



**FCDPAG2**

# **Flood and Coastal Defence Project Appraisal Guidance**

**Strategic Planning and Appraisal**

**Ministry of Agriculture,  
Fisheries and Food**



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**Strategic Planning and Appraisal**

**FCDPAG2  
A PROCEDURAL GUIDE FOR  
OPERATING AUTHORITIES**



# Foreword

This is one of a series of guidance documents designed to provide advice on best practice for the appraisal of flood and coastal defence projects.

The content is based on interim guidance issued in July 1997 developed and updated as necessary from experience in application of the interim guide. The final text reflects comments received from a period of formal consultation from July to October 2000. The comments of all those who have contributed, formally and informally, are gratefully acknowledged.

The final text is guidance issued by the Ministry, specifically for use in the development of strategy plans for flood and coastal defence in England although the principles will have wider application in the planning and appraisal of flood and coastal defence projects.

Ministry of Agriculture, Fisheries and Food

Flood and Coastal Defence with Emergencies Division

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# 1. Introduction

## 1.1 Overview

This guide, one of a series on the appraisal of flood and coastal defence projects in England and Wales, covers strategic aspects of project planning and appraisal. It assumes that the reader has prior knowledge of general project management and appraisal techniques.

**Flood and coastal  
defence project  
appraisal guidance  
series**

The full list of titles in the flood and coastal defence project appraisal guidance series (FCDPAG) is as follows:

FCDPAG1	Overview
FCDPAG2	Strategic planning and appraisal
FCDPAG3	Economic appraisal
FCDPAG4	Approaches to risk
FCDPAG5	Environmental appraisal
FCDPAG6	Post project evaluation

The six volumes of this series are designed to provide an integrated suite of guidance on all aspects of project appraisal. The documents are intended to assist knowledgeable practitioners; they are not comprehensive manuals or textbooks and they do not define Government policy. However, compliance with the guidance series is likely to produce projects that are acceptable for Government support.

FCDPAG1 provides an overview with guidance on combining the different approaches and the recommended use of the document series.

This volume, FCDPAG2, seeks to set out a framework for strategic consideration of appropriate flood or erosion risk areas related to river catchments or lengths of coast. This should lead to appropriate problem definition and identification of broad options for solution.

FCDPAG3 identifies methods for valuing costs and impacts in monetary terms and also sets out a recommended decision-making process, based on economic values.

FCDPAG4 encourages the proper consideration of risk issues in the derivation of appropriate economic values and decision making, as set out in FCDPAG3.

FCDPAG5 encourages the proper consideration of environmental aspects of flood and coastal defence works and provides guidance on the derivation of appropriate economic values for decision making, as set out in FCDPAG3.

FCDPAG6 provides updated guidance on undertaking monitoring and post project evaluation.

**Aim of Strategic  
Planning and  
Appraisal**

## 1.2 Aims

This guide aims to improve decision making for investment in sustainable river and coastal flood alleviation and coastal protection through improved appreciation of issues within a strategic framework. The document focuses on the appraisal and development of strategy plans, but the principles are also applicable at the large-scale planning and design and appraisal stages of scheme development. Large-scale planning should build the guiding framework within which layers of smaller-scale strategies or schemes can be developed (see FCDPAG1).

This document sets out the generic principles to be considered for the strategic planning of flood defence and land drainage works (fluvial, tidal and coastal) and coastal protection works in England and Wales. It should be read in conjunction with other guidance from the Ministry. In particular, the other volumes in this series on Project Appraisal Guidance; the MAFF Code of Practice on Environmental Procedures for Flood Defence Operating Authorities; and more specific current guidance for the production of Shoreline Management Plans, Catchment Flood Management Plans and Water Level Management Plans.

A strategic approach is relevant to many aspects of the provision and management of flood and coastal defences. The principles set out in this document should be considered in relation to all management, maintenance and construction activities and not just major investments in structural solutions. Strategic planning is essentially a thought process and it is not possible to be prescriptive.

Although not all flood and coastal defence problems will benefit from a strategic solution, application of these principles should be seen as part of a structured approach to flood and coastal defence which facilitates the planning and management of future works. In many cases the strategic issues identified in this guide may be addressed adequately within the scope of the appraisal report (previously called the engineer's report) for a specific scheme but a separate strategy study will often be more appropriate (see section 2.2).

The guidance applies to all works for flood defence, coastal protection or water level management promoted by the Environment Agency, local authorities, Internal Drainage Boards (IDBs) or other bodies. It has been produced to promote a consistent, efficient and effective approach; it is not intended to add any new requirements to the processing of schemes for grant aid.

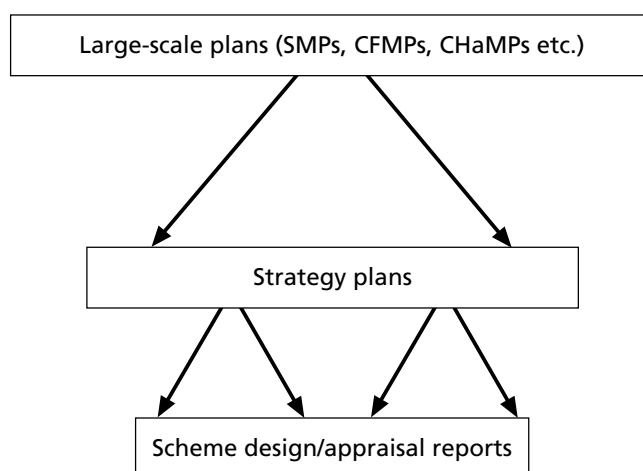
It is recognised that it is not possible to undertake strategic studies in the short term for all areas where they may eventually be beneficial. Some prioritisation of studies on the basis of risk will be required and may also be considered for those areas where there is a likelihood of major works within five years.

## 1.3 Hierarchy of flood and coastal defence planning and appraisal

There is now a wide range of large-scale plans, either developed or progressing that relate to the development of broad policy for river and coastal management. Shoreline Management Plans (SMPs) and others, such as, Coastal Habitat Management Plans (CHaMPs) and Catchment Flood Management Plans (CFMPs) should be the vehicle for considering high level plans and strategies. Inevitably

such plans must initially adopt a broad-brush approach. Subsequently there will often be a need to refine and revisit policies over particular sections of coast or river if subsequent detailed investigations for strategies or schemes indicate alternative solutions. Large-scale plans, strategies and schemes will thus form a strategic framework within which flood and coastal defence will be managed.

**Figure 1.1 Hierarchy of plans**



**Large-scale plans** will typically cover a whole coastal process unit, river catchment or estuary system and define the broad policy for management of the plan area. Such plans will also be useful for prioritising the development of strategy plans.

**Strategy plans** will normally be prepared for coherent subsets of the large-scale plan area, for example a linked group of coastal management units, or a major sub-catchment. Strategy plans will normally be consistent with the recommendations of relevant large-scale plans, unless detailed strategy investigations suggest that these should be revised.

The strategy plan is not necessarily limited to capital works but can encompass any programme of management or action. In some cases specific functions may be considered over a broader area, such as a regional flood forecasting and warning strategy.

Scheme design and appraisal is appropriate to projects that will be carried out over a limited time, generally as either maintenance or capital works, to deliver part of the strategy plan. However, this stage could also apply to the detailed consideration of other activities such as the delivery of a flood forecasting and warning scheme.

## 1.4 Structure of this document (FCDPAG2)

This document explains the benefits of a strategic approach and describes suggested procedures and approaches to develop a strategy. The document is set out in five sections as follows.

### Structure

### **Section 1: Introduction**

### **Section 2: Strategic thinking, principles and issues**

This section sets out the reasons for taking a strategic approach. This is applicable to all levels of flood and coastal defence planning and project appraisal including large-scale plans such as SMPs and smaller-scale projects for flood alleviation.

### **Section 3: The strategic approach**

This describes the stages of problem identification, development of a strategy and compilation of a strategy plan.

### **Section 4: Strategy implementation**

This considers the stages after a strategy has been developed (including a part on interim works required during strategy development) and the need for review and periodic reappraisal of any strategy plan.

### **Section 5: Examples**

A section providing some generic examples of how the principles may be applied to the development of strategy plans for typical flood and coastal defence problems.

## **1.5 Terminology used in this document**

### **Terminology**

During the consultation phase of the development of FCDPAG2 comments were received about the use of the words 'strategic' and 'strategy'. To provide clarification, the meanings of these words in the context of this document are as follows.

**Strategic:** Used to describe the undertaking of any process in a holistic manner taking account of all associated impacts, interests of other parties and considering the widest possible set of potential options for the solution of a problem. In the context of this document, the word 'strategic' does not imply any particular level in the hierarchy of the planning process.

**Strategy:** Following a 'strategic' study into a problem the 'strategy' describes the course of action that has been determined to implement the preferred option. It is the responsibility of the operating authority preparing the strategy to determine its appropriate scope and context with other plans/strategies. Section 1.3 titled 'Hierarchy of flood and coastal defence planning and appraisal' indicates the most likely position of strategy plans prepared for flood and coastal defence scheme appraisal within the planning process.

**Strategy plan:** The documentation compiled to support the developed strategy as described in section 3 and annex A of this guidance.

## 1.6 Quick guide to strategic planning

The box below provides a summary of the strategic planning process.

### A quick guide to strategic planning

#### Advantages of strategic planning

A strategic approach may be required to provide a framework for developing, appraising and implementing flood and coastal defence works in a logical manner where, for example:

- problems of a large-scale or solutions of a long-term nature are involved;
- works will be implemented over a long time scale;
- there are process connections and interactions between different sections of work;
- there are interconnected benefit areas;
- several smaller problems can be tackled in an integrated way;
- the effects of any works, including environmental impacts, are likely to extend over a wide area.

It will also provide an effective framework for wide consultation in relation to the key flood and coastal defence issues for the strategy area. The process should be used to extend ownership of both problems and opportunities amongst all bodies with a legitimate interest in these issues.

#### Strategy development

Having determined that a strategic approach is appropriate, the development of the strategy should proceed in a logical manner through the following general stages.

1. Identification of problems and key issues (taking account of issues identified in large-scale planning such as SMPs and CFMPs).
2. Establishment of strategic aims and objectives.
3. Data gathering and analysis, consultation, option appraisal and resolution of conflicting interests.
4. Decision on preferred policy and implementation options.
5. Establishment of arrangements for ongoing monitoring, review and feedback to subsequent versions of the strategy.

Such decision making will normally be recorded in the strategy plan. This will be subject to regular review (generally at around five-year intervals) as the strategy develops and knowledge is gained through feedback and monitoring.



# 2. Strategic thinking, principles and issues

## 2.1 Why a strategic approach?

The Strategy for Flood and Coastal Defence set out by MAFF and the former Welsh Office (now the National Assembly for Wales), and developed in large-scale plans of the Environment Agency and others, laid particular emphasis on the importance of a strategic approach and long-term view. This is intended to avoid disruption to natural processes and encourage defences that are sustainable in the long term. Such matters can often only be considered by taking a long-term coherent view of a large area of coastline or river catchment.

### Principal reasons for taking a strategic approach

- It gives the ability to be proactive rather than reactive and achieve best long-term value for money and environmental and other benefits through a planned approach to integrated investments in major works, management and maintenance. Traditionally flood and coastal defence expenditure has often been identified through various *ad hoc* routes such as local complaints or as a result of flooding. Authorities can plan and prioritise their work better if assets and standards of protection are regularly reviewed at a strategic level. National losses will be minimised if works can be identified, developed, justified and carried out before flooding or erosion takes place.
- It provides sound decision making and balanced solutions based on a wide ranging appraisal which takes account of all the key issues, including all impacts or consequences and opportunities. This includes environmental assessment at the strategic level and identifying opportunities for enhancement.
- It encourages co-operation and partnerships between operating authorities and other stakeholders and interested parties. A strategy will be a useful platform for opening a rational debate so that, for example, decisions related to standards of defence versus the cost of public investment can be seen to be taken in a reasonable and open way or opportunities for joint action can be identified.
- It promotes long-term sustainability through strategic thinking and planning. This can often avoid fundamental unforeseen weaknesses in detailed scheme implementation and avoid the assumption that works are inevitable.
- It provides the opportunity to undertake assessments of risk and sensitivity at the widest levels, for example assessment of the sensitivity to climate change or changes in planning or investment policy.

Taking a strategic approach is not a reason to promote blanket standards of defence when these are not justified or to promote defence works that would otherwise not be worthwhile. Different benefit areas may be identified in a strategy with different benefit–cost ratios. A strategy will not necessarily identify a single benefit area but

**Strategic thinking**

**Proactive**

**Sound decisions**

**Partnerships**

**Sustainable**

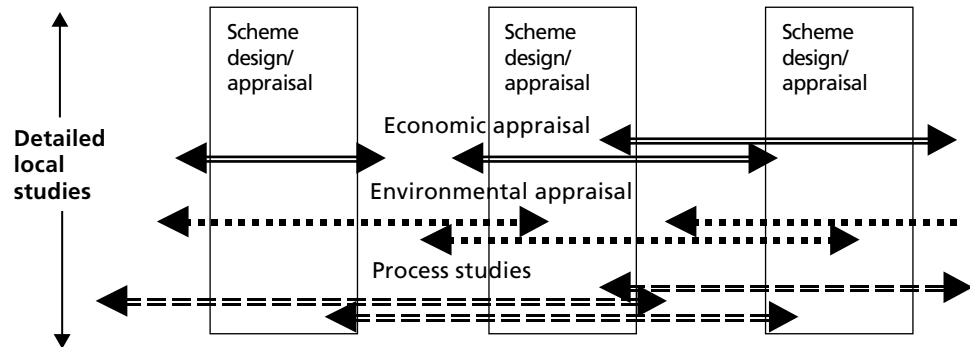
**Assessing risks**

may result in several interconnected, but nevertheless separate areas, where investments have to be considered individually within the strategic framework.

A comparison between taking a stand-alone and a strategic approach is illustrated in Figure 2.1.

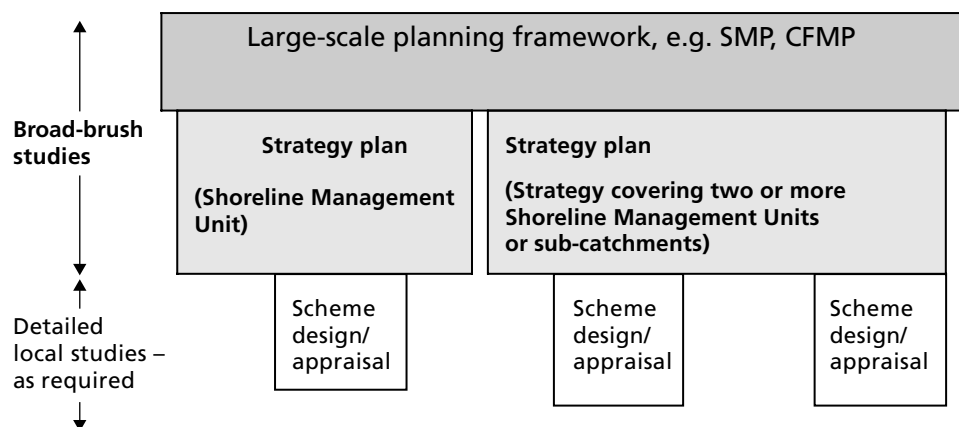
**Figure 2.1 Comparison of strategic and stand alone approaches**

**(a) Illustration of potential interaction between adjacent stand-alone schemes**



This illustrates the process where each scheme is considered on a stand-alone basis. When this happens, process studies, environmental assessments and economic evaluations have to be undertaken significantly beyond the scheme boundaries with the potential for duplication of effort, leading to inappropriate decision making and possibility of inconsistency and double counting between adjacent schemes.

**(b) Example of scheme development within framework of large-scale planning and strategy plans**



This illustrates the alternative situation where a strategy plan has been developed, significantly reducing the level of information required for individual scheme appraisal. As successive rounds of strategy development take account of feedback from scheme-specific or wider process studies and drop the level of information down the diagram, less information is required for each detailed scheme appraisal.

It should also be noted that adoption of a strategic approach could reveal problems and difficulties. For example, it may become clear through the process of development and consultation that certain defences cannot be maintained in the longer term or that some properties or communities are at greater risks than others. Such difficulties should not detract from the reasons for embarking on a strategic approach, but they do place responsibilities on those carrying out the work to explain clearly what is involved and adopt transparency in decision making that is seen to be fair and equitable.

## 2.2 When and where is a strategic approach desirable?

Very few schemes for management or construction on rivers and coasts have a totally local short-term impact and few flood and coastal defence schemes can therefore be regarded as truly 'stand alone'. Every major scheme requires the evaluation of all costs, benefits, and physical and environmental impacts over the affected area for the whole life of the scheme. This will often be most easily achieved within a strategic framework.

This should not be taken to imply a blanket requirement for the production of strategy plans. However, a strategy for flood and coastal defence works will usually be specifically required if any of the following conditions apply.

- Where a large-scale plan has already identified the area for strategy development.
- Where there is advantage in considering problems and solutions in the longer term and over a wide geographical area. For example, the management of beaches by enhancement of natural coastal processes or the enhancement of natural river wash-land functions in river catchments.
- Where implementation of a programme of works or management is to be carried out over a long time scale, typically greater than five years, such as the ongoing long-term management of beaches.
- Where there is a hydraulic or process connection between physically separate works. Such connections may not always be obvious or readily apparent and some may only become known as a result of further research, such as that into the processes, form and function of estuaries. Examples of obvious connections are the provision of a river flood relief channel that may increase peak flows downstream, or a beach control structure that will interrupt long-shore sediment drift to adjacent beaches.
- Where there is a physical interconnection between benefit areas, for example, situations where flood risk areas are contiguous and a breach or overtopping in any one of several locations could lead to flooding of the whole area.
- Where several smaller problems can be considered in an integrated way. For example, where flood alleviation can be achieved by enhancement of the total storage in a catchment or by a major river diversion scheme. This might also include partnership opportunities in situations where common interests could be addressed through joint approaches.

### Deciding on a strategic approach

### Factors to consider

- Where environmental or other implications extend outside the immediate area of a scheme. For example, the continuing erosion of a cliff or foreshore providing a source of recharge for down-drift beaches, mudflats or salt marshes. Particular consideration will be required where works may affect the integrity of a site designated under the Habitats Directive or other protected area such as a scheduled monument or designated historic wreck (see FCDPAG5).

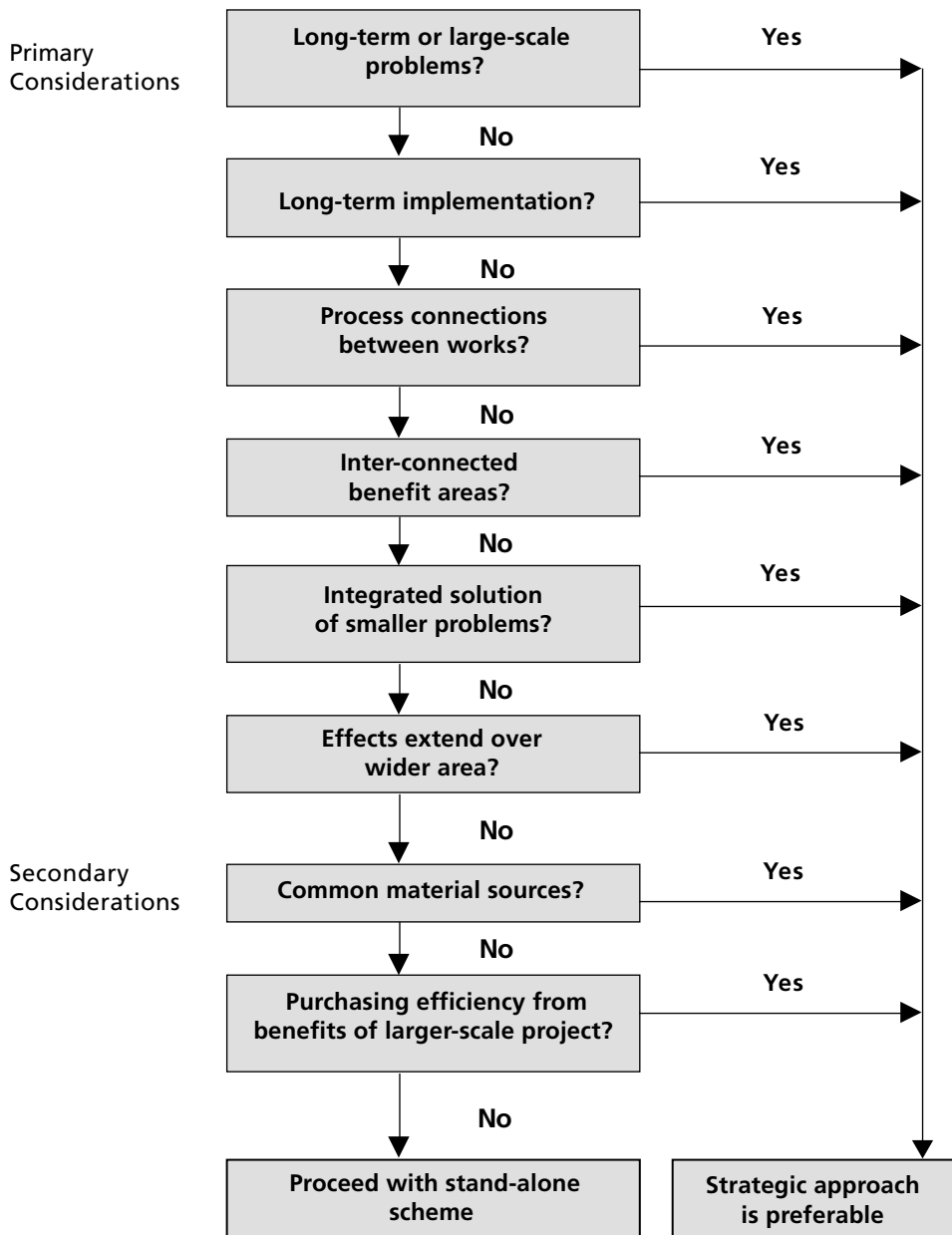
As a secondary consideration, a strategic approach may also open up the possibility of achieving wider opportunities and addressing issues that can only be resolved on a larger scale. For this reason an operating authority may consider that a strategy would be desirable if, for example, either of the following might apply:

- there is the potential to develop common sources for materials for a set of schemes – for example, major embankment schemes may benefit from a common approach to borrow pit development or a group of beach recharge schemes might usefully collaborate to develop a dredging programme or even seek to licence a specific material source;
- there may be opportunities for more cost effective or efficient procurement of works – for example, the adoption of a long-term plan for renewal or replacement of pumping stations in a large area may allow a significant package of work to be tendered as a single contract.

Existing flood or coastal erosion risks will usually be the primary reason to embark on development of a strategy. There are other circumstances such as the likelihood of proposals for major development or major changes in structure planning where production of a strategy should be considered. An example of this might be a catchment strategy to investigate and mitigate the effects of runoff changes from a proposed large development situated on high ground.

Figure 2.2 shows a sample decision tree to indicate whether or not strategy development is likely to be the preferred approach. The contents of the boxes are not definitive and should be adapted to the situation under consideration.

Figure 2.2 Example decision tree for indicating if strategy development is the preferred approach



## 2.3 Who should develop a strategy?

### Lead organisations

It will normally be the role of the relevant operating authorities to prepare flood or coastal defence strategies. Where large areas are involved this will often involve consortia groups or partnerships of, for example, local authorities, Environment Agency areas and/or Internal Drainage Boards. The particular arrangements for sharing the work and funding will be a matter for local negotiation, although it will always be necessary to identify a lead organisation and individuals with a clear brief and terms of reference to guide the strategy development.

In some circumstances where, for example, there are extensive port interests or other private owners, it may be appropriate for strategies to be initiated by groups of those owners or others with a significant interest in the maintenance or development of defences. However, such studies would not normally be publicly funded and it will be important that such initiatives involve representatives from the main public bodies if all interests are to be fully considered.

The development of a flood or coastal defence strategy may well bring to the fore issues such as regional habitat resource, that would otherwise not be addressed at a scheme by scheme level; some of these may need to be resolved in a wider forum. There may also be a need to resolve local issues at an appropriate local level but this should not compromise the strategic approach.

# 3. The strategic approach

## 3.1 Overview

Where it is decided that a strategic approach to flood or coastal defence planning or appraisal should be developed, it is recommended that the appraisal process of define, develop, compare and select is used (see FCDPAG1) as follows:

- Define
  - Identification of problems and key issues.
  - Establishment of strategic aims and objectives.
- Develop
  - Strategy development, e.g. data gathering and analysis, consultation.
- Compare
  - option appraisal using economic, technical and environmental criteria and resolution of conflicting interests.
- Select
  - Decision on preferred policy and/or implementation options, e.g. select the preferred strategy/policy to be promoted.
  - Compilation of a strategy plan, documenting the process and recommendation.

For a few areas where the issues are relatively straightforward a brief meeting of interested parties may be sufficient to set out the strategy. More commonly, the commissioning of a scoping study and the production of a programme for subsequent strategic studies leading to the development of the strategy may well be required. Whether or not a formal scoping study is carried out, it is important to develop an interdisciplinary approach to the identification of all strategic issues at an early stage. A consultation programme may also be necessary to ensure that all issues are identified.

Figure 3.1 shows the stages that may be included in a typical development programme for a strategy (time-scales are illustrative only).

Figure 3.1 Example of the typical components of a programme for strategy development

Activity	Duration of activity – months														
	0					5						10			15
Scoping	■	■	■												
Preliminary consultation			■	■	■										
Data gathering		■	■	■	■	■	■	■	■	■					
Research		■	■	■	■	■	■	■	■	■					
Geomorphological studies		■	■	■	■	■	■	■	■	■					
Environmental and heritage studies		■	■	■	■	■	■	■	■	■					
Other specialist studies			■	■	■	■	■	■	■	■	■				
Economic studies				■	■	■	■	■	■	■	■				
Strategy development										■	■	■	■		
Main consultation											■	■	■		
Strategy plan compilation													■	■	■

All strategic studies and plans should be appropriate to the scale of the problem being addressed. Some may be very brief, whereas other large strategy plans may incorporate a series of linked studies and should be evaluated accordingly. In each case the depth of study should be **appropriate to the level of decision making required** and this can be achieved through an iterative approach which concentrates on progressively addressing areas of uncertainty.

The remainder of this section sets out a suggested approach to strategy development and technical, environmental and economic appraisal, which should be adapted to the particular circumstances of each project or area.

### 3.2 Identification of problems and key issues

#### Identify key issues

This is a most important stage in the appraisal process and is often the key to the successful development of sound strategic solutions. The real flood or coastal defence problems must be identified in a way which do not presuppose any particular outcome or solution. The existing situation should be analysed in a rational manner to determine, for example, points of weakness, realistic mechanisms for failure and likely probabilities of damaging events. Often this will involve logical consideration of risks and consequences (see FCDPAG4). Public

perception of risk does not, however, always coincide with technical assessments; careful consideration and understanding of local needs and attitudes may be required if the final outcome is to gain public support and confidence.

The process of identifying problems and key issues can be considered under the following broad headings:

- co-ordination with high level plans (if suitable plans exist, these should have already identified the majority of key issues and problems);
- establishment of appropriate boundaries;
- establishment of an appropriate time frame;
- review of current data and knowledge;
- evaluation of do-nothing scenarios;
- identification of significant opportunities/constraints.

The collation and storage of information in a secure, accessible and visually available manner can be a significant advantage in strategic or other appraisals. It may therefore be appropriate to use a database and GIS (Geographic Information System) for this purpose.

The key issues listed above are considered in turn in the sections below.

### 3.2.1 Co-ordination with high level plans or other planning initiatives

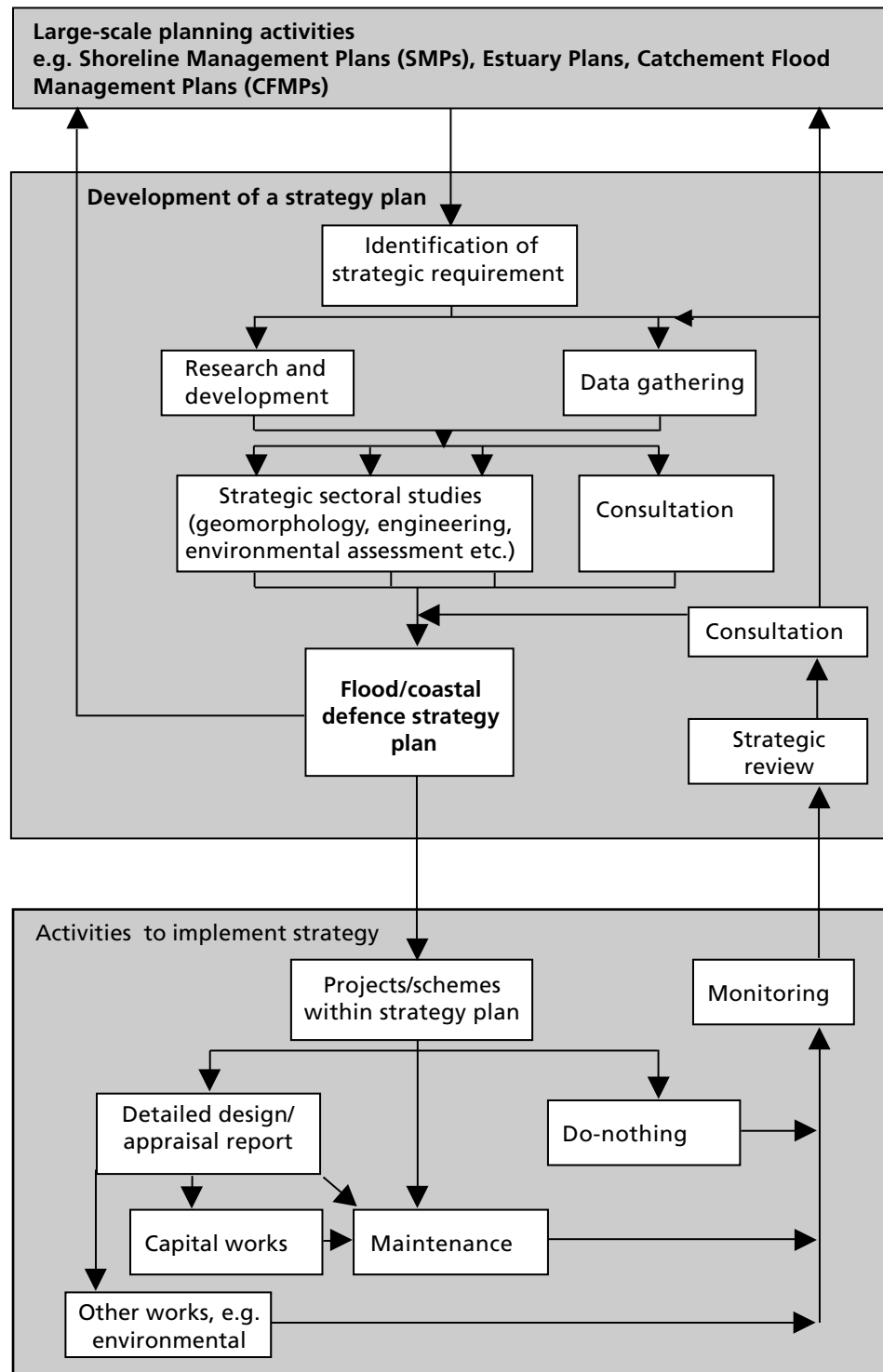
Large-scale statutory plans such as Local Authority Structure Plans and Management Schemes for Special Areas of Conservation (SACs) or large-scale non-statutory plans such as national Biodiversity Action and Coastal Habitat Management Plans, may have already been developed. It is important that early links are made at policy level with these plans, as well as with plans more directly connected with flood and coastal defence such as Shoreline Management Plans (SMPs) or Catchment Flood Management Plans (CFMPs).

In some instances key issues and broad solutions may have already been identified in large-scale plans. Such plans may contain relevant data and analysis work, that can be extracted to avoid repetition, and other information to help establish appropriate boundaries or the time frame for subsequent strategy development. The findings from flood and coastal defence strategy plans should also be used to influence subsequent reviews of these large-scale plans in an iterative cycle.

It is not possible to be prescriptive when defining the relationship between a strategy plan and any larger-scale plans. The strategy plan will need to take account of the likely implications of decisions taken elsewhere. However, the level of confidence and credibility that can be attached to those decisions will clearly depend on the depth to which relevant factors have been investigated in the large-scale plan.

**Links to other plans**

Figure 3.2 Relationship between strategy development and other activities showing feedback loops and iterations in process



For example, an economic analysis carried out using broad brush approaches for an SMP will need to be refined for detailed consideration of options within a strategy for a group of management units and this refinement may not necessarily support the policy options previously indicated. However, if a detailed study of coastal processes has been carried out on a coastal cell basis for the SMP, it may not be necessary to carry out any significant additional extra work to determine the long-term sediment transport impacts of a particular management unit strategy. If the large-scale plan shows significant interactions between areas of coast or catchment then clearly these must be taken into account when determining the outcome of all relevant management unit strategies.

Other plans, in particular Water Level Management Plans (WLMPs) may constitute a strategy for the catchment, or part catchment, although they usually have more limited objectives. Similarly other plans such as those relating to water quality, water resources or small scale environmental plans should also be fully utilised as they will have been subject to extensive consultation and data gathering.

Figure 3.2 illustrates the relationship between larger-scale plans, strategy plans and implementation through specific schemes or projects for a section of river catchment or length of coast. It emphasises the iterative nature of the process with successive feedback loops to evaluate progress and reconsider decisions as necessary.

### 3.2.2 Establishment of appropriate boundaries

Boundaries need to be set in relation to the objectives of the strategy. The main aim should be to ensure that all major processes, impacts and consequences of the defence strategy are captured within the area considered. As a minimum, the area should take account of the main morphological, hydraulic and hydrological processes which are likely to influence the solution of any flood or coastal defence problem. Other factors, such as accounting for the loss or gain of habitats may also help define the boundaries.

Large-scale plans may provide information to aid the selection of boundaries.

#### Boundary issues

### Examples of factors affecting boundary definition:

- A strategy for a chain of coastal defences to a low-lying area will need to consider all elements that contribute to the defence chain. In relation to flood defence, it will also have to consider, in broad terms, maintenance of the long-term internal drainage infrastructure including floodbanks, sluices and pumping stations that are required for the full achievement of flood alleviation for the area.
- A strategy for an inland drainage area may have to assume that the overall sea defences, or defences to adjacent areas, will be maintained unless there is an identified long-term plan for their abandonment or realignment.
- A flood defence strategy for the middle reaches of a river may not necessarily need to consider the whole catchment, provided that upstream and downstream boundaries are defined with known inputs and outputs that remain unchanged by the strategy.

NB: In exceptional circumstances different boundaries may need to be established for different purposes; for example, the area of economic benefit may not coincide with that for consideration of coastal processes or environmental impact.

### 3.2.3 Establishment of an appropriate time frame

#### Time frame

It is usually appropriate to consider strategies over approximately 50 years because:

- it is generally not feasible to make reasonable physical or social predictions over a significantly longer time interval (some coastal processes can be an exception to this – see below); within the 50-year time frame, strategies need to have a degree of flexibility and to be robust to uncertainties;
- through use of discounting, differences in the cost or benefit stream in the more distant future are unlikely to have a significant impact on current decisions;
- policies that can be shown to be sustainable over this period are more likely to be sustainable in the longer term.

However, it is recognised that there will be some features, such as long-term geological changes to the coast, where a longer-term perspective should be taken into consideration even if it can not be precisely evaluated.

Conversely there will be situations where, because the rate of change in either natural or man-made systems is high, it will not be practical to make predictions over this time scale, and a rather shorter time horizon is appropriate. In these cases the economic analysis may have to take account of residual values of assets or impacts at the end of the shorter appraisal period.

When a strategy is reviewed, it will normally be desirable to update and extend the plan to maintain the same time horizon (e.g. 50 years from the review date). See section 4.5 – Periodic review.

### 3.2.4 Review of current data and knowledge

A strategy must be based on the best knowledge currently available, so an early review of current knowledge and both natural and man-made processes should be carried out. This should use all available sources in-house, private or published.

**Review current knowledge**

#### **Examples of factors that should be included in a review of data:**

- other plans or strategies which may have relevant information or relate to the proposed strategy (see section 3.2.1);
- physical processes such as tides, waves, currents, river flow regimes and sediment movement;
- social and economic factors such as current development, commercial, industrial and recreational uses of the coast or river and future development plans;
- environmental data covering features that are most likely to be influenced by future management or works representative indicators of current and future targets for species and habitats should be used wherever possible and relevant data on historical sites and monuments collated.

### 3.2.5 Evaluation of do-nothing scenarios

A realistic do-nothing scenario should be developed however inconceivable it may seem. The do-nothing option should always be considered as a potential solution, although the way it is presented to a wider audience will often need to be carefully considered. The do-nothing scenario will then form the baseline against which all other scenarios, including continuation of present practice (often the do-minimum option), should be tested in terms of economic, technical and environmental performance. FCDPAG1 stresses the importance of the do-nothing option in assessing sustainability. For further discussion of this issue, including the do-minimum option, see FCDPAG3.

**Consider the do-nothing option**

### Examples of do-nothing options

For do-nothing it is necessary to consider the case where there is no future intervention of any kind – for example no further maintenance and no emergency response. Once damage has occurred it is likely that property will be written off and the damage cannot, therefore, recur although the time scale over which write off is likely to occur will have to be carefully considered.

As with all losses, it may be necessary to consider appropriate levels of capping if the results are to be realistic. For example, if flood damage to commercial or residential property becomes large in relation to the property value it must be assumed that the owners will behave in a logical economic manner and relocate rather than face continuing losses. However, the public perception of risk may not always be logical and careful presentation of such issues may be required. In a similar way it should be assumed that transport disruption costs or other infrastructure damage will not exceed the cost of creating an alternative route or facility. (See also FCDPAG3)

The actual risks of failure should not be overstated. It will often be necessary to adopt a probabilistic approach to the evaluation of damages that are likely to result from increased risk of structural failure over time combined with the random occurrence of extreme events. Many structures will continue to provide a degree of protection from moderate events for some time after effective structural failure. (See also FCDPAG4)

#### Opportunities and constraints

### 3.2.6 Identification of significant opportunities and constraints

As far as possible, all major opportunities and constraints should be identified at an early stage. It is important to ensure that constraints are real and do not unnecessarily limit the choice of possible options for further study. Innovative approaches and lateral thinking may be required to develop a range of potential opportunities appropriate to the strategy being considered. When the main aim is to minimise flood or coastal erosion risks, the study should avoid being unnecessarily distracted by third party objectives whilst being alive to the opportunities which could be offered by joint projects.

#### Setting the objectives

### 3.3 Establishment of strategic aims and objectives

Strategic aims and objectives should be established jointly through consultation with all stakeholders and consultees and be expressed in suitable terms, which address the identified problems without presupposing any specific solution.

### Examples of strategic aims

Acceptable aims might be one of the following:

- to develop a policy for future flood risk management of a defined urban area;
- to determine appropriate policies for management of potential erosion of coastal cliffs between ..... and .....
- to ensure that flood risk management is compatible with and, where appropriate, contributes to the sustainable development of the estuary or coastal cell (process unit).

The following aims would **NOT** be appropriate as they are **too specific** and presuppose the solution:

- to provide the most cost effective flood wall to give a 1 in 200 year standard of protection along a defined line; or
- to develop a policy for retention/improvement of the existing sea wall.

## 3.4 Strategy development

This section describes the stages for developing a strategy to achieve the strategic aims that have been established. It includes:

- data gathering and analysis;
- identification of options;
- development of options;
- environmental appraisal at the strategic level;
- risk and sensitivity analysis;
- evaluation of costs;
- benefits and other impacts or consequences;
- consultation.

### Stages of strategy development

### 3.4.1 Data gathering and analysis

Collection, collation and analysis of data relevant to the aims of the flood or coastal defence strategy should be managed as part of the strategy development process to ensure that the right information is available at the right time. Data collection and analysis can be expensive and time consuming. It needs to be justified and tailored within the context of the strategic aims, time frame and boundaries identified. Where a need for further data is identified, the collection and analysis of this should be integrated with the evolving strategy.

### Data collection

### 3.4.2 Identification of options

#### Innovative options

All reasonable and significant options to address the strategic objectives should be investigated. They should cover an appropriate range of both structural and non-structural solutions, including soft engineering, flood warning, development restrictions or managed re-alignment. There is a need for creative and lateral thinking in the development of alternatives, which should not be constrained by previous assumptions or past practice. The degree of detail considered for each option should be appropriate to the strategic nature of the decisions required.

Standards of protection should take account of all failure modes – for example the standard of protection offered by a sea wall is the combined probability of ‘failure’ through overflow, excessive wave-induced overtopping or structural collapse from whatever cause.

#### Examples of options

Do-minimum options include:

- maintenance of sluices and pumps in working order;
- repair breaches as they occur.

More proactive intervention options include:

- responding to potential breaches or wall failures;
- management of set back;
- provision of flood warnings (if feasible).

Larger-scale renovations, replacements or new construction should consider:

- alternative defence lines, including possible property acquisition and demolition at hydraulic pinch points;
- a range of alternative standards of protection between do-minimum and protection levels in excess of indicative standards.

### 3.4.3 Development of options

The development and appraisal of options is an iterative process leading to a set of alternative solutions where technical aspects, costs, benefits, environmental and other impacts have been assessed and appropriate allowances made for any uncertainty. Consultation may also be undertaken at this stage with relevant stakeholders. The appraisal should take account of any wider implications and processes identified in high-level plans but should not be unduly constrained by solutions if these are from large-scale studies which have not considered all reasonable alternatives in sufficient detail.

FCDPAG3, FCDPAG4 and FCDPAG5 provide more detail on economic, risk and environmental appraisal techniques. FCDPAG1 includes some guidance on aspects of technical appraisal. In most cases the economic appraisal carried out at the strategy level will provide a significant part of the necessary justification for expenditure on subsequent individual schemes promoted to implement the strategy.

If, within the strategy, there are individual areas where costs and benefits can be evaluated separately, this should be done as one of the options considered. This does not preclude the consideration of an option where several individual areas are covered by one scheme and justified by a single benefit–cost value. The grouping of such individual areas should not, however, be used to justify works to areas that do not stand up to evaluation on their own merits.

The following sections summarise the process of appraising options on the basis of environmental, risk, cost, benefits and other impacts.

### 3.4.4 Environmental appraisal at the strategic level

An environmental appraisal is required for all flood and coastal defence schemes. It is important that the environmental acceptability of alternative schemes is integral to the strategy development and that opportunities for enhancement are considered at every stage.

#### Environmental acceptability

The strategic level environmental appraisal should start with a scoping exercise to determine the relevant environmental issues. This should include consultation based on the strategic aims under consideration. Issues to be considered are the same as for the environmental appraisal of a scheme (see FCDPAG5 for further details).

An important aspect of the scoping exercise will be to consider the level of detail required for different issues. In many cases, it may be decided that the appraisal will be based on existing information. However, if, for example, there are a series of recorded archaeological features of unknown importance that may be affected, it might be sensible to undertake quite detailed archaeological investigations at this stage with appropriate expert advice.

In the absence of design details, the assessment of impacts is likely to be more qualitative and less quantitative than in a scheme appraisal. For example, it may be predicted that significant heavy traffic would be generated during construction, but it is unlikely that the quantity of material to be transported would be known. It might, therefore, be possible to predict noise levels, but not the frequency of occurrence.

In developing the strategy and producing a strategy plan, the following should be taken into account:

- any environmental objectives of the strategy, including enhancement opportunities;
- the environmental scoping process and its conclusions;
- the existing environment, highlighting features of particular importance;

- the environmental impacts of the alternative options considered;
- the impact of environmental considerations on option choice;
- any mitigation measures required;
- proposed monitoring to measure environmental impact or confirm that no significant impact has occurred.

Mitigation and monitoring proposals in most strategy plans are likely to be provisional, since they will probably change subsequent to a more detailed scheme appraisal.

It is important to ensure that, as far as possible, work undertaken during the strategic appraisal should not have to be duplicated for any subsequent scheme appraisal. Indeed, the environmental appraisal of the individual schemes should be made easier. For this reason, environmental information should be collected, analysed and stored in such a way that it can be used effectively at the scheme appraisal stage.

### 3.4.5 Risk and sensitivity analysis

#### Considering risk

Analysis of risk and sensitivity will play a significant role in option assessment. Although it may be difficult with present knowledge to assign particular probabilities of failure to different standards of activity such as beach management, it is important that the sensitivity of different options is considered against a reasonable range of probabilistic outcomes. Assessment should include the sensitivity testing of a range of alternative policy scenarios.

#### **Examples where risk assessment should be considered**

As discussed in FCDPAG4, risk assessment should be applied to all stages of decision making and should be considered, for example, in relation to:

- budgets and planning, particularly the timing and phasing of schemes;
- design parameters such as flood volume/frequency relationships or water level/frequency relationships;
- long-term impacts of works on the river or coastal system including interactions between phased works;
- risks inherent in scheme implementation, and procurement strategies, usually considered in developing envelopes of implementation costs;
- other risks such as those associated with the re-establishment of environmental features, which may not be amenable to quantification, but should be taken into account qualitatively when comparing strategic options.

### 3.4.6 Evaluation of costs

Costs should be considered at a level of detail appropriate to strategic decision making. The precision of cost estimates should take account of the sensitivity of subsequent decisions to be made. Where a decision between very different approaches is finely balanced, the costs and benefits may have to be evaluated in detail. In other cases there may be greater scope for refining cost estimates at detailed scheme appraisal stage within a broader range of strategic options.

The assessment should include **all** direct and indirect costs required to achieve the identified objectives for all options, whether or not they are likely to be funded from flood or coastal defence allocations. Certain transfer payments should be excluded from the economic costs as detailed in FCDPAG3. Some costs are not readily quantified – such as the loss of habitat. However a realistic estimate should generally be attempted. Guidance is given in FCDPAG5 on environmental valuation methods.

Lessons learnt from post project evaluations indicate that sufficient allowance for error should be made for the uncertain nature of cost estimates at the strategic level. Wider areas of risk and uncertainty should also be considered (see section 3.4.5).

### 3.4.7 Benefits and other impacts or consequences

Benefits should be assessed at a level of detail appropriate to the strategic decisions to be addressed. For example, at a strategic level it may not be appropriate to consider the risk to each individual property and it will usually be sufficient to band properties by area and location, including property floor levels, in relation to flood risk levels or erosion risk zones.

Assessments should include **all** direct and indirect consequences and impacts for all options, whether costed or not, and should also identify non-costed impacts, such as long-term disruption to coastal processes. The economic value of tangible benefits should be assessed using recognised approaches such as those recommended in the Middlesex University manuals. Intangible benefits and impacts can be significant particularly those relating to recreation and the natural and historical environment.

FCDPAG3 and FCDPAG5 provide further guidance on the valuation of environmental and recreational benefits and alternative methods that are likely to be appropriate in strategic studies. Studies are also in progress on the economic valuation of human health impacts and results are expected in 2003.

A particular benefit of strategic studies will be the development of a framework within which the benefits remote from the site of works can be taken into account. For example, in an estuary it may be possible to determine that setting back of a defence line at one point will absorb tidal energy and reduce extreme water levels elsewhere. In this case the benefits of these reduced levels can be evaluated as a benefit of the set back works which may have only limited benefit in their immediate area.

#### Costing option

#### Evaluating benefits

**Building stakeholder ownership**

### 3.4.8 Consultation

Consultation is an essential element of strategy development. It requires careful preparation and management. All stakeholders and interested parties should be involved in the process at an appropriate time and kept informed of developments without inducing ‘consultation overload’. All consultations should be appropriate in scope and extent to the circumstances of the proposed strategy. The objective of each consultation exercise must be clearly set out and the material presented in accordance with the needs and understanding of the target audience.

A prime function of consultation will be to build a framework of relationships with stakeholders to develop ownership of flood and coastal defence problems and partnerships committed to finding acceptable solutions. Consultation is also an opportunity to maintain the awareness of statutory bodies and others to flood and coastal defence issues and to take good account of them, particularly in statutory plans.

Consultation at the strategic level will only be fully effective if all parties are committed to an early exchange of full and frank information and have adequate opportunities to make their requirements known.

Whilst each successive round of strategy development and approval offers a further opportunity to refine requirements, the building of successful partnerships with all major stakeholders and consultees and shared ownership of problems and opportunities should ensure that this does not result in identification of any major new requirements.

#### **Examples of consultation objectives**

- to ensure that the long-term plans of official bodies are made available, understood and are taken into account as fully as possible;
- to build confidence and trust in an open decision-making process;
- to avoid results dominated by specific sectoral interests or pressure groups;
- to balance the aspirations of legitimate stakeholders within a wide-ranging policy framework.

Many consultees can play a useful role in identifying impacts of alternative approaches on specific areas of interest. Their expertise should be sought at an appropriate time during the appraisal process. On the other hand, consultation can be dominated by individuals with a direct interest in a specific location. Whilst the strategic issues raised should be taken fully into account, decision makers need to ensure that the overall process is not unduly distorted by concerns that would be more appropriately addressed at the detailed design stage.

Engineers and other specialists play a key role in the consultation process by setting out a realistic set of options which are technically, environmentally and economically viable and providing an assessment of the range of potential impacts. The presentation of probabilistic information where there are uncertainties in the outcome of different actions offers a particular challenge but innovative ways of expressing such issues in layman’s terms can often convey the meaning very successfully.

### 3.5 Decision on preferred options

When the strategic study has been developed to an appropriate level of detail, it should then be possible to develop a recommendation for a preferred strategic option or set of options based on technical, economic and environmental criteria. The decision process described in FCDPAG3 should provide a basis for the selection of the preferred option on economic grounds together with guidance given in FCDPAG5 for option selection from the environmental perspective. FCDPAG4 gives other techniques to aid decision making – such as multi criteria analysis, which may be used where there are complex trade offs between tangible and intangible benefits or other impacts that cannot be accurately valued.

In some cases the strategy will result in a detailed implementation plan. In other cases the result will be adoption of a generic solution which will be significantly developed and refined at the scheme appraisal stage.

Any additional studies, information, monitoring or local research required to fill gaps in current knowledge should be clearly identified in the strategy plan and identified for further work during the periodic review (see section 4.5). Where this leads to uncertainty in the preferred solution, this should be clearly stated in the strategy plan (see section 3.6) and the effects of such uncertainty should be evaluated in making recommendations for any interim solution(s).

#### Selecting the preferred option

### 3.6 The strategy plan

The compilation of the strategy plan is the final stage of strategy development and consists of recording the process undertaken and the course of action recommended. For flood or coastal defence this is a long-term (usually 50 years or more) documented plan for river or coastal management, including all necessary work to meet defined flood or coastal defence objectives for the target (strategy) area. It is designed to provide the basis for decision making and action related to the provision and management of flood or coastal defences. Strategy plans are evolving documents, which inevitably have to be reviewed as experience is gained and as external factors change

The strategy plan should include a long-term implementation programme covering the time scale of the strategy. This will provide the framework and milestones against which progress on development of the strategy may be evaluated. A record of progress against the implementation programme should be maintained throughout the period of the strategy plan. Appendix A shows the contents of a typical strategy plan.

The strategy plan should:

- provide a means of establishing, justifying and prioritising the overall aims and objectives of flood and coastal defence policy for the area concerned;
- concentrate on the generic principles for the achievement of these aims and objectives;
- be appropriate to the scale of problems identified and provide a guide for delivery of specific engineering schemes or other solutions;

#### Documenting the strategy

- document the economic, environmental and technical assessments undertaken at the strategic level, which take account of all relevant impacts and opportunities and the recommendations to be applied at the scheme level;
- enable effective feedback so that lessons from scheme implementation which have an impact at the strategic level and developments in knowledge and understanding are incorporated into subsequent reviews of the overall strategy or associated large-scale plans ( e.g. CHAMPs, SMPs, CFMPs);
- set out long-term maintenance commitments of the flood and coastal defence operating authorities for the area concerned;
- provide sensible forward-looking plans to be submitted for agreement.

In relation to third parties, the strategy plan should:

- form the basis of an agreement concerning the general direction of future policy;
- provide a statement of shared objectives which reflect the concerns of all consultees and stakeholders (all those individuals and organisations with a legitimate interest in the area considered or likely to be affected by possible works);
- develop partnerships with key stakeholders;
- define ownership of the overall aims and objectives, even if this means acknowledging that there are still significant areas of detail to be developed for final implementation;
- highlight any major areas of possible conflict or future concern where it is not possible to achieve full agreement.

# 4. Strategy implementation

## 4.1 Introduction to implementation

Having developed a strategy, there needs to be an active process to put the plan into practice. Successful implementation will obviously be subject to available funding. This section outlines the process through agreement, implementation and periodic review. A section is also included on how to deal with the need for interim works before a strategy is fully developed.

**Putting the strategy into practice**

## 4.2 Principles of strategy agreement and approval

Procedures for the approval of schemes are laid down in MAFF's flood and coastal defence grant memoranda. This section summarises the general approach and the issues that may be considered in seeking agreement to strategies both within an authority and with third parties.

Whilst strategies set out a programme of management and works, often extending for 50 years or more, there are clearly very few circumstances where firm commitments can be entered into for such periods. Gaining **agreement** to a strategy (including agreement from MAFF or other Government departments) means that the developed strategy is judged to be technically sound, economically viable and environmentally acceptable but will not imply any commitment to funding. It will therefore provide a firm basis for subsequent development of short-term work programmes often covering the period between strategy reviews (see section 4.5)

**Gaining agreement**

The general procedure is therefore to seek **approval** (implying a commitment to expenditure) to a shorter scheme of work consistent with the recommendations of an agreed strategy. It will be much easier to gain approval for a scheme proposal **within** an agreed long-term strategy, than for a stand-alone scheme. The reason for this is that the basic viability and the wider impact of the scheme and its relationship to other works should have been satisfactorily resolved at the time of the strategy agreement.

**Seeking approval**

Some strategies will involve different authorities, possibly acting under different legislation. This should not cause difficulty but it will usually be desirable to nominate one lead authority to steer the overall process and ensure that all relevant consents are sought and obtained at the appropriate times.

**Collaborative proposals**

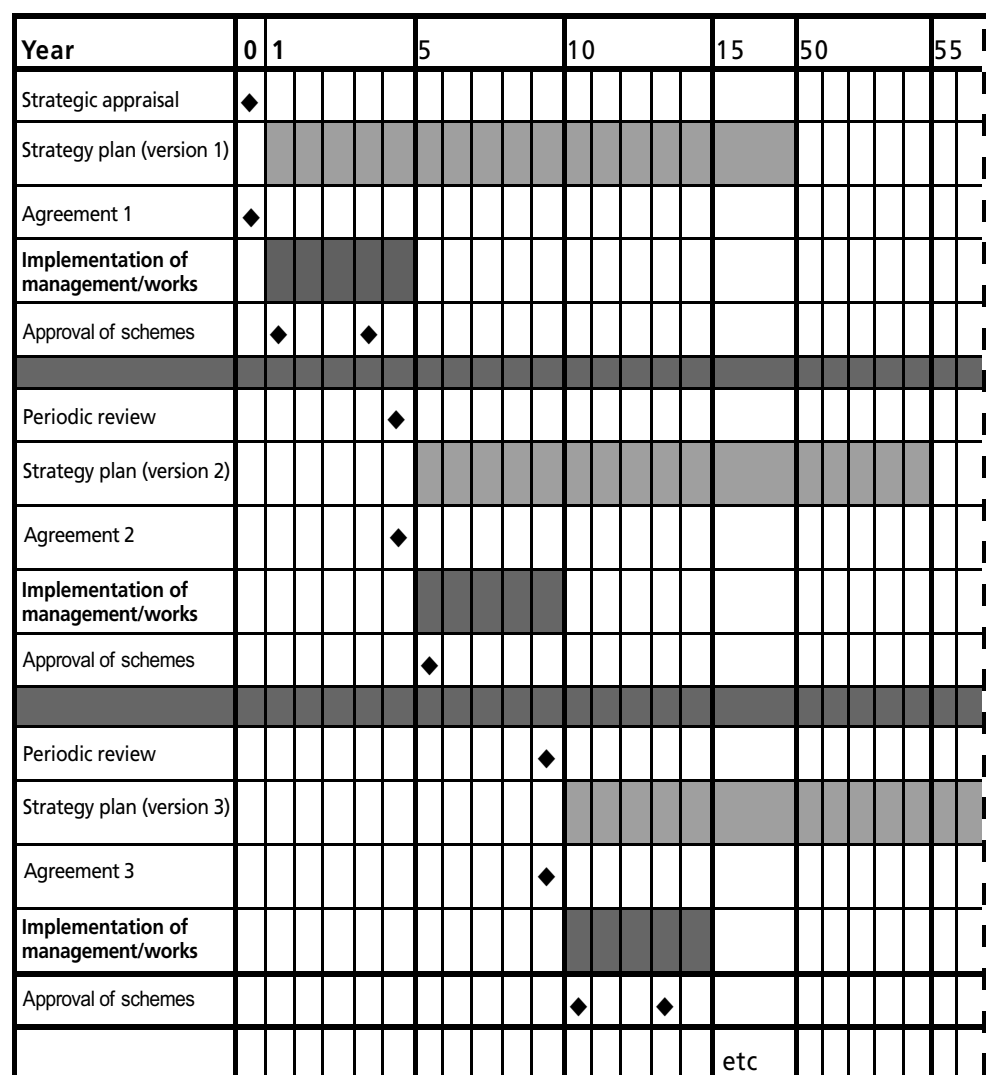
Different organisations have different requirements and procedures when considering works and strategies for works. For example, some consents relating to navigation or deposit of materials can only be given when detailed proposed methods of work are available. However, as noted in section 3.4.8, there are positive benefits to all parties from the early involvement of all interests, including statutory consultees, if all opportunities are to be pursued and later problems avoided. It is important for the effective use of public funds that statutory bodies, in particular, provide a commitment to confirm their overall requirements at the earliest opportunity.

**Third party consents**

In most cases, such as for environmental clearance, it will be most appropriate to seek agreement to programmes of work of about five year’s duration, provided that these can be sufficiently clearly defined. Where the strategy has been developed in partnership with all major stakeholders and consultees, and shared ownership of problems and opportunities has been established, each review should not result in any major new requirements. Whilst consultees may need to give conditional responses at any stage in respect of matters which will only become available at later stages of detailed design, the process should ensure that these do not have a significant impact on the strategy development.

Figure 4.1 shows a chart representing the approval and implementation stages for a typical strategy.

**Figure 4.1 Chart indicating an example of a long-term implementation and agreement process for a 50-year strategy**



Key:  
 ◆ = milestone    [Light grey] = strategy lifespan    [Dark grey] = programme of works

## 4.3 Implementation

Section 3.6 refers to the need to develop an implementation programme for a strategy. Figure 4.1 shows the form that an implementation programme may take, including the stages at which agreement and approvals may be sought.

It will usually be appropriate to divide a strategy implementation programme into phases. The first phase of work may be identified over a period of three to five years. An appraisal report for these works may be submitted for approval at the same time as (or shortly after) agreement is sought for the strategy plan. Subsequent short-term implementation plans would be developed following each periodic review of the strategy as described in section 4.5

### Phasing the works

## 4.4 Determination of appropriate interim actions

The development of some strategies for complex areas with many interrelating pressures and influences may be a long-term process involving collection of data and development of understanding of natural processes over a wide area. In these circumstances there will be a need for pragmatism and recognition of the potential for ongoing refinement and development of strategic approaches, whilst acknowledging that interim works may need to proceed if lives or property are not to be exposed to unacceptable risks. However, such works will normally be of limited extent and cost commensurate with the immediate problem to be addressed.

### Interim actions

Even if it is not possible to produce a definitive strategy, a framework for action should be produced which will allow the strategic policy to be developed as work proceeds, increasing the incorporation of strategic principles with time. It will be necessary to agree the framework with interested parties and to carry out a full technical, environmental and economic appraisal of any interim works to a level appropriate to their scope and impact.

All works carried out in the interim should:

- take account of best current knowledge;
- determine the real urgency in terms of the current state of defences, their realistic residual life, the potential for failure and the risk to lives, property and assets;
- consider the impact of any works on all likely long-term solutions;
- avoid prejudicing the final choice of long-term options;
- carefully evaluate and consider any necessary compromise in short-term protection standards including economic, environmental and social consequences.

Where there are significant strategic considerations, as identified in section 2, there may be difficulty in obtaining agreement to interim works in an area unless substantial moves have been made to develop a strategy within a reasonable time period.

## 4.5 Periodic review

### Updating strategies

All strategies should be subject to periodic review in order to reflect changes in the area, improvements in understanding of the processes involved, the results of monitoring and any other lessons learnt from scheme implementation. They are a vital link in the feedback chain, which should ensure that the benefit of expertise and knowledge gained is actively used in the development of future strategic planning including reviews of large-scale plans (e.g. SMPs and CFMPs).

Each review should follow the procedures for strategy development, although the actual scope of each review will depend on the complexity of the area considered. In the simplest case (where there are no significant changes in external factors and works have been implemented in accordance with the strategy which have had no unexpected results or consequences) the review may be a relatively simple and straightforward process. However, where there are any significant developments or changes all major assumptions that are likely to affect the future direction of the strategy should be critically re-examined to determine whether there is a need for any change in strategic direction.

Normally a maximum period of five years between reviews is appropriate but this may be adjusted if there is a need to take account of particular external factors or the time scales of specific changes are particularly short. The strategy should normally be extended at the time of the review to maintain its time frame (e.g. a further 50 years from the review date for a 50-year strategy) as indicated in Figure 4.1.

# 5. Examples

The following examples are intended to provide an indication of how strategies might be developed for a number of hypothetical situations. The examples are illustrative of a general approach that might be incorporated or adapted to real cases. The examples include:

- flood risk in a compartmentalised lowland river;
- coastal area at risk from sea and river flooding;
- flood risk management for urban rivers;
- estuary management for flood alleviation;
- managing coastal erosion risks;
- flood alleviation taking account of internationally designated environmental sites.

These examples are not intended to be a definitive guide or cover all situations.

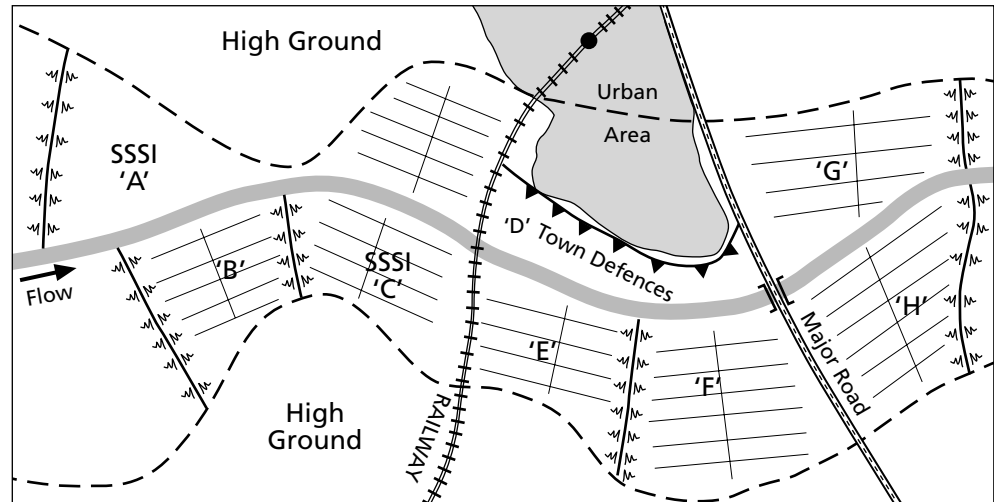
## 5.1 Flood risk in compartmentalised lowland river

### Description of problem

The wide floodplain of a lowland river is compartmentalised into separate areas (A–G) by extensive lengths of embankment and natural areas of raised ground (see Figure 5.1). A history of varying land use in the compartments, including two SSSIs (A and C), has developed into complex water level management requirements. Many of the embankments are in a poor state of repair and will require considerable investment if they are to be maintained. Generally there is thought to be considerable variation in the standard of defence provided to the different areas.

Within one of the compartments (D) is a large town protected by fluvial defences built in the mid-1970s. Following several large floods where the town's defences were tested to the limit a reassessment of the defence standard indicated that they were to a 2% to 2.5% (1 in 40–50-year) standard, not the 1% (1 in 100-year) originally designed. Significant development has taken place in the town over the past 10 years and more is proposed.

**Figure 5.1 Example of flood risk in compartmentalised lowland river**



### Identification of need for a strategic approach

The key drivers for change are the long-term maintenance requirements of the flood embankments in the area, the need to reconsider the standard of protection to the town and future development proposals. The lowland area is complex with interconnected hydraulic, social, commercial and environmental interests between various organisations. All these issues need to be taken into account in the determination of suitable flood defences and water level management if they are to be sustainable in the longer term.

A strategic approach is desirable and an acceptable strategic aim for this situation might be:

*to develop a long-term plan for achieving appropriate and sustainable defence standards and water level management.*

### Strategic approach

#### *Identification of strategic issues*

- determining appropriate geographical boundaries for the extent of the impact of potential solutions;
- consideration of opportunities to review water level management, appropriate standards of defence and achieving environmental gains for the different land use areas;
- consideration of the effects of changing defence standards in one compartment on standards elsewhere;
- reviewing the current state of knowledge and data available for the area including the understanding of the natural and manmade processes in the catchment, availability of rainfall and water level data, previous river modelling or environmental studies and long term effects such as those of climate change;

- reviewing the impact or constraints from any existing high level plans such as CFMPs or WLMPs and consider the impact of any local development plans and the objectives and interactions of different organisations operating within the catchment;
- consideration of the do-minimum scenario of leaving the defences at a lower than indicative standard and the do-nothing scenario of allowing the defences to deteriorate naturally.

### *Development of strategy*

Since the interactions and processes are complex, the early stages of strategy development are likely to include appropriate modelling of the natural and artificial processes within the determined boundaries of the catchment for the chosen time scale. It is important that such modelling should be appropriate to the situation.

As a prelude to modelling, as much historical flow, level and rainfall data would be collated as is available to enable models to be validated for existing conditions. It should then be possible to develop and test models to try options for different water level regimes and defence standards. A wide range of options should be considered and their impacts examined.

Consultation with the various interested organisations on a wide a range of alternative solutions will help to identify valid constraints and viable solutions. The technical feasibility, costs and potential benefits of each option should be considered, including the possibility of attracting additional external funding from environmental enhancements, developers or opportunities such as tourism.

Risks associated with all options will need to be quantified, and the sensitivity of solutions to data errors or assumptions tested as recommended in FCDPAG4. It will also be necessary to examine incremental costs and benefits on a compartment by compartment basis with appropriate allowances for interaction between compartments.

The outcome of this process is a set of options with technical, economic and environmental assessments including do-nothing and do-minimum options.

Suitable options or combinations of options might include:

- reducing the standard of defence in some compartments (or allowing them to deteriorate naturally) to increase flood plain storage and effectively raise the standard of defences in other areas;
- raising the town defences sufficiently to cause overtopping of some other compartment areas without lowering the embankments or affecting their standard of defence to higher frequency floods;
- realigning and/or dredging of the river channel, including possible set back of existing defences, to improve hydraulic conditions and improve the standard of defence to all areas;
- improving the flood warning service to the town and recommending against further development in flood risk areas.

The selection of a preferred option is unlikely to be straightforward or to completely satisfy the wishes of all interested parties. However, a preferred option, satisfying the environmental assessments set out in FCDPAG5 and economic assessment requirements as set out in FCDPAG3, will need to be identified as the basis of a strategy.

The process of consultation and discussion of the plan will inevitably raise issues such as differential standards of protection to different areas of the catchment. The presentation of these will have to be carefully explained so that unrealistic or unachievable expectations are not raised.

### **Development of the strategy plan**

A strategy plan will incorporate all aspects of the preferred option, justify its selection and set out a timetable for stages of the strategy to be carried out over its time frame. The plan will include:

- the results of the modelling, options appraisal and consultation;
- justification for the proposed choice of strategic option;
- timing and description of construction, management or maintenance activities (which may be phased);
- identifying the responsible organisations who have agreed to undertake different elements of the plan;
- registering unresolved issues and how these are to be addressed;
- milestones at which progress and success, or the direction of, the strategy should be reconsidered.

## **5.2 Coastal area at risk from sea and river flooding**

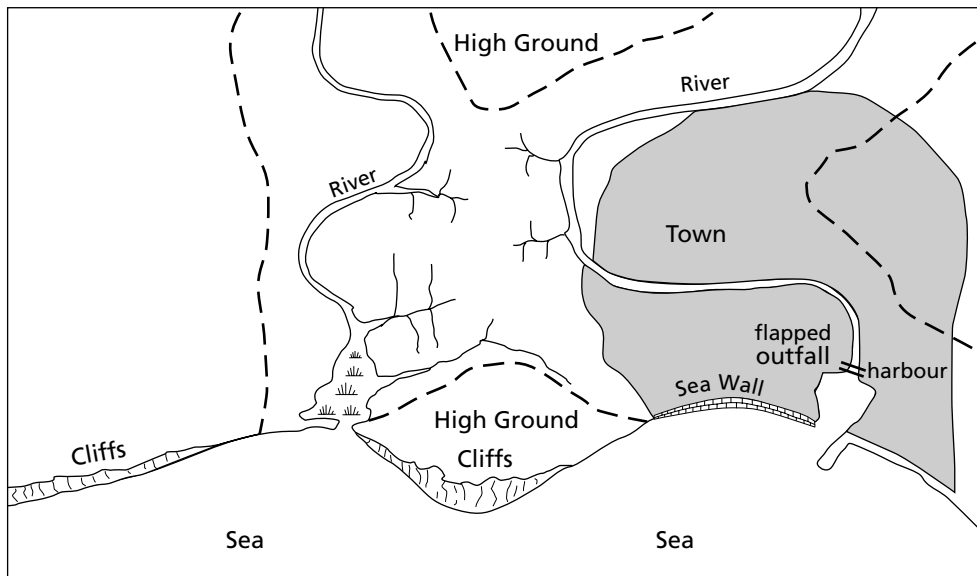
### **Description of problem**

A coastal town has ageing sea defences, which are coming to the end of their useful life. The promenade/sea wall was originally built primarily for amenity purposes in the late 1900s and severe overtopping occurs when high tides coincide with offshore gales. The seafront area has not received any significant investment in recent years and has suffered regular winter damage.

A river flows through the centre of the town and outfalls through a tidal flap into the harbour. There have been several historically noteworthy floods from the combined effects of the river and tides affecting the central part of the town. The town lies within an identified CMU with a total frontage length of 5 km including another non-urban river which outfalls through mud flats regarded as a locally important environmental feature.

At times of river or tidal flooding, drained pasture land between the two rivers can become a single flood plain (see Figure 5.2). The local authority wants to rejuvenate the sea front area and feels that a scheme to rebuild the sea wall is essential to achieve this.

**Figure 5.2 Example of coastal area at risk from sea and river flooding**



### Identification of need for a strategic approach

There is an obvious risk with this example of opting too readily for the solution of developing a scheme to improve the sea wall. Holding the line of the current defence is identified as a SMP policy option covering this area. The SMP suggests potential schemes for renewal of existing defences and beach recharge. Not only would this reduce the flood risk to the seafront area but could also offer extensive amenity and aesthetic enhancements.

However, this approach does not solve the problem of the fluvial flooding in the town and does not address the potential impact of local works on the wider area. There may be other potential options, which could offer equal opportunities for redevelopment of the town, that might be more sustainable in the long term or offer more environmental benefits. When these issues are considered there is a stronger argument for the need to develop a strategy covering the CMU and the two river catchments.

A strategic approach to determining a solution to this problem is desirable and a suitable strategic aim might be:

*to determine a long-term plan for sustainable river and coastal defences whilst providing options for the enhancement of the environmental and economic potential of the area.*

### Strategic approach

#### *Identification of strategic issues*

- ageing sea defences coming to the end of their viable life resulting in an increasing risk of tidal flooding due to poor standard of defences;
- risk of fluvial flooding behind tidal defences and combined tidal/fluvial events, requiring consideration of the joint probability of flooding;
- identification of appropriate standard of tidal and fluvial defences;

- need to ensure that all costs and benefits of flood avoidance are fully considered whatever the source of flooding;
- desire to maintain or enhance the amenity, recreational and environmental value of the beach, shoreline and the river corridors and any interactions between these. This may include identifying both the UK and local Biodiversity Action Plan priorities for the area;
- pressure to improve the economic potential of the area;
- need for consideration of impacts on adjacent areas as identified in the SMP strategy and as determined in studies of the river catchments;
- potential impact of sea level rise and climate change on water levels and the frequency of extreme events.

#### *Development of strategy*

A thorough understanding of the hydrological and hydraulic processes of the rivers and the tidal and wave regime affecting the area will need to be developed as the situation is potentially complex. The town is subject to flooding from both sea wall and fluvial overtopping, either separately or at the same time.

A joint probability approach will be required to determine the probability of flooding from the river due to the coincidence of flood flows and tide lock, from tidal flooding alone or from both sources. Damage probability curves will need to be developed for the combination of fresh and seawater flood damage.

Options for protection will need to ensure that the total flood risk to the area is considered, as benefits from one form of defence cannot be fully achieved if risk remains from another source. The impact of options on the natural regime of both river catchments and the intervening land will need to be investigated thoroughly and the potential for habitat replacement, or preferably enhancement, considered.

Although the SMP for the area recommended a strategy of 'holding the line' of the defence, a full range of options or combinations of options should be considered in the light of more detailed analysis including:

- do-nothing or do-minimum (e.g. continued maintenance);
- managed re-alignment possibly combined with restricted re-development in risk areas;
- setting back the line of the defence – an option that may affect the viability of property on the seafront or the future land use options of the area;
- upstream storage on the river, possibly with real time controls to manage fluvial and tidal levels or the possibility of diverting flood flows between rivers;
- beach nourishment or re-profiling;
- offshore reefs to reduce wave action;
- fluvial and tidal defences.

All options will need to take full account of their impact on the CPU within the relevant SMP. An option differing from that identified for the CMU may be preferred on the basis of the detailed technical, economic and environmental assessment undertaken within this strategic study. This is acceptable, provided that it is still consistent with the other general strategic objectives of the CMU and any changes in impact are fully investigated. In this instance it would be important to feedback such changes into the SMP review process.

#### *Development of the strategy plan*

The content and purpose will be as for the example in section 5.1.

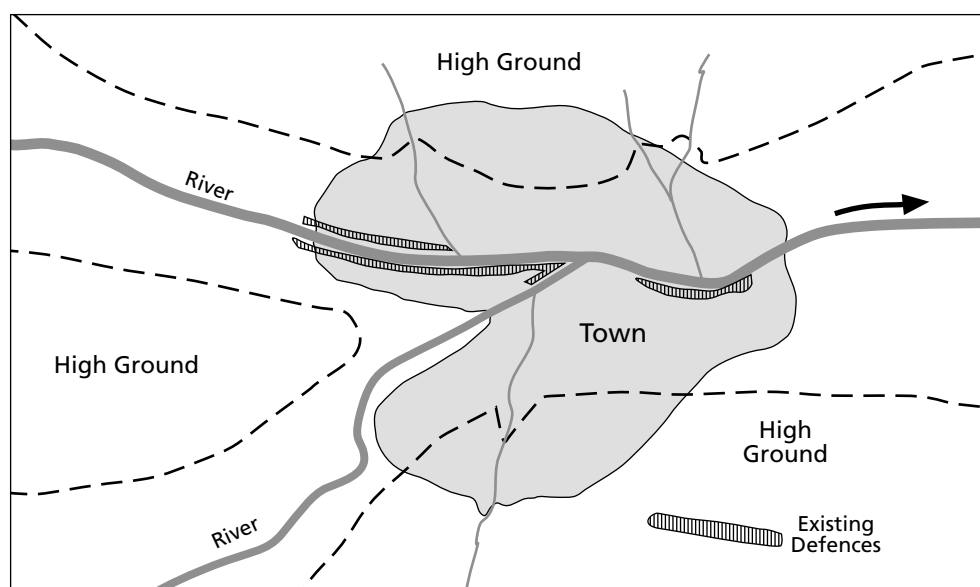
### 5.3 Flood risk management for urban rivers

#### Description of problem

An industrial town is built on the confluence of two rivers draining an extensive upland area. A number of tributaries join the main river channel in the town. The tributaries have either been fully culverted over in the last century or canalised with development close to the banks. Flood defences have been built along vulnerable lengths of one of the rivers to a 1% (1 in 100-year) standard in the past. The other river skirts the upstream edge of the town adjacent to industrial areas that are now largely derelict but identified for redevelopment (see Figure 5.3).

Historically the industrial area is known to flood but with unknown frequency. There is a continuing problem with flooding from the tributaries whose standard of defence is typically 4% (1 in 25-year). There are also more frequent surface water problems due to storm drainage surcharging. There is growing concern about the potential flood risk from culvert blockage. Drainage from recent development has been dealt with in a piecemeal fashion usually involving on site detention. The local authority wish to promote a scheme to reduce flood risk in the town and maintenance costs on the tributaries.

**Figure 5.3 Example of flood risk management for urban rivers**



### Identification of need for a strategic approach

The drainage systems within urban areas are usually highly interactive and complex. Flood risk to different areas often varies significantly, having built up over time with no clear policy on defence standards. Because the problem is complex, there are many different options which could be considered to improve the situation. Relatively independent schemes could be developed to alleviate the problems in the existing risk areas.

However, it is possible that such a piecemeal approach will potentially build on the existing maintenance problems and do nothing to address the longer-term pressures for development and social change within the catchments. Long-term sustainable solutions for the whole area are more likely to be developed from looking at the wider picture with greater scope for novel or innovative options. Similarly, spin-off opportunities and benefits from such an approach could be considerable.

A strategic approach to this problem is likely to provide better long-term solutions and the strategic aims might be defined as:

*to reduce flood risk in the town to appropriate standards and develop long-term drainage infrastructure plans to facilitate future economic growth.*

### Strategic approach

#### *Identification of strategic issues*

- determination of suitable boundaries within which the widest possible set of options can be developed;
- links to existing aims and objectives of town plans and balancing issues such 'brown field' site development against deterring development in flood risk areas;
- condition and standard of existing defences, culvert and channel capacities;
- apparent restricted opportunities for channel improvements within the town;
- high construction costs and public disruption due to works in an urban area;
- availability of rainfall and flow data in the catchment and urban drainage systems in the town;
- an understanding of the increasing effects of urbanisation or land use changes on data records;
- opportunities for combined purpose schemes and new partnerships;
- public expectation and acceptance of differing flood risk;
- high costs and safety issues of maintenance to existing drainage systems.

### *Development of strategy*

The development of viable technical options will require understanding of the hydraulic system. This may require modelling to be undertaken of the catchment, and within the town boundaries. Accurate hydraulic modelling of the network, including culvert sections and artificial channels, will be crucial if the current capacity of the drainage system is to be established.

Where possible field data for calibration of models should be used for verification, particularly where the sensitivity of results – is significant such as in confined urban reaches. Blockage scenarios will also need to be tested in the culverted area with full appraisal of resulting flood risk areas and possible ‘escape route’ flow paths. A joint probability approach will be necessary to establish likely combinations of river and tributary flow. An understanding of the relative timing of peaks in the rivers and tributary flow will be essential. Having established an understanding of the existing system, the future design standards will need to be determined on the basis of risk and economics.

The options considered for flood management might include any or combinations of the following:

- upstream detention on tributaries outside the boundaries of the town – this could be achieved by reservoir construction;
- the possibility of land management changes might be explored – including ploughing practice, hedge and ditch reinstatement, tree planting or drainage system changes – although the scale and likely impact of any such changes would have to be carefully considered;
- the creation of additional floodplain storage on the rivers upstream of the town or the creation of floodable ‘amenity spaces’ or new habitats within the town; derelict areas could be redeveloped in a way that allows them to continue to flood by adopting novel building and infrastructure techniques;
- channel or environmental improvements within the town including removing pinch points, possibly by the purchase and removal of buildings;
- works on the rivers or changes in the management of water levels to improve the hydraulic conditions in the tributaries or to reduce the coincidence of peak flows – for example, by channel works such as reinstating meanders;
- improved flood warning systems (increased advance warning) and flood proofing of properties to reduce the impact of inundation.

Options to make channel improvements should not necessarily be constrained by existing features such as roads or bridges, as opportunities may exist to make changes alongside other redevelopment activities with mutual benefits. Full consultation with other authorities is therefore essential if a full range of options is to be developed.

The choice of preferred options is likely to follow considerable consultation both with other authorities and also with the public, businesses and landowners in the areas concerned. Disruption from scheme works in the town may be considerable and is an additional reason for seeking alternative solutions to traditional ‘hard

engineering’. A full understanding of the benefits to the local community at an early stage may smooth the way for the future.

Whilst the economic and environmental appraisal of options as indicated in FDCPAG3 and FCDPAG5 will guide the decision towards the preferred option, the assessment of relative risks as described in FDCPAG4 will provide further direction towards the final choice. Sometimes risk assessment may indicate preferences between options or it may influence the way a single option is followed through.

**Development of the strategy plan**

The content and purpose will be as for the example in section 5.1.

**5.4 Estuary management for flood alleviation**

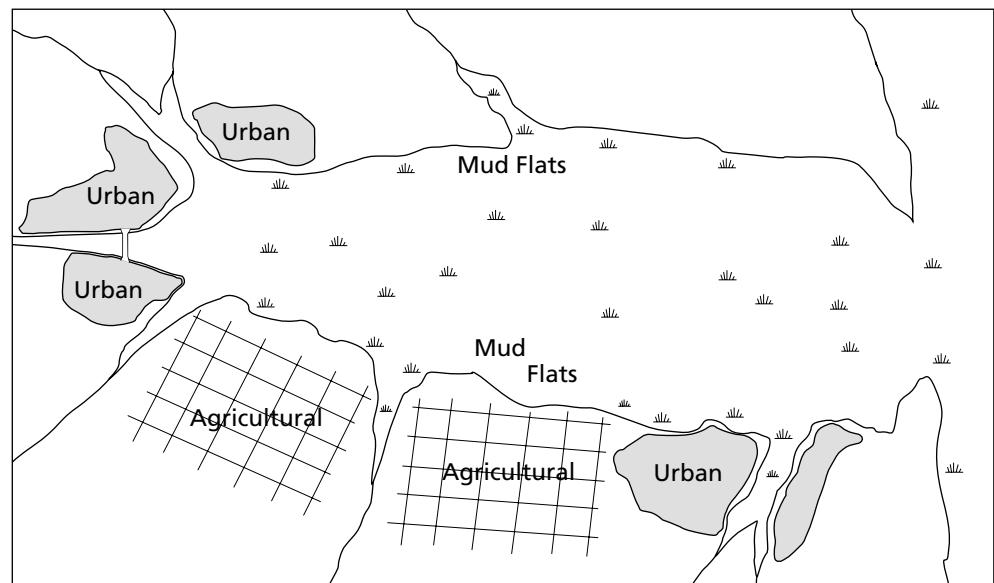
**Description of problem**

A tidal estuary has a mix of land uses, major urban developments, agricultural areas and important ecological sites all situated below high tide level and all protected by flood embankments of different standards and conditions (see Figure 5.4).

A series of unusually high tidal surges over recent years has resulted in repeated flooding in some areas and raised concerns about the relative standards of protection in the risk area.

The poor condition of some defences has led to demands for major maintenance to be undertaken by the operating authority.

**Figure 5.4 Example of estuary management for flood alleviation**



## Identification of need for a strategic approach

General concern has been expressed about the relative standard and condition of defences in the risk area and whether they suitably address the flood protection needs of the different land use and habitat areas. A strategic approach to the problem will offer the widest examination of the interrelated issues and enable a holistic solution to be developed.

At this stage, whilst it may not be possible to define detailed objectives before further work is carried out to investigate and define the issues, it should be possible to set out an overall strategic aim. For example the aim might be:

*to produce a long-term plan for sustainable flood defences in the estuary which takes full account of the justified protection needs of different areas and balances this with the main functions of the estuary for both natural development and human use.*

## Strategic approach

### Identification of strategic issues

- optimising long-term defence location and alignment for hydraulic efficiency;
- determination of optimum standards for different flood compartments (and need for additional compartmentalisation, where appropriate);
- influence of changes to one compartment on standards elsewhere;
- accommodation of long-term geomorphological change, including that due to predicted climate change and sea level rise;
- identification of opportunities for long-term retention and enhancement of environmental features;
- development of a prioritised programme for achieving required changes.

### Development of strategy

The basis of any estuary strategy is likely to be development of an understanding of its large-scale hydraulic behaviour and the way that it would be likely to evolve without further human intervention, based on records of past change and modelling of future scenarios. Hydraulic processes vary considerably within an estuary; tidal processes dominating in the outer estuary and fluvial in the inner. For this reason it may be applicable to divide the estuary into several zones to aid analysis. In most cases this will only be possible with a wide range of uncertainty.

However, if a range of sufficiently extreme hypothetical scenarios is examined, including, for example, complete (theoretical!) removal of all defences or extreme throttling of the channel, then it should be possible to identify likely key sensitivities. It should also be possible to consider the impact of future sea level rise. Allowances quoted are for open coast conditions. Model studies will be required to translate these into impacts on high water levels in the estuary.

It will also be important to take account of any local factors that may affect changes in land level such as well-established local rates of subsidence. Historical tide gauge records should be examined with care when evaluating past trends, as these can be influenced by local tide gauge movements. The well-known long-term cyclic variations in tidal levels also need to be taken into account.

Having established a basic understanding of hydraulic and sediment processes, this can then be applied to consider a range of future options. At the initial stages it is better to consider broad options for the long term rather than being constrained by the existing defence infrastructure. It will then be possible to consider the interim stages that would be required to achieve an optimal result over the lifetime of the strategy.

Options to consider might include:

- whether higher standards to areas with high asset values can be achieved by reducing the standard of protection to other areas;
- whether significant realignment of defences or the river channel could improve performance and whether this would be sustainable in the long term;
- what arrangements could be made to mitigate unavoidable environmental loss and what defence options can be adopted to maximise environmental gain, by sustaining, restoring and creating habitats and landscapes.

Once a framework for assessing the physical impacts of change has been established, then the impacts on protected assets, including the built and natural environment, can be calculated for alternative options. This will require valuation in general terms of assets and damages for different scenarios of overtopping and/or defence failure and identification of those impacts for which monetary valuation is not possible.

Typical strategic options to be considered include:

- the possibility of adopting major estuary wide solutions such as tidal barrages;
- compartmentalisation of flood areas to take account of the requirements of different land uses;
- alternative alignments of defence;
- different programmes of rebuilding or replacement.

The benefits and costs of these options should be examined in accordance with the decision process set out in FCDPAG3. There will often be a wide range of uncertainty in many of the considerations. Final decisions between options will need to take account of this uncertainty in the likely range of outcomes through risk analysis (see FCDPAG4). Unvalued impacts will also have to be considered (see FCDPAG5).

It will often be necessary to adopt a flexible response that can be adapted, as more information becomes available. The identification of ‘no regrets’ options, such as resisting intensification of development in particularly vulnerable areas, may be particularly important.

## Development of the strategy plan

The content and purpose will be as for the example in section 5.1.

## 5.5 Managing coastal erosion risks

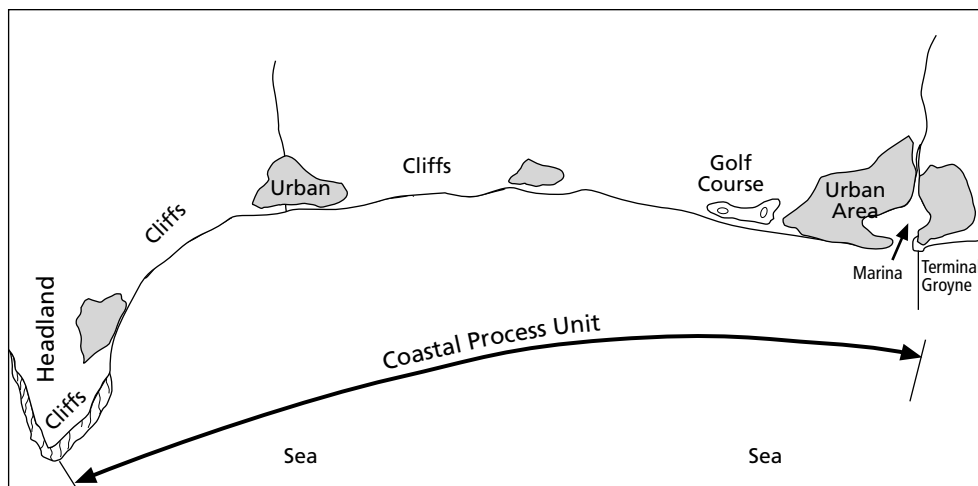
### Description of problem

The SMP has identified a relatively self-contained process unit for future management that consists of a group of 16 management units between a major headland and a harbour/marina complex, which incorporates a terminal groyne. The coastal area includes a variety of land use types from dense urban development to more scattered settlements and cliff top amenity sites, including a golf course.

About 60% of the coast has existing coast protection structures, mainly in the form of concrete walls and revetments, fronted by groyne fields to control beach movement. Some lengths of unprotected cliff are designated for their geological interest, which depends on continued erosion. Two different local authorities are responsible for the coast protection works along their respective frontages.

The Coastal Defence Survey and the SMP have identified a number of lengths with limited residual life and a number of the groynes are in urgent need of attention. Routine monitoring has indicated a decline in beach levels over the past five years. Both authorities are keen to explore the possible efficiencies that could be obtained by managing the whole process unit more strategically.

**Figure 5.5 Example of managing coastal erosion risks**



### Identification of need for a strategic approach

The area has already been identified as a coastal process unit within the SMP. The development of a strategy for long-term beach management operations, taking into account sediment budgets and movement within the unit, is likely to be the most effective approach. The strategic aim is:

*to produce a long-term plan for sustainable coastal defence management which takes account of coastal processes and balances the maintenance of natural coastal systems against the reasonable requirements to control rates of coastal erosion on developed frontages.*

### Strategic approach

Understanding of near-shore coastal processes and their relationship with any larger-scale sediment circulation system is clearly key to developing a strategic approach. The degree of additional study required will depend on the level of study undertaken for the SMP and any other previous work in the area.

#### Identification of strategic issues

- near-shore sediment transport rates and budgets, including onshore/offshore transfers and sediment inputs from eroding areas;
- the impacts of alternative management systems (such as longer groynes or offshore breakwaters) on the overall system and on individual frontages up and down-drift;
- the sensitivity of predicted impacts to potential change, including sea level rise and climate change;
- opportunities for environmental benefits from different management systems;
- the relative benefits of protecting different land use areas to different standards of residual risk (see below);
- reductions in risk through measures such as slope stabilisation or drainage, which may be outside the scope of the Coast Protection Act;
- other approaches to hazard reduction, such as development control.

In assessing the benefits of changes in management regime it will usually be necessary to assess the changes in risk of loss through erosion over time (see FCDPAG3). A strategic approach is particularly necessary where defences protect a linear coastal asset such as a trunk sewer or main road, as consideration of individual lengths may lead to significant double counting.

At the strategic level it will usually be appropriate to use council tax valuation bands, suitably updated, as the basis for property evaluation. However, it may be necessary to give more attention to any particularly large properties that could be lost and would have a significant impact on the overall totals.

In the case of amenity land such as a golf course, it will usually be appropriate to assign an economic value based on purchase of equivalent agricultural land (adjusted for national subsidies in accordance with FCDPAG3) and reasonable

establishment costs. This is likely to yield a more realistic and defensible lower bound estimate of potential national loss than other forms of valuation.

### *Development of strategy*

The strategy plan will need to consider overall costs and benefits for the whole system but also marginal costs and benefits of incremental changes, taking full account of their likely impact elsewhere. It should then be possible to develop a long-term optimised plan, which may be a combination of strategic beach nourishment, beach control structures, shoreline defences and ongoing management, whilst still allowing some coastal erosion to continue in unprotected areas.

The strategy plan will provide a sound basis on which to put forward a long-term prioritised programme of work for funding to both the respective local authorities and to Government for national grants. It will also provide the basis for demonstrating the consequences if full funding is not available. It is also likely that it will identify opportunities for a longer-term procurement strategy for works where it may be possible to achieve savings and efficiencies. For example, it may be possible to award longer-term joint contracts for activities such as beach management or renourishment, if not for the whole shoreline management process.

### **Development of the strategy plan**

The content and purpose will be as for the example in section 5.1.

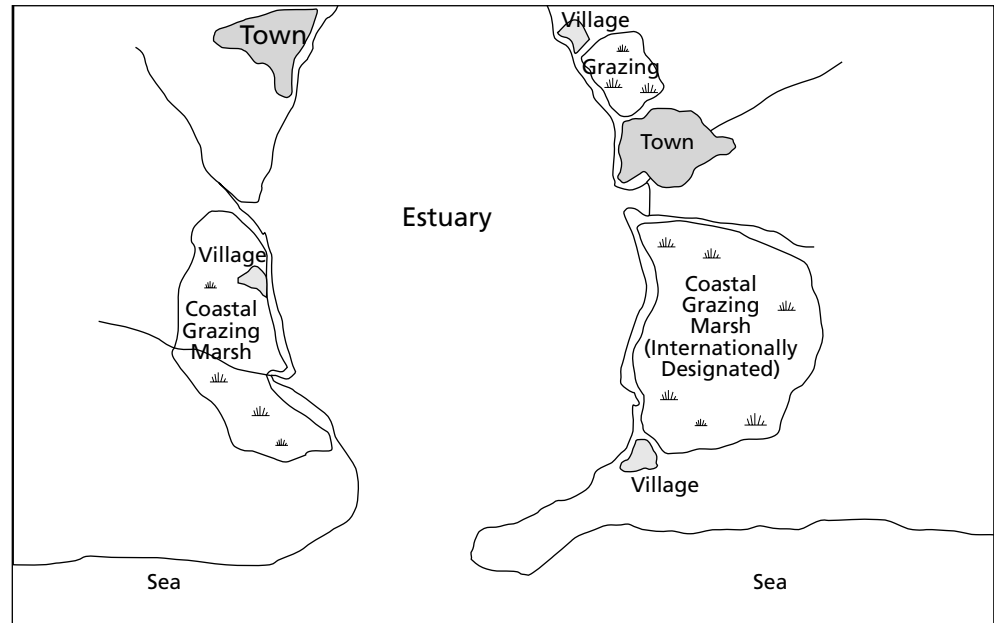
## **5.6 Flood alleviation taking account of internationally designated environmental sites**

### **Description of problem**

The lower reaches of an estuary system are designated as a Special Protection Area (SPA) and there are extensive areas of internationally designated coastal grazing marsh behind the defences. There are also two towns and a number of villages adjacent to the estuary, protected by flood defences, a number of which are approaching the end of their useful life.

A CHaMP has been prepared for the area. This has identified areas of set back required to compensate for long-term losses of inter-tidal habitat due to sea level rise and also areas of mitigation required for the consequent losses of freshwater marsh. It has also identified appropriate minimum standards of flood defence for the various environmental areas.

**Figure 5.6 Example of flood alleviation involving internationally designated sites**



### Identification of need for a strategic approach

The requirement is to identify a long-term programme of flood defence management that takes full account of agreed requirements in the CHaMP. A number of the flood risk areas cover a range of land use classifications with different protection requirements. There are also process links between areas so that increases or reductions in standard to one compartment will have a potential impact elsewhere. The strategic aim is:

*to produce a long-term plan for sustainable flood defence management in the lower estuary that takes full account of requirements set out in the related CHaMP and provides appropriate levels of protection to all flood risk areas.*

### Strategic approach

#### *Identification of strategic issues*

- impacts of different levels of protection on defence standards elsewhere;
- impacts of different solutions on environmental interests identified in the CHaMP;
- consideration of differential standards of protection – for example, whilst in some cases it may be more economic to provide standards of protection to a whole compartment appropriate to the highest risks in that area, in others it will be more economic to provide a higher standard only on a more localised basis, around developed areas or particularly sensitive sites, by using secondary defences or counterwalls.

#### *Development of strategy*

Much of the strategic planning should already have been carried out for the CHaMP and in an ideal situation, the flood defence strategy and the CHaMP would be progressed in parallel to produce a single integrated strategy for the

whole area. However, there are particular issues, such as appropriate standards of protection to urban areas and other infrastructure, that will not be considered in the CHaMP process. These may need to be addressed through additional analysis or modelling.

Once the key strategic interactions and processes are understood it should be possible to take a logical approach to the consideration of all impacts of a range of management options for different defence standards (taking account of both overtopping and breaching scenarios). An optimum strategy implementation plan can then be produced. All impacts should be quantified as far as possible (see FCDPAG5 and FCDPAG3).

#### **Development of the strategy plan**

The content and purpose will be as for the example in section 5.1.



# Key references

1. MAFF/Welsh Office: *Strategy for Flood and Coastal Defence in England and Wales*, Publication PB1471, September 1993.
2. MAFF: *Shoreline Management Plans, a Guide for Coastal Defence Authorities*, (Revision in press 2001).
3. Parker D J, Green C H, Thompson P M, *Urban Flood Protection Benefits: a Project Appraisal Guide (the Red Manual)*, Gower, 1987.
4. Middlesex University Flood Hazard Research Centre: *FLAIR (Flood Loss Assessment Information Report)*, December 1990.
5. Penning-Rowsell E C, Green C H, Thompson P M, Coker A M, Tunstall S M, Richards C and Parker D J: *The Economics of Coastal Management: a Manual of Benefits Assessment Techniques (the Yellow Manual)*, 1992.
6. MAFF: *High Level Targets for Flood and Coastal Defence and Elaboration of the Environment Agency's Flood Defence Supervisory Duty*, MAFF Flood and Coastal Defence with Emergencies Division, November 1999.
7. MAFF: *Water Level Management Plans; a Procedural Guide for Operating Authorities*, Publication PB 1793, June 1994.
8. English Nature: *Coastal Habitat Management Plans: an Interim Guide to Content and Structure*, April 2000.
9. Institute of Hydrology: *Flood Estimation Handbook*, Volumes 1–5, 1999. [Volume 1 in particular has a summary of useful guidance on approaches to hydrological problems in flood estimation.]
10. CIRIA (Construction Industry Research and Information Association): *Beach Management Manual*, 1995
11. EA/DETR: *Guidelines for Environmental Risk Assessment and Management*, 2000.



# Glossary of terms

<b>Catchment Flood Management Plan (CFMP)</b>	A large scale planning document that identifies long-term sustainable policies for the holistic management of flood risks in a defined river catchment or group of related catchments.
<b>Coastal Habitat Management Plan (CHaMP)</b>	A management plan that identifies the flood and coastal defence works that are likely to be required in a given area to conserve the nature conservation interest of a European site or a group of sites, particularly where the current defence line may be unsustainable.
<b>Coastal Management Unit (CMU)</b>	A term used in SMPs to describe a length of shoreline with coherent characteristics in terms of coastal processes and assets at risk that can be managed efficiently. Usually a subunit of a CPU.
<b>Coastal Process Unit (CPU)</b>	A term used in SMPs to describe a length of shoreline in which the physical processes are largely independent of processes operating in adjacent process units.
<b>Do-nothing scenario</b>	An option used in benefit–cost analysis to act as a baseline against which all other options are tested. It assumes that no action whatsoever is taken. In the case of existing works it assumes ‘walk-away’, i.e. cease all maintenance, repairs and other activities immediately. In the case of new works it assumes that there is no intervention in natural processes. Politically this is often seen as a non-viable option but it is an important comparison tool in benefit–cost analysis.
<b>Environmental</b>	When environmental issues are referred to, this term is used to encompass landscape/natural beauty, flora, fauna, geological or geomorphological features, and buildings, sites and objects of archaeological, architectural or historical interest.
<b>Hazard</b>	A situation with the potential to result in harm. A hazard does not necessarily lead to harm.

<b>'No regrets' actions</b>	Actions taken to respond to perceived climate change impacts whose consequences both economic and environmental will be beneficial (usually in the short term) without imposing any long-term commitments.
<b>Probability</b>	The probability of an outcome is the relative proportion or frequency of events leading to that outcome, out of all possible events.
<b>Qualitative methods</b>	Approaches which use descriptive rather than numerical values for assessment and decision making.
<b>Residual life of defences</b>	The remaining time until a defence is likely to fail or no longer achieve minimum acceptable performance criteria in terms of serviceability or structural strength. (Criteria for failure need to be carefully considered.)
<b>Return period</b>	A measure of the rarity of an event: the longer the return period, the rarer the event. It is the average length of time (usually in years) separating flood events of a similar magnitude. Sometimes referred to as the recurrence interval.
<b>Residual risk</b>	The risk which remains after risk management and mitigation. May include, for example, risk due to very severe (above design standard) storms, or risks from unforeseen hazards.
<b>Sensitivity testing</b>	Method in which the impact on the output of an analysis is assessed by systematically changing the input values.
<b>Shoreline Management Plan (SMP)</b>	A large-scale planning document that identifies policies for coastal defence for a specified length of coast, normally a self contained sediment cell or group of cells, taking account of natural coastal processes and human and other environmental influences and needs.
<b>Site of Special Scientific Interest (SSSI)</b>	A site notified under the Wildlife and Countryside Act 1981 because it is of special interest by reason of the flora, fauna, geological or physiographical features.
<b>Special Area of Conservation (SAC)</b>	An internationally important site for the conservation of habitats and/or species, designated under the EU Habitats Directive, A cSAC is a candidate site, but afforded the same status as if confirmed.

<b>Special Protection Area (SPA)</b>	An internationally important site for the conservation of wild birds, designated under the EU Wild Birds Directive. A pSAC is a proposed site, but afforded the same status as if confirmed.
<b>Strategic approach</b>	Any process or element of a process undertaken in a holistic or comprehensive (strategic) way whilst not being to any great level of detail.
<b>Strategic framework</b>	A planning structure which has been developed using strategic principles within which layers of consistent and interrelated plans and strategies can be developed.
<b>Strategy plan</b>	A long-term (usually 50 years or more) documented plan for river or coastal management, including all necessary work to meet defined flood or coastal defence objectives for the target area.
<b>Sustainability</b>	The degree to which flood and coastal defence solutions avoid tying future generations into inflexible and or expensive options for defence. This will usually include consideration of interrelationships with other defences and likely developments and processes within a catchment or coastal cell. It will also take account of long-term demands for non-renewable materials.
<b>Water Level Management Plan (WLMP)</b>	A means by which the water level requirements for a range of activities in an area, including agriculture, flood defence and conservation, can be balanced and integrated. The plan outlines the objective for the area and the means by which those objectives may be achieved.
<b>Whole life (costs)</b>	The total costs associated with a scheme for its full design and potential residual life span, taking proper account of all aspects of design, construction, maintenance and external impacts. A particularly useful approach in helping to determine economic sustainability when used to compare the relative costs of long-life schemes such as flood defences and where decisions between short-term capital costs and long-term maintenance costs need to be made.



# Annex A

## Contents of a typical strategy plan

- Executive summary (no more than two pages)
- Establish benefits of a strategic approach
- Identification of problem(s)
  - Establishment of appropriate boundaries with justification
  - Establishment of appropriate time frame
  - Review of current knowledge
  - Links to high level plans
  - Review of previous policy options
  - Evaluation of do-nothing scenarios
  - Significant opportunities/constraints
- Establishment of strategic aims and objectives
- Alternatives considered
  - All reasonable and significant options
  - Alternative standards of protection or defence
- Costs
  - Costs of all options
- Benefits, impacts and consequences
  - Valuation of tangible and intangible benefits for all options
  - Statement of unvalued benefits or consequences
- Risk and sensitivity analysis
  - Assessment of risks for all aspects of strategy
  - Assessment of sensitivity of strategic decision making

- Conclusions, choice of preferred strategic solution(s)
  - Recommendation of preferred option(s) based on technical, economic and environmental criteria
  - Identification of areas where additional studies, information or monitoring are required to address major areas of uncertainty
  - Timetable and description of activities to be undertaken and outputs to be delivered to implement the strategy, i.e. construction, management or maintenance, further studies
  - Identification of the responsibility of different organisations to undertake elements of the plan
  - Reference to any unresolved issues and how they are to be addressed
  - Milestones at which progress and success should be reviewed and reported on. Suggested dates when the strategy direction should be reviewed.





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