MINEHEAD SEA DEFENCES SCHEME

- taming the tempestuous tides

ENVIRONMENT AGENCY

MINEHEAD

THE TOWN AND THE TIDES

The West Somerset town of Minehead is situated on the coast at the foot of North Hill, an outcrop of Exmoor. Traditionally, the tides there have been a mixed blessing. They helped the town become a prosperous port and more recently, a thriving holiday resort. But in contrast their potential for flood has brought damage and misery.

There has been a long history of waterfront activity in Minehead. A flourishing shipyard provided vessels for the busy harbour with over 40 registered boats in its heyday during the early 1700s. Trade, particularly in herrings, was carried out with a large number of places including the West Indies, Virginia, France, Spain and Ireland.

Daniel Defoe, author of Robinson Crusoe, visited Minehead at the time and described it as "the best port and safest harbour" along the Bristol Channel.

Although considered safe compared to other ports, Minehead was not immune to the ravages of the tides. The Luttrell family, which owned the harbour for hundreds of years, graphically described the power of the sea in a report to the Government. They wrote:

"that about Christmas 1715, by the badness of the weather and tempestuous tides then happened, it shattered, loosened and broke down the top walls or breast work on the old key all round, and broke down and damnified some of the wharfe walls and houses....."

Front cover storm photograph - Graham Sizer

In the latter part of the 18th century, the port went into decline, but a new and equally rewarding economy grew from Minehead's emerging attraction as a health and holiday resort.

A directory published in 1794 said that "on account of the pleasantness of the situation and salubrity of the air, a number of persons of fashion have been induced to visit it as a bathing place in the summer season".

The status of Minehead as an important seaside town was confirmed when the Great Western Railway extended its tracks there in 1874 and later when a major complex was built by Butlins in the 1950's.

But alongside the sunshine and clean air there was also still the spectre of tidal flooding. Over the years, various attempts were made to build up the sea wall only for Mother Nature to gain the upper hand again.

A local newspaper described how on 2 November 1859, a 'hurricane' caused 'considerable damage'. It reported that:

'a great part of the sea wall, which protected the quay houses, was beaten down by the waves. Doors and windows were driven in, the rooms filled with mud and fragments and every fishing boat belonging to the place has been literally beaten to pieces.

'Part of the street leading to the Pier is washed away close to the foundations of the houses, and the inmates are driven out into the open air, or compelled to risk their lives by retiring to their upper rooms, everything below being smashed by the fury of the waves.'

Major floods have also been recorded this century in 1910 ('a tidal wave' according to the local newspaper) 1936 and 1981. More recently, flooding has taken place in 1989, 1990, 1992 and January and October, 1996.

The various piecemeal attempts to provide sea defences had obviously not been enough. It was clear that a comprehensive solution was required. The Environment Agency decided to meet the challenge of taming the tides and generally improving the amenity of the seafront at the same time, by promoting a £12.7 million project aimed at truly making a difference that lasts. This booklet tells the story so far.

▲ *Sea wall damage after storm, 1910*
▶ *Sea wall damage after storm, 1996*

Photograph - Graham Sizer

BACKGROUND

Minehead is situated in the Bristol Channel - an area of water that is subject to one of the largest tidal ranges in the world as well as very fast running tides and currents.

The sea defences at Minehead have existed for several hundred years. When the town was just a small hamlet, it was protected from the sea by a high beach which was backed by a natural shingle and cobble ridge. As the town grew, the ridge was gradually replaced with a masonry wall. West of the harbour, barriers, known as groynes, were also put in place and the combination of these and the new wall has contributed to a significant loss of beach material since the beginning of the 20th Century.

The existing wall has suffered from frequent damage and despite repairs is now reaching the end of its 'useful life'. Further flooding of private houses, businesses and Somerwest World would be unacceptable. The poor condition of the existing defences may not withstand a further serious storm and a breach is a very real threat. If improvements are not made in the near future it is estimated that storm damage to local houses, businesses and Somerwest World could cost somewhere in the region of £21million at present day prices over the next 50 years.

Responsibility for the upkeep of the sea wall lies with the Environment Agency, West Somerset District Council, Rank Group and Somerset County Council. Before commencing any kind of improvements, it was decided to employ consulting engineers to assess the situation and advise on the best and most

economical way of proceeding. Mouchel Consulting Ltd. were selected to carry out this important task.

Flood defence engineers describe the severity of storms in terms of a 'return period'. This is a statistical term and it is used to measure the frequency of any storm event. So a storm with a return period of 100 years means there is a one in a hundred chance of such a storm occurring in any one year. It was calculated that a storm of this size would see the town suffering an inundation of 120 million gallons of water which would engulf the Esplanade, Somerwest World, across the Warren and industrial areas to the south. The new defences planned for Minehead have been designed to withstand such a storm. The area could still flood in a really extreme event, but even then the effects would be dramatically reduced and controlled.

▲ *Minehead Seafront 1920 and 1992*

HOW THE SCHEME WAS DEVELOPED

PROJECT SEQUENCE

CONSULTATIONS

1992

- PROJECT START
- FEASIBILITY AND ECONOMIC JUSTIFICATION
- EXAMINATION OF POSSIBLE OPTIONS
- SELECTION OF PREFERRED SOLUTION
- ENVIRONMENTAL APPRAISAL AND DESIGN DEVELOPMENT
- PLANNING APPROVAL OF DETAILED DESIGN
- MAFF APPROVAL FOR GRANT FUNDING

1997

- CONSTRUCTION START

Consultations

The primary objective of this scheme is to provide flood protection. However, the Environment Agency are equally committed to ensuring that environmental issues and public concerns are fully taken into account as schemes such as this develop. In this way, potentially adverse impacts can be minimised and opportunities for mitigation can be taken.

A considerable number of organisations and individuals have been consulted during the course of the project, both through the formal planning process, and by direct contact, public exhibitions, meetings, and a questionnaire. Consultations enabled valuable information and views to be collected on a wide range of issues including amenity, visual impact, archaeology, conservation and construction impacts. A comprehensive Environmental Report was produced based on the information obtained, and this report was used to support the planning application for the scheme which gained planning approval in November 1996.

▲ *Medieval fish weirs in Minehead bay are still in use today.* *Picture: Christopher Jones*

Archaeology

The potential effect of the scheme upon important archaeological sites within the bay has been a key consideration. Minehead Bay contains a wealth of archaeological features, including medieval fish weirs which are still used today by locals as well as commercial fishermen. These structures, visible at low tide, are Scheduled Ancient Monuments, and it has been important to ensure that the sea defences scheme will not affect these or any other significant archaeological sites in the Bay. Consultations have taken place with English Heritage and the County Archaeologist, and the Agency has commissioned archaeological site surveys to record and evaluate existing features. During construction, the Agency will be undertaking a "watching brief" to record and evaluate uncovered areas and ensure known sites are not disturbed.

Amenity

During the scheme development, careful consideration has been given to safeguarding and improving the amenity value of the seafront.

The importance of the fine sea views, safe access onto the beach, and the provision of seating have all been taken into account when designing the new sea defences. Whilst raising the wall to protect against flooding, it has been important to counterbalance this with raising the promenade and shelters wherever possible to retain views of the bay.

Existing access onto the beach is in need of improvement, and the scheme has provided the opportunity to do something about this, especially for the benefit of people using pushchairs and wheelchairs. New ramped access points will be provided as part of three new attractive seating and viewing platforms at intervals along the promenade (see artist's impression on centre pages).

These improvements, together with enhancement proposals put forward by West Somerset District Council, will greatly add to the attraction of Minehead for residents and tourists alike.

THE SEA DEFENCES SCHEME

QUAY STREET

ROCK ARMOUR
will be deposited next to the seawall along Quay Street and the Esplanade to break wave energy. This solution was preferred to that of beach replenishment and construction of additional groynes as this may have caused obstacles and increased siltation affecting harbour usage.

Steps

RAISED PAVEMENT LEVELS
adjacent to the sea wall will retain sea views for pedestrians. Includes new seating areas and raised shelters.

Slipway

NEW SEA WALL
with curved profile.

ESPLANADE

Steps

Ramp

Ramp

Ramp

Ramp

JUBILEE GARDENS REDEVELOPMENT
This will include raised shelters and seats allowing views of the bay over the top of the new sea wall.

THE AVENUE

Alignment of new town culvert

W

LANDSCAPIN
contractor's

CONTRACT
COMPOUN

N

NEW RAILWAY SIDING
for importation of rock armour

West Somer

KEY

- Sand
- Rock Amour/groynes
- Cobbles
- Concrete Block Revetment
- Access/Viewing Point
- Existing pavement to be raised in level
- New promenade
- Contractor's compound area
- Landscaping

NEW ROCK ARMOUR GROYNES

These will prevent newly placed beach material from drifting eastwards out of the bay.

The crest of the groyne will be about 1m (3ft) higher than the beach level.

NEW STEPPED CONCRETE BLOCK REVETMENT along Warren Road

BEACH REPLENISHMENT

This will cause waves to break further offshore, reducing their energy when they approach the sea wall.

Periodic maintenance operations will take place to recover and replace shifted beach material to maintain the sea defence.

Warren Point

Steps

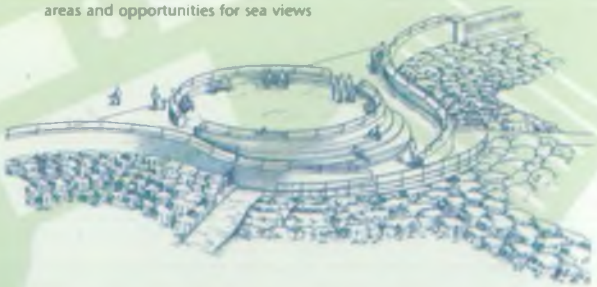
Maintenance Access

Ramp

Ramp

NEW PROMENADE

NEW IMPROVED ACCESS ONTO BEACH. These circular features will provide safe ramped access for wheelchair and pushchair users. They will also include new seating areas and opportunities for sea views



R R E N R O A D

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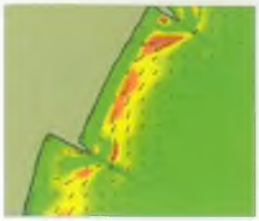
SEAWARD WAY

DESIGN ISSUES

The design team have been faced with the challenge of improving the standard of sea defence whilst taking into consideration:

- the effects of the proposals on the environment
- technical feasibility and construction issues
- economics and cost constraints
- the need to minimise future maintenance requirements



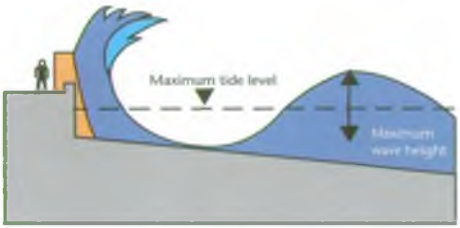
Output from computer model showing predicted sediment transport rates

Understanding the Bay

Before options for detailed design could be considered it was necessary to understand the complex inter-relationship between tides, waves and sediments within Minehead Bay, particularly under extreme storm conditions. To do this, both physical and computer models were used to assess the effects of a combination of high tides and waves. These models were then used to test preliminary scheme options. The computer model was subsequently used to refine the design of the preferred option.

Scheme Options

A range of options were considered, but these were soon reduced to three for detailed consideration:



Option 1

Increase the height of the sea wall in excess of two metres to stop waves overtopping during a storm.

This was ruled out because of the unacceptable impact on the visual amenity of the bay and access to the beach.

Option 2

Increase the level of the beach to the promenade level by importing large quantities of sand and cobbles. Waves would then break further offshore away from the sea wall. This was also unsatisfactory because of the excessive maintenance requirement, the need for very large, long and additional groynes, and the prohibitively high cost.

Option 3

Combine elements of the first two options to provide a composite scheme.

THE PREFERRED SOLUTION

Option 3 was developed as the preferred solution, combining a relatively small (0.6 m) increase in the existing wall height with the replenishment of the beach using a moderate volume of sand and cobbles, raising the beach level by up to two metres. This solution will cause waves to break further offshore and eliminate waves overtopping at the sea wall in all but the most extreme storms. A series of four new rock groynes along the upper beach will help to prevent the newly placed beach material from drifting eastwards out of the bay.

After severe storms, beach reshaping is likely to be required. This will be a low key operation involving a digger/loader and dumper trucks recovering and replacing shifted materials.

The New Sea Wall

Whilst engineering performance and safety have been guiding forces behind the design of the sea defences, a great deal of attention and care has been given to the finished appearance of the new sea wall. The unique curved shape of the wall will deflect waves back to sea and deter people from walking along its top. The landward side of the wall will be faced with red sandstone to enhance its appearance, particularly since part of the seafront falls within a Conservation Area including Quay Street and the Esplanade. The stretch of existing wall between the amusement arcades and the north end of Quay Street will only be demolished and rebuilt from pavement level up, with the original foundations being retained. Rock armour will be placed on the beach at the base of the wall so that the power of large waves will be deflected in storm conditions. In contrast, the length of sea wall along the Warren Road frontage will be demolished completely and a new wall constructed. The seaward side of this will be protected with a stepped concrete revetment, allowing people to use it as part of the beach amenity.

▲ *Quay Street 1992*

HOW THE SCHEME WILL BE BUILT

The Scheme is being built in two distinct phases.

Phase 1

The first phase of the construction period was launched in January 1997 when Councillor Steven Pugsley, Chairman of West Somerset District Council, cut the traditional "first sod" in a ceremony on the site of the new railway siding being built for the scheme.
The first part of the overall scheme is being carried out by contractors Tarmac Construction Ltd., and is due to take around two years. The following elements will be constructed during the first phase:

- The sea wall
- The town culvert diversion and outfall plus drainage works
- Raised areas along the promenade, including new shelters and seats
- Rock groynes
- Rock armouring in front of the new sea wall
- New access ramps onto the beach
- Landscaping along the frontage of the contractor's compound and Quay Street Green

Construction of rock armour groynes (Preston Beach sea defences, Weymouth)

The Scheme commencement ceremony, January 1997

Every effort will be made to minimise the disruption for residents and tourists during the construction period. In order to do this, the works will be carried out in no more than four locations at a time such that in total, only 10% (about 180m) of the seafront will be disrupted at any one time. To avoid affecting the busiest part of the tourist season there will be no construction works during the six week school summer holiday. Working in this way will go some way towards minimising the inconvenience. The road along the promenade will remain open throughout the duration of the contract, but there will be traffic controls in place at critical points to enable plant to cross from the contractor's compound (former lido site) onto the seafront.
Noise and dust will be unavoidable, particularly when sheet piling work is being carried out. However, the Agency are exercising strict controls to ensure that disturbance is kept to a minimum.

Phase 2

This second phase will involve the replenishment of the foreshore using sand and shingle probably dredged from the Bristol Channel. All the material for this will be brought in by barge and pumped ashore between the newly created rock groynes. Bulldozers will be used to move the material into place and form the new beach. This part of the work is comparatively short in time (approx 3-4 months) and although noisy there will be minimal disruption along the sea front.

▲ *Moving beach material into place*
(Preston beach sea defences, Weymouth)

▼ *Beach recharge in action*

BOATS & TRAINS

First delivery of rock armour to Minehead, March 1997

The material for the rock groynes and armouring is being obtained from a Mendip quarry. Obviously, transportation by road of such a large amount of rock would have involved many lorry loads to the site. The roads into Minehead are not the easiest of roads to negotiate, particularly during the summer months. As a result, the Agency was very keen to avoid this disruption and looked for a "greener" transport solution.

The privately owned West Somerset Railway operate steam engines and carriages between Bishops Lydeard and Minehead. The service is usually for tourists and railway enthusiasts to enjoy a trip on a steam train. The railway company was approached to see whether they would be both willing and capable of carrying the rock to the site, thus eliminating the need for lorries. An agreement to this option was negotiated between the contractor and the railway company. This solution not only helps the Agency, the residents of Minehead and villages in the area, but also the West Somerset Railway, as the fee for using the railway will go towards improving their rolling stock.

Along with the importation of beach sand and shingle by sea in Phase 2, this provides a truly environmentally sensitive solution to the potential problems of traffic congestion caused by the scheme.

The Agency is confident that the obvious benefits the scheme will bring to Minehead will outweigh any inconvenience experienced during the construction period.

FACT SHEET

Funding Authorities:

Ministry of Agriculture, Fisheries and Food, Environment Agency, West Somerset District Council and Rank Group Co.

Length of Defence:	1.8km
Quantity of Rock Armour:	90,000 tonnes
Quantity of sand & shingle:	300,000 tonnes
Consultants:	Mouchel Consulting Ltd Nicholas Pearson Associates Ltd
Contractor:	Tarmac Construction Ltd
Cost of construction (Phase 1):	£9.2m
Cost of construction (Phase 2):	£3.5m (estimated)
Total cost of construction	£12.7m

FACT SHEET

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For general enquiries please call your local Environment Agency office. If you are unsure who to contact, or which is your local office, please call our general enquiry line.

ENVIRONMENT AGENCY
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The 24-hour emergency hotline number for reporting all environmental incidents relating to air, land and water.

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