

Minsmere Flood Risk Management Scheme

working with nature to adapt to climate change was the most successful and sustainable approach in this environmentally-sensitive coastal area

by Alex Schofield & Ed Ferguson

Minsmere Nature Reserve is owned and run by the Royal Society for the Protection of Birds (RSPB) in Suffolk, England. The site is internationally designated as a Special Protection Area, Special Area of Conservation, and Ramsar site (internationally important wetland); as well as being nationally designated as a Site of Special Scientific Interest and Area of Outstanding Natural Beauty. The coastal frontage (seaward of the coastal defences) is important for its coastal features, whilst the area landward of the coastal defences is important for its freshwater habitats and species.



View of the penstock controls, where timber fencing provided safety and aesthetically blended into the natural landscape of the Minsmere Royal Society for the Protection of Birds (RSPB) reserve - Courtesy of Black & Veatch

Understanding the need

To maintain the welfare of the public and our natural areas we are often required to try and exert control over natural forces. But resisting coastal change through hard-engineering is often not the most sustainable solution. Instead, there is a growing awareness of the need for engineering solutions to work with nature.

The project team and stakeholders understood this need in the planning, design and implementation of a scheme to help protect an internationally important area of nature conservation lying on one of the UK's fastest-eroding coastlines. The Minsmere Flood Risk Management Scheme allows natural coastal change to occur while protecting the majority of the freshwater features of the nature reserve from the sea.

Existing defences

The coastal defences consist of a frontline dune system (primary bank). A tidal sluice and outfall approximately midway along the frontage drains the hinterland via gravity. A man made secondary bank is located behind the primary bank north of the sluice. The sea defences have been under increasing pressure from the sea, with the primary sea defence being breached during a surge in

2006. Simply maintaining the pre-existing sea defence system would mean that coastal habitats would be increasingly subjected to coastal squeeze, as sea levels rise in the future. Allowing the coastal defence to fail would lead to the loss of the internationally important freshwater site.

The Environment Agency had previously engaged Black & Veatch to investigate flood management options for the Minsmere coastal frontage when the existing flood defences ceased to provide an adequate standard of protection due to coastal erosion and sea level rise. Black & Veatch had also developed the business case for the selected solution; which was largely driven by the need to defend the internationally protected habitats and species at the site from deterioration (a requirement of the Habitats Directive).

Preferred solution

In April 2010, the Environment Agency commissioned the preferred solution which was identified through close working with Natural England, the RSPB and other stakeholders. The solution was to allow the most at-risk coastal defences to continue to evolve under natural processes in one area – for which 28 hectares of replacement 'Compensatory' habitat has been included as part of the project –

whilst protecting the majority of the freshwater site against coastal flooding. An existing earth embankment, known as the Coney Hill Cross Bank, separates two areas of the Minsmere site.

This was rebuilt to provide a controlled cut-off between the two areas and therefore an improved line of defence from coastal flooding within the RSPB reserve. A new culvert was constructed through the bank and an associated water control structure was installed. Two coastal bunds were also required to help reduce erosion on the coastal frontage.

Undertakings

The Environment Agency led and funded by the £1m sea defences project with Black & Veatch providing detailed design and site supervision for the scheme. This included environmental surveys; preparing and submitting the planning application (which included an Environmental Report to document the Environmental Impact Assessment); and preparing the contract document pack for tender and construction.

For the construction phase of the works, Black & Veatch continued to provide design and environmental support to the team, undertaking the roles of Site Supervisor and Environmental Clerk of Works. Interserve was the scheme's principal contractor.

Rising to the challenges

Project challenges were threefold: a large volume of construction traffic to a remote location; the technical problems of soft and very wet ground conditions; and the number of protected species in the area.

Construction traffic: The remote location and popularity of Minsmere posed a substantial design and construction challenge. More than 90,000 visitors to the reserve annually use a single-track road, which passes through villages and becomes a footpath for the

final 3km. After concluding that on-site fill material for the flood-defence embankment was not an option and despite reducing the required volume by a third through reuse where possible, the project team realized that importing fill material to the remote rural site would disturb the local community as well as the RSPB reserve and would pose safety risk associated with public interaction with site vehicles and plant. The team focused on risk mitigation through effective coordination, planning and communication.

Early engagement with stakeholders enabled the project team to identify the best site route and constraints. With the RSPB, the team implemented an alternative route for a footpath along – but safely removed from – the reserve's access road. Traffic management discussion with the local community through the Parish Council and public forum identified additional constraints, such as important local events. The team developed design-stage traffic management plan (TMP), which was disseminated as a national best practice for projects with similar issues. The contractors further developed this in construction-phase TMPs with their tender returns. Close work with the RSPB and distribution of community newsletters helped foster understanding and acceptance.

Success can be measured not only by the complete absence of accidents and complaints but also by multiple positive comments and an RSPB reserve visitor's tweet that said it all: "*If you want to see best-practice traffic management, come to Minsmere.*"

Ground conditions: The new flood embankment was constructed within a reed bed. The soft and wet ground presented a technical and construction challenge that was addressed through various measures. Alignment of the new flood bank was designed to take advantage of better areas of ground, and the foundation and toe detail of the bank were designed to avoid excavation into the soft ground; geotextile and hard core layers were used to create a firm foundation. A partnered approach led to a construction



Minsmere coastal area, designated internationally as a Special Protection Area, a Special Area of Conservation and Ramsar Wetland
Courtesy of Black & Veatch

methodology that consisted of creating a haul road from an existing raised footpath that later formed part of the new embankment. This provided an access route across the reed bed and also precluded the need for working platforms within the reed bed.

Species protection: While the goal of the project was to protect as much freshwater habitat as possible, everyone involved with the project was keenly aware of the need to protect the reserve's many rare and protected species of plants and animals during construction. To this end project personnel worked closely with RSPB to carry out species surveys, design ecological mitigation measures, reduce and manage water levels, and utilise the most appropriate plant and equipment (for example, an amphibious excavator was used to undertake works in the reed bed).

Restricting the timing of work to outside the bird breeding season required careful advanced planning and rapid construction activity. Working hours and materials delivery were scheduled so as to minimize disturbance to birds and bats as well as school collections and drop-offs. The works commenced in September 2011 and were completed by January 2012. Although winter is not the ideal time for construction, activities were planned to make the best use of favourable weather.

An environmental scientist on the project team developed mitigation plans for the main protected species of flora and fauna. The scientist also facilitated mitigation of an invasive plant species to avoid spreading. 'Species management cards' produced in conjunction with the contractor's environmental representative informed site workers what to look for and what to do upon spotting these species.

Other special measures to protect wildlife included the following:

- Staging of vegetation clearance prior to construction to encourage water voles to voluntarily vacate the working areas.
- Capture and relocation of reptiles to other parts of the Minsmere Nature Reserve prior to topsoil stripping.
- Fish relocation (through electro-fishing and capture-release), to a non-affected area of the site, prior to lowering of water levels.
- Design and construction of a bespoke eel pass for the new water control structure conforming to the RSPB's specific operational requirement.
- Well-considered site compound and access route fencing to minimise disruption to the range of species present (for example to allow continued deer crossings).

Additional project highlights and acclaim

The works were carefully designed with full consultation with the RSPB to ensure they blended well with the reserve. For example, sand was used to cover the clay coastal embankment, then existing vegetation was put back into place to provide a more natural appearance.

Site waste minimization, environmental action plans and a carbon calculator provided direction and benchmarks, and demonstrated cost savings of £142,000 as well as a carbon saving of 43%.

The project has earned multiple awards in recognition of environmental and project safety achievements.

- Gold-level Green Apple Award in November 2012. This national campaign recognizes Britain's greenest companies, councils and communities for Environmental Best Practice. The Green Apple Awards honour environmental endeavour, and the Gold award is the highest accolade bestowed by the Green Organisation.
- Earlier last year the Minsmere project was credited across all

four categories; physical achievement, sustainability, team achievement, and technical excellence and innovation, with the Institution of Civil Engineers (ICE) East of England Merit Award.

- The Association for Project Safety (APS) awarded the scheme 'Engineering Project of the Year' at its Annual Awards 2012. The APS awards recognize excellence in health and safety risk management in the construction industry. The judges cited "excellent early cooperation between designers and contractors" and the "huge effort... to protect the public during construction" as award-worthy achievements.

Conclusion

The construction works were successfully completed in January 2012, slightly ahead of schedule and under budget. A truly collaborative effort has brought to conclusion a scheme of significant environment value. Despite a myriad challenges, project participants successfully built a new coastal defence that will continue to mitigate natural but destructive forces and protect the 246 hectare internationally treasured environmental and landscape asset, along with 12 homes, for the next 50 years.

Early planning allowed project participants to work within a special area heavily populated by wildlife and visited by admirers with minimum impact to people and the environment. Effective overall management, a partnered team with shared vision, and engagement with the local community were some of the factors that contributed to the success of the Minsmere flood risk management scheme.

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Narrow access road, depicting one of the most severe project challenges and requiring careful traffic management planning and effective public communication - Courtesy of Black & Veatch



Visiting children from the local primary school with their painted observations, as part of the community education and outreach programme - Courtesy of Black & Veatch