheme has restored the former land use. At the eastern end of Field 6 near the tidal River Rother, the reclamation was achieved in part through filling the former main creek with waste material. This material posed a potential health and safety risk after being exposed during excavation of a borrow pit for the Pett Frontage secondary embankment works. The Rye Harbour Farm scheme presents an opportunity to manage this waste securely for the future.

The scheme falls under the Town and Country Planning Environmental Assessment Regulations 1999. Due to the scheme's objectives and issues, an Environmental Statement was produced as part of the outline design stage. The most important environmental risks identified included:

- the presence of protected species (mitigation – trap and relocate following detail surveys for appropriate species)
- increase in groundwater salinity (mitigation – considered to be low risk following a conceptual groundwater model)

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)

This solution was based on preventing harm to European designated sites and providing much needed compensatory and migratory habitats. The design allows for more natural processes throughout the SAC shoreline as the SAC vegetated shingle is 'non-intervention' and therefore Working with Natural Processes (WWNP). The creation of additional intertidal habitats was principally to provide additional habitat on the site, but allows a combination of natural processes and habitat management by the Sussex Wildlife Trust to take place. This provides a balance between natural processes and management for public benefits.

What was the design rationale?

- Non-intervention stretch of shingle beach (3.5km) (WWNP)
- Re-creation of intertidal habitats and allowing these to colonise and evolve (WWNP)
- Secondary sea defence (engineered solution)
- Shingle recycling around the non-intervention stretch of coast (engineered solution)

Project summary

Area of transitional and coastal water body or length benefiting from project:	100ha habitat creation site (~20ha intertidal) 3.5km of natural shingle beach/100ha of improved management of natural shingle beach
Types of measures/interventions used (Working with Natural Processes and traditional):	Non-intervention Intertidal habitat creation (tidal exchange)
Numbers of measures/interventions used (Working with Natural Processes and traditional):	2 WWNP 2 traditional
Standard of protection for project as a whole:	Property protection is all provided by the secondary defence and is therefore 100% engineered. The WWNP

	elements safeguard habitats and may also help provide additional flood storage on land that was previously farmland.
Estimated number of properties protected:	There are no direct damages or benefits as a result of reduced flood risk to property as a result of this scheme.

How effective has the project been?

WWNP is not providing a measureable benefit to properties, but it is providing a cost-effective way of managing the land. The purpose of the scheme is environmental enhancement through habitat creation.

The multiple benefits of the site and the enlargement of the nature reserve have improved local amenity and tourism. Therefore the benefits are savings for management, improved habitats and socioeconomic factors (amenity). Specifically the project has:

- improved the habitat within an SSSI/SPA and extended the features of an SAC
- improved public footpaths around the site, better fencing and easier access to bird hides
- led to significant improvement in the numbers and range of species found on the site
- enabled successful management of the nature reserve and additional investment by Sussex Wildlife Trust

5. Project construction

How were individual measures constructed?

The preferred option was a regulated tidal exchange solution made up of the following elements:

- Excavation of approximately 55,000m³ of material won from Fields 1– 4 to create a freshwater wet grassland, ponds and ditches, and topsoil stripping across Fields 4 and 6 to expose the former shingle ridges
- Filling of the existing borrow pits in Field 6 and capping of the waste material to prevent future erosion
- Excavation of a new creek network across Field 6 and construction of culverts linking the tidal River Rother to Fields 5 and 6 to create an intertidal habitat
- Construction of a new sheet piled outfall structure to the main tidal River Rother channel at the existing Western Training Wall Sheet Piling
- Future site management to maximise the quality of the mosaic of habitat as it establishes
- Non-intervention shingle beach –no construction
- Shingle recycling: annually outside of the SAC.

How long were measures designed to last?

This was a 50-year project for the Pett Frontage Sea Defences and Rother Walls West. It will be reviewed in around 2050.

Were there any landowner or legal requirements which needed consideration?

- Land purchase
- Requirements associated with SSSI, SAC, SPA and potential Ramsar site designations
- Negotiations with adjacent landowners over the water level change

6. Funding

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

Year project was undertaken/completed:	Environment Agency Flood and Coastal Risk Management (FCRM) funding 2003 to 2011 + ongoing management
How was the project funded:	Flood Defence Grant in Aid Ongoing management: partnership of Environment Agency (FCRM), Sussex Wildlife Trust and others
Total cash cost of project (£):	£1.6 million of which £790,000 was for construction
Overall cost and cost breakdown for WWNP/NFM measures (£):	£1.6 million, of which £790,000 was to construct the WWNP measures Ongoing maintenance and monitoring: annual £30,000 contribution to nature reserve (largely for nature reserve/people management)
WWNP/NFM costs as a % of overall project costs:	49%
Unit breakdown of costs for WWNP/NFM measures:	Not available
Cost–benefit ratio (and timescale in years over which it has been estimated):	See Table 1

Table 1: Benefit–cost ratios and Outcome Measures (source: Environment Agency business case)

	Contribution to Outcome Measure
OM1 – Economic Benefit: present value benefits–costs ratio	£1,612/£2,099 = 0.77
OM2 – Households at risk	0
OM2b – Households moving risk bands	0
OM3 – OM2b households in deprived areas	0
OM4 – Improvement of condition of SSSIs	31ha
OM5 – Biodiversity Action Plan (BAP) habitats	31ha (of which ~17ha for OM5i)
OM Prioritisation Score	18.7

7. Wider benefits

What wider benefits has the project achieved?

- Habitat – securing management and extension of nature reserve and designated sites
- Access to green space and improved footpaths
- Aesthetic value – restoring views of coastal habitats

- Cultural activities – the nature reserve has an environmental education programme
- Property value – possibly.
- Tourism increase (due to improved nature reserve and access) providing more for the local economy

How much habitat has been created, improved or restored?

- 100ha of water-dependent habitat created to help meet Water Framework Directive, Habitats Directive, Birds Directive and Biodiversity 2020 targets
- 100ha of coastal habitats with improved management to meet Water Framework Directive and Habitats Directive targets

The scheme has created ~31ha of new BAP habitat made up of ~17ha intertidal saltmarsh, ~5ha of restored shingle ridge, ~8ha of wet grassland and ponds, and ~1ha of lowland meadow. The actual areas and mixed proportions of these different habitats will be determined by local site conditions and natural processes as the habitat establishes.

An estimate of the monetarised value of the habitat created and its recreational use was made using the guidance given in the 'Economic Valuation of Environmental Effects Handbook' (Eftec 2007) have an estimated valuation of the environmental benefits of £1,612,000 (Environment Agency 2010).

Photo 2 shows 2 views of the area in 2011 following completion of the construction of the secondary sea defences and the creation of the habitat.



Photo 2: Two views of Rye Harbour Farm in 2011 (source: Environment Agency)

8. Maintenance, monitoring and adaptive management

Are maintenance activities planned?

Maintenance of the reserve is ongoing.

Is the project being monitored?

The monitoring programme covers geomorphology, fish, birds, plants and invertebrates.

Has adaptive management been needed?

The design of the intertidal area has made its management a learning process.

9. Lessons learnt

What was learnt and how could it be applied elsewhere?

Tidal exchange will cost more in terms of long-term maintenance than entirely natural intertidal habitats due to the coastal processes attempting to change the coastline. When planning a project, it is therefore important to consider carefully these long-term maintenance costs versus higher capital costs. The Environment Agency's FCRM function currently has no way of planning for ongoing maintenance of compensatory habitat sites and the costs of this. The partnership approach with local trusts is the lowest cost option, but ideally the Environment Agency would hope to achieve coastal improvements using WWNP without owning the land.

FCRM teams need to ensure there is early engagement with their colleagues in Fisheries, Biodiversity and Geomorphology (FBG) and other stakeholders so that projects are properly integrated. This is more cost-effective than delivering elements separately and avoids mistakes in the design of the FCRM scheme.

10. Bibliography

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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](#).