



FCDPAG5

Flood and Coastal Defence Project Appraisal Guidance

Environmental Appraisal

**Ministry of Agriculture,
Fisheries and Food**

Flood and Coastal Defence Project Appraisal Guidance

Environmental Appraisal

**FCDPAG5
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 Ministry is grateful for the advice and guidance of the steering group members and others who have provided useful comments during the development of this guidance note. Members of the steering group were:

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Ministry of Agriculture, Fisheries and Food

Flood and Coastal Defence with Emergencies Division

March 2000

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1. Introduction

This guide, one of a series on the appraisal of flood and coastal defence in England and Wales, covers the environmental aspects of project appraisal. The complete list of titles to be published 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 (this volume)
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 is likely to produce projects that are acceptable for central government support.

FCDPAG1 provides more guidance on the general integration of approaches and the recommended use of the document series.

FCDPAG2 sets 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 then identifies methods for valuing costs and impacts in monetary terms and also sets out a recommended decision process, based on economic values.

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

This guide (FCDPAG5) provides a similar function in the derivation of economic values for input to economic decision making, set out in FCDPAG3, for environmental aspects of flood and coastal defence works. It also replaces previous guidance on the implications of the Habitats Directive (see reference 1) and good practice for coastal defence and the environment (see reference 2). In conjunction with other publications (particularly the Code of Practice on Environmental Procedures – see reference 3) it should be used by the flood and coastal defence operating authorities, (namely the Environment Agency, Internal Drainage Boards (IDBs) and local authorities) to ensure proper account is taken of environmental considerations when preparing schemes for flood and coastal defence works.

FCDPAG6 provides updated guidance on undertaking post project evaluation.

What is environmental appraisal

1.1 Definition

Environmental appraisal is a generic term relating to the identification, measurement and assessment of environmental impacts. The term ‘assessment’ refers to the process for determining the importance of any impact. Thus an impact might be identified as the effect, over the lifetime of the scheme, of constructing a new flood bank on a site of nature conservation importance. This impact might be measured, for example, in terms of the reduction in the area or quality of habitats. Assessment involves determining the importance of these impacts.

Although environmental appraisal includes all aspects of environmental impacts, this document concentrates on nature conservation and heritage issues (archaeological sites and listed buildings), that are the most relevant in the majority of flood and coastal defence schemes. There is particular emphasis on nature conservation, particularly sites of international importance. This reflects significant recent development in thinking in this area, and the introduction of new policy on protecting habitats.

Relationship between environmental appraisal and scheme development

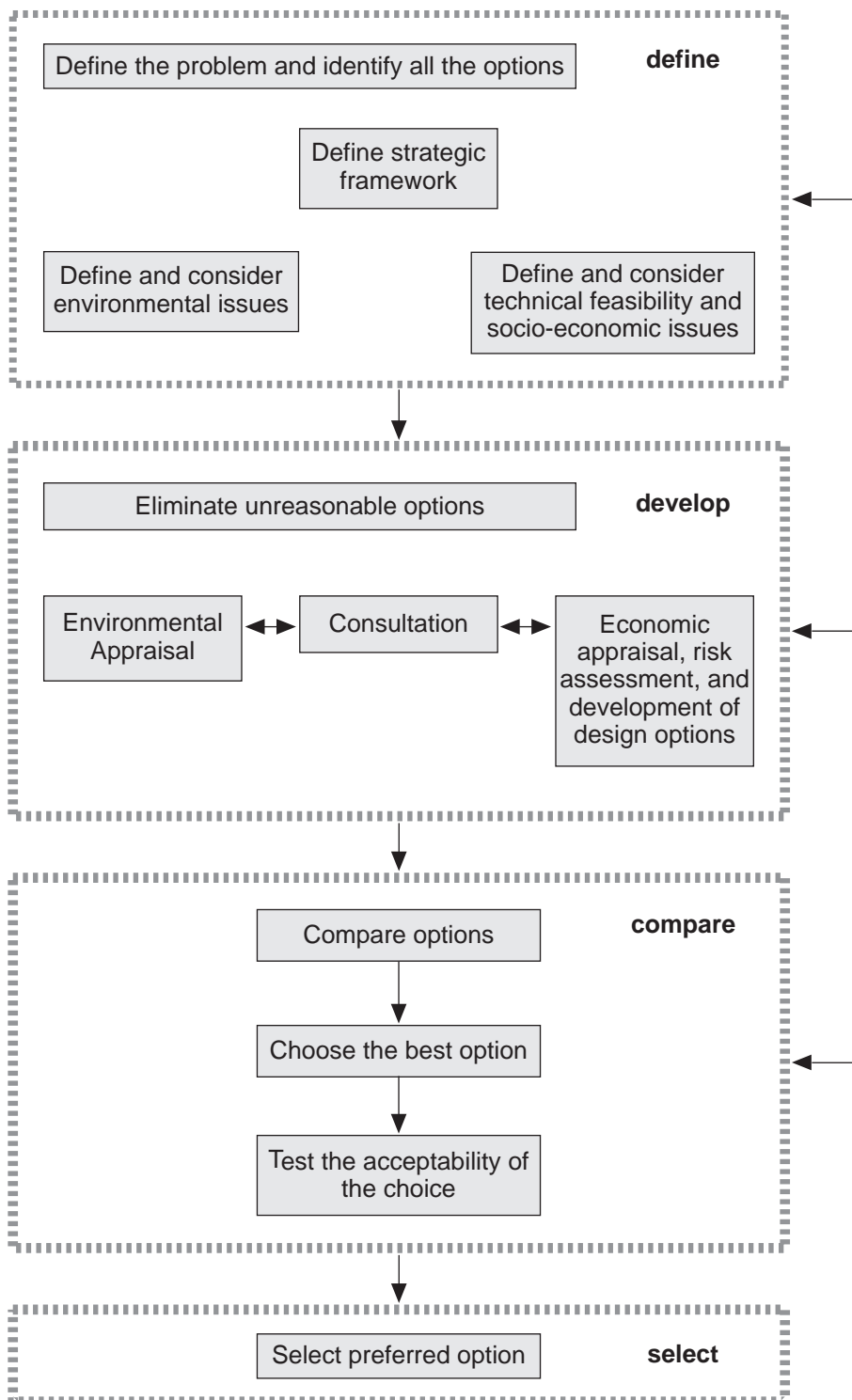
The environmental appraisal should continue through the whole scheme development process, starting at the time when a problem is perceived and continuing through option development and choice, scheme design and operation, audit and post project appraisal. It is also important to ensure that environmental appraisal interacts with economic appraisal so as to ensure that the final design is both environmentally acceptable and economically viable. This relationship is illustrated in figure 1.1, below.

1.2 Objectives

The broad objective of this document is to assist flood and coastal defence operating authorities to improve decision making with regard to environmental impacts and to facilitate compliance with relevant environmental legislation. This is achieved by referring to existing publications, such as the Code of Practice on Environmental Procedures, and by providing further guidance. In particular, this publication seeks to:

- advise on how to take account of environmental objectives and sustainability in scheme design (chapter 2);
- improve project appraisal by drawing attention to the range of techniques available for use in environmental valuation, including monetary (implicit and explicit) and non-monetary (multi-criteria analysis) techniques (chapters 3 and 4);
- provide updated guidance on compliance with the Habitats and Birds Directives following the announcement that designated features within European sites must be protected from flooding and coastal erosion (chapter 5); and
- provide advice on scheme design by reference to theoretical examples (chapter 6).

Figure 1.1 Relationship between environmental and economic assessment and scheme development



2. Guidance on scheme appraisal, legal requirements and good practice

2.1 Scheme appraisal

2.1.1 General approach

Operating authorities are encouraged to adopt a strategic approach to flood and coastal defences based on sound knowledge of riverine and coastal processes, and to take account of all existing strategic plans when preparing schemes (see also FCDPAG2). This allows environmental implications to be considered over whole catchments or coastal cells, as operating authorities are urged to undertake strategic environmental appraisal at this level. This is a means of ensuring, through consultation with interested parties, that the wider environmental implications, including cumulative effects, are taken into account (see reference 3).

In order to deliver environmentally acceptable solutions, broad-option development is required, including consideration of options that deliver environmental benefits or minimise damage. It is essential to consider such options, which can then be developed for testing in the subsequent cost-benefit analysis. However, whilst the cost-benefit analysis should, as far as possible, take all relevant factors into account, some impacts cannot easily be valued in monetary terms, but still need to be taken account of properly in the appraisal process. Such impacts must be considered through environmental appraisal. Project designers should adopt an appraisal-led approach. The recommended procedures to ensure that environmental issues are taken into full and proper account are described in detail in the MAFF/Welsh Office *Code of Practice on Environmental Procedures* (see reference 3).

Operating authorities are also encouraged to adopt an integrated approach to river management, and schemes should seek to address wider environmental issues such as catchment management and land use, low flow, or channel and floodplain habitat diversity as an integral part of option selection and design. For fluvial systems, the Local Environment Agency Plan (LEAP) for the particular catchment will inform the scheme design process by identifying some relevant environmental issues. Schemes should normally also be consistent with any completed Water Level Management Plans (WLMPs) within the catchment, and it is important to ensure that proposals will not unduly constrain the preparation and implementation of WLMPs.

On the coast the Shoreline Management Plan (SMP) for the relevant coastal cell and any subsequent strategy studies will normally be the starting point for scheme design and appraisal. Where designated sites of international nature conservation importance are likely to be affected the situation is more complex, and will be discussed in detail in chapter 5. Proposals involving estuaries that are not covered by SMPs should be in accordance with the relevant Estuary Management Plan where such a document exists. These provide the basis for identifying environmentally acceptable flood defence policies in estuaries outside the area covered by SMPs. Reference should also be made to any other relevant strategic documents.

Relevance of Local Environment Agency Plans and Water Level Management Plans

Shoreline Management Plans and Estuary Management Plans

2.1.2 Environmental duties of operating authorities

Section 7 of the Environment Act 1995 and sections 61A and 61B of the Land Drainage Act 1994 require the Agency, Internal Drainage Boards (IDBs) and local authorities respectively to contribute to the conservation of nature and heritage when carrying out their flood defence functions under the relevant Acts. In this context, the main environmental duties are:

- to further the conservation and enhancement of natural beauty, and the conservation of flora, fauna and geological or physiographical features of special interest, so far as may be consistent with the purposes of any enactments relating to their functions and, in the case of the Agency, with any guidance given to it under section 4 of the 1995 Act;
- to have regard to the desirability of protecting and conserving buildings, sites and objects of archaeological, architectural or historic interest (and in the case of the Agency engineering interest);
- to have regard to the desirability of preserving public access to areas of woodland, mountains, moor, heath, down, cliff or foreshore and other places of natural beauty, and to buildings, sites and objects of archaeological or historic interest (and in the case of the Agency engineering interest); and
- to take into account any effect which proposals would have on the preservation of such public access or on the beauty or amenity of any rural or urban area, or on any flora, fauna, features, buildings, sites or objects.

Section 6(1) of the Environment Act 1995 imposes a duty on the Environment Agency generally to promote, to such extent as it considers desirable:

- the conservation and enhancement of the natural beauty and amenity of inland and coastal waters and of land associated with such waters;
- the conservation of flora and fauna which are dependent on an aquatic environment; and
- the use of such waters and land for recreational purposes.

Policy statement

In England, all flood and coastal defence operating authorities should prepare a policy statement setting out, amongst other things, commitments to comply with the sustainability policies, and environmental obligations and targets set out in the High Level Targets (see reference 4).

Environmental implications are therefore fundamental to scheme design and need to be carefully considered at every stage in the design process if environmentally acceptable results are to be achieved. When designing a scheme, therefore, operating authorities should:

- seek to avoid environmental damage;
- minimise environmental damage where some impact is unavoidable;
- devise suitable mitigation to offset residual impact where possible; and
- identify and where practical include opportunities for environmental enhancement.

2.1.3 Powers of direction and supervision

Under section 40 of the Environment Act 1995, the Minister and/or the National Assembly for Wales Secretary (Assembly Secretary) may give directions to the Agency in respect of its flood defence and land drainage functions. Under section 61D of the Land Drainage Act 1994, the MAFF Minister or the National Assembly for Wales Secretary (Assembly Secretary) may give a direction to an IDB if he considers that destruction or serious damage to an environmental asset of national or international importance could result from any works, operations or activities which are being or are about to be carried out. In both cases, except in an emergency, these powers can be exercised only after consultation with the body concerned.

**Powers of direction
of Minister/
Assembly Secretary**

Under section 6(4) of the Environment Act 1995, the Environment Agency has a general supervisory role over all matters relating to flood defence in England and Wales. The Agency may issue directions to IDBs in connection with drainage works as part of its supervisory role under the Land Drainage Act 1991. Directions can only be issued for the purpose of securing efficient working of existing drainage works or for the construction of such new drainage works as may be necessary.

**Environment Agency
supervisory role**

2.1.4 Identifying the preferred option

FCDPAG3 advocates an appraisal-led design process. Guidance on identifying the preferred option from an environmental perspective is provided in the MAFF/Welsh Office *Code of Practice on Environmental Procedures* (see reference 3). Identifying the best option requires careful consideration of environmental issues alongside economic and other issues as set out in Figure 1.1, above.

Prior to commencing detailed economic analysis, it is particularly important to ensure that all appropriate options have been identified. The most promising options for environmental protection and gain should be taken forward to the cost-benefit analysis. Operating authorities are encouraged to be innovative in identifying environmentally benign solutions. There may be sites, for example, where it is possible to undertake managed realignment over agricultural land, and provide local protection of properties (FCDPAG3, section 3.2). For inland wetlands it may be possible to locally increase water levels to benefit wildlife, whilst maintaining low water levels for agricultural purposes elsewhere.

When considering the environmental implications of different options, it is necessary to consider impacts throughout the life of the scheme. For example, the build-up of sediment in new areas is likely to have long-term effects (that could be either positive or negative) on landscape and nature conservation. It is also important to consider timing of works during option development, since this can often reduce environmental impacts. Where initial consideration suggests that an option is likely to be particularly environmentally damaging, it should not normally be taken further.

Where designated sites are involved, the starting point for decision making must be to minimise risk to the features of interest. When considering options it is important to pay particular attention to the reasons for designation. If a site is designated for species associated with wetland habitats, then lowering water levels is unlikely to be acceptable. Conversely, where a site is important for species that require dry habitats, keeping water out is likely to be favoured for nature conservation. When

determining the standard of protection to provide, it will be important to consider the impacts of previous flood defence schemes and past flooding events. The advice of English Nature/Countryside Council for Wales (CCW) should be sought when determining appropriate options for SSSIs, SPAs, SACs and Ramsar sites (see section 2.3 and Glossary for definition of terms). County ecologists and the local wildlife trust should be consulted where non-statutory designated local wildlife sites are involved, and the landowner or manager will be an important contact for nature reserves.

For designated sites of historic interest it may be necessary to contact English Heritage/Cadw.

2.1.5 Detailed design considerations

At the detailed design stage there are opportunities for reducing/eliminating environmental impacts, and/or providing environmental enhancements. For example, facing materials can be chosen to blend with the landscape setting, or trees adjacent to a watercourse can be retained by identifying a sensitive dredging regime. However, at this detailed level, the medium to long-term benefits of environmental protection and enhancement measures must be considered against costs. For example, it will not always be cost-effective to save every tree along a river, and there may be cases where the environmental benefits of a sensitive mitigation scheme are greater than the environmental benefits achieved at greater cost through avoidance measures. An example of such a scheme is provided in chapter 6.

2.2 Environmental appraisal and assessment

2.2.1 Initial considerations

Strategic appraisal

An environmental appraisal must be an integral part of the overall project design process. The process starts with an appropriate degree of appraisal at the strategic level to reduce the risk of unacceptable options/schemes being considered. Undertaking appraisal at the strategic level also allows the potential significance of the combined effects of schemes to be considered.

Relationship between environmental appraisal and Environmental Impact Assessment

Furthermore, an environmental appraisal is required for all flood and coastal defence schemes, and must be carried out prior to application for grant-aid (references to grant-aided schemes throughout this document also cover section 5 approvals under the Coast Protection Act 1949, even when the grant is not being provided). In certain circumstances, the environmental appraisal must be in the form of an Environmental Impact Assessment (EIA), which includes preparation of an Environmental Statement (see reference 5). Flood defence capital works are subject to The Environmental Impact Assessment (Land Drainage Improvement Works) Regulations 1999 (S.I. No. 1783) if they are improvements to existing works. Otherwise flood defence and coast protection works are subject to the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999. These Regulations implement Council Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment, and the amending directive 97/11/EC. They require the preparation of an Environmental Statement of the effects where the impact of these projects is

likely to be significant. DETR Circular 02/99 introduces and explains Environmental Impact Assessment procedures, and the Environment Agency has produced internal guidance on the subject (see reference 6).

Maintenance works are not covered by the EIA regulations. This means, for example, that operations such as de-silting, weed cutting and other operations where the hard bed or banks are not excavated, do not require an EIA. However, dredging that includes excavation of the hard bed material (i.e. creating a larger channel) or creating meanders, for example, does require an EIA if there are likely to be significant effects.

Although an EIA is not necessary, environmental considerations must still be taken into account when planning and carrying out maintenance works, and an appropriate level of environmental appraisal is required. Every effort should be made to maintain and enhance the quality of the river and coastal environment. This is particularly important where SPAs, SACs and Ramsar sites are involved. Operating authorities are strongly encouraged to undertake detailed environmental appraisals in advance of maintenance activities on such sites, and to consult English Nature/CCW where negative effects are likely. Where European sites are involved, an Appropriate Assessment may also be needed (see section 5.2).

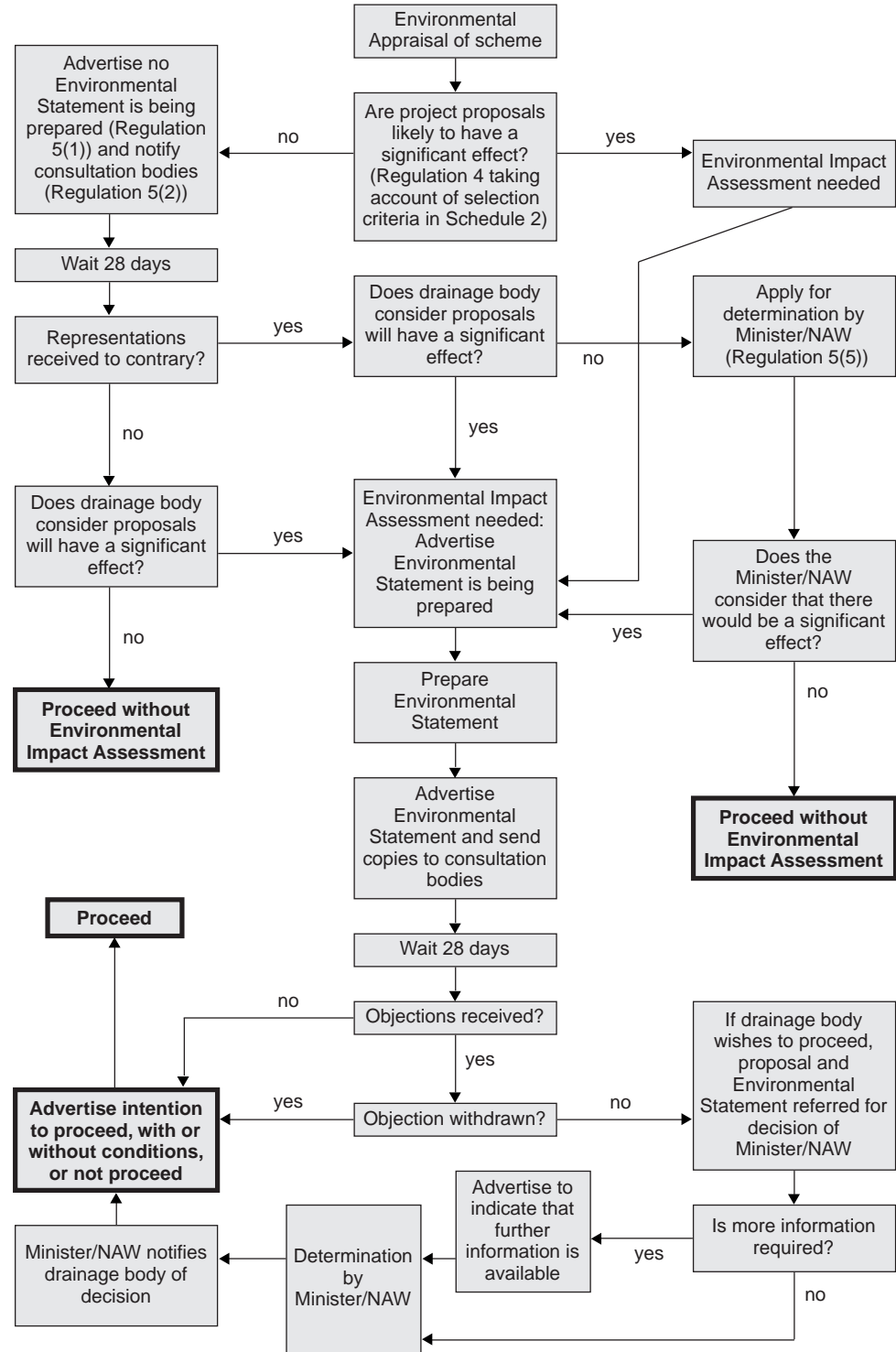
Figure 2.1 describes the process for deciding on the need for an EIA, and the steps that need to be taken. Where planning permission is required, the planning authority decides the level of environmental information that is needed. Where planning permission is not required, the decision lies with the operating authority. Where the main elements of the proposal do not require planning permission, but there are some elements that do (e.g. access for construction vehicles), the operating authority and local authority should identify the required approach jointly.

Is an Environmental Impact Assessment required?

For land drainage improvement works, having decided in consultation with relevant bodies whether or not an Environmental Statement (ES) is to be prepared, this decision must be advertised. If it is initially decided that an ES will not be prepared, organisations and individuals with an interest in the scheme may object, and request that a formal ES be prepared. If, following further discussion, agreement cannot be reached, MAFF/National Assembly for Wales may, as a last resort, be asked to decide whether or not an ES is required. When an ES has been prepared, organisations and individuals then have an opportunity to comment on the scheme. Again, if objections cannot be reconciled, the appropriate Minister/Assembly Secretary may, as a last recourse, be asked to decide whether the scheme should proceed. Full details of the process are provided in the MAFF/Welsh Office *Code of Practice on Environmental Procedures* (see reference 3).

For new works the procedures are similar to those described above. The operating authority can formally request screening and scoping opinions from the relevant planning authority, regarding the need for and required content of an EIA. There is, however, no requirement to consult with relevant bodies prior to determining whether an EIA is required.

Figure 2.1 Environmental Impact Assessment procedures for improvement works



2.2.2 Undertaking environmental appraisal/Environmental Impact Assessment

When undertaking an environmental appraisal (whether or not it includes an Environmental Impact Assessment (EIA)), sufficient environmental information must be obtained by a combination of reviewing existing information and collection of new data, in order to identify the likely significance of alternative scheme options. A full list of the environmental factors that need to be considered when undertaking an EIA is provided in the Schedules of the relevant EIA Regulations. Where an EIA is not required, these Schedules should nevertheless inform the decision as to what information is required.

What needs to be considered

For flood and coastal defence projects, environmental factors that are particularly relevant are:

- flora;
- fauna;
- population;
- cultural heritage;
- property and the built environment;
- landscape; and
- geological/geomorphological features.

Impacts of the various options on these factors will normally require thorough consideration. However, other effects that should be considered include:

- the impact of construction traffic;
- impacts on access (e.g. public footpaths);
- impacts due to construction noise and air emissions;
- longer term recreation and amenity considerations;
- social and economic considerations;
- health and safety (especially during construction);
- impact on soils and mineral deposits; and
- water quality implications (both surface and ground water).

An appropriate level of investigation is required to allow proper consideration of the environmental acceptability of alternative schemes. In particular, the area covered by the appraisal should be large enough to include wider effects, e.g. impacts on the floodplain, not just the river itself.

Specific guidance on the procedures to be adopted for flood and coastal defence schemes is provided in the MAFF/Welsh Office *Code of Practice on Environmental Procedures* (see reference 3). Scoping is a very important process through which the key issues of concern are identified. To be effective, the scoping exercise should be

undertaken at an early stage. Effort can then be focused on considering the most important environmental effects and consequences. Consultation is an essential part of scoping, and this must involve statutory consultees. It is best practice to also involve relevant non-governmental organisations and interested individuals as appropriate. This will help i) to identify key impacts and concerns; ii) to identify sources of useful information; and iii) to facilitate stakeholder participation. Guidance on scoping an EIA for flood and coastal defence projects is available from the Environment Agency.

An EIA should be undertaken for all schemes where, as identified above, there is likely to be a significant effect (in the context of the EIA regulations). PPG9 and TAN (Wales) 5 confirm that, in practice, this will include all proposals within, or adjacent to, designated sites of national or international importance, unless a preliminary assessment demonstrates that no effect is likely (see references 8 and 9). An EIA should be prepared for all proposals that are likely to have a significant effect on a SPA, SAC or Ramsar site.

It is important to ensure that the recommendations in the environmental appraisal or ES are incorporated in the final design and construction process. Operating authorities are encouraged to prepare an Environmental Action Plan for this purpose. This should set out the environmental actions to be undertaken before, during and after construction, together with details of the monitoring and management procedures.

2.2.3 Relationship with other studies

During the appraisal/assessment process, it is also important to obtain sufficient information to inform the estimation (either in monetary or non-monetary terms) of costs and benefits associated with alternative schemes and hence influence economic appraisal. This issue is dealt with in chapter 3.

It is important to recognise that undertaking an environmental appraisal will not, in itself, ensure that an environmentally-acceptable scheme is developed. To be successful, appraisal needs to be an iterative process that starts at project inception and involves continued dialogue between environmental experts and designers, together with full consideration of the views expressed by consultees. Willingness to consider options or adapt a scheme to account for the findings during the preparation of an appraisal is essential if an operating authority is to fulfil its environmental duties.

2.3 Nature conservation designations

Key legislation

Environmental legislation, designations and responsibilities of operating authorities were dealt with in some detail in previous MAFF/Welsh Office publications, especially the *Code of Practice on Environmental Procedures* (see reference 3). The cornerstone of nature conservation legislation in England and Wales is the Wildlife and Countryside Act 1981, under which SSSIs are designated. More recently, the EC Birds and Habitats Directives have been transposed into UK law by the Conservation (Natural Habitats, &c.) Regulations 1994. This legislation has considerable significance for flood and coastal defence.

Sites protected under the Birds Directive are known as Special Protection Areas (SPAs), and sites protected under the Habitats Directive are known as Special Areas of Conservation (SACs). Ramsar sites are wetlands designated under the 'Convention on Wetlands of International Importance especially as Wildfowl Habitat (Ramsar, Iran) 1971'. Government policy is to treat Ramsar sites in the same way as SPAs and SACs, whilst proposed SPAs are also to be treated as if they were designated (see reference 8). The Conservation (Natural Habitats, &c.) (Amendment) (England) Regulations 2000, and the equivalent Welsh legislation, give the same level of protection to 'candidate SACs' (cSACs) as SACs. The implications of these designated areas are considered further in chapter 5.

SPAs, SACs and Ramsar sites

There are a number of obligations associated with sites designated as SSSIs, SPAs, SACs and Ramsar sites. The Secretary of State wishes to ensure that these obligations are fully met, and that, as far as possible, these sites are protected from damage and destruction, with their important scientific conservation features conserved by appropriate management.

There are also a number of local designations for sites of lesser wildlife importance, including those adopted by local authorities for planning purposes. Even where there are no designated sites, it is possible that specially protected habitats or species are present. These are habitats listed on Annex 1 of the Habitats Directive, species listed in Annex 1 of the Birds Directive or Annex 2 of the Habitats Directive, or species which are given special protection under the Wildlife and Countryside Act 1981 (as amended). Some of the more widespread specially protected species that may be present in waterbodies and watercourses include water vole, great crested newt (ponds), white-clawed crayfish, otter and kingfisher. Badgers are specially protected under the Protection of Badgers Act 1992. Information on the presence of these and other protected species may be available from English Nature/Countryside Council for Wales, but it will also be important to check with other organisations such as local wildlife trusts and the Royal Society for the Protection of Birds (RSPB). Where presence is confirmed or strongly suspected, specific surveys are likely to be required to identify the likely impact of a scheme. Impacts to such species should be avoided wherever possible through careful scheme design. Where impact on the species or its habitat is unavoidable, and there are no viable alternatives, mitigation will be required. Where possible, operating authorities should seek to enhance the habitat of specially protected species through careful consideration of scheme design.

Other protected sites and species

2.4 Sustainability

Current government sustainability policy is set out in the sustainable development strategy for the UK, which was prepared to fulfil commitment to the 1992 UN Conference on Environment and Development (the Earth Summit) in Rio de Janeiro (see reference 10). The most widely quoted definition of sustainable development is taken from the Brundtland Report (see reference 11), where it is defined as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs'.

Government policy on sustainability

Sustainable flood and coastal defence schemes

It is government policy to encourage the provision of technically, environmentally and economically sound and sustainable defence measures. Sustainable schemes are defined as schemes which take account of the interrelationships with other defences, developments and processes within a catchment or coastal sediment cell, and which avoid as far as possible tying future generations into inflexible and expensive options for defence (see reference 12).

Need for a strategic approach

Flood and coastal defence works should be developed within a strategic framework that takes account of long-term sustainability and recognises the significant impact on geomorphology and long-term development of coastal systems. Thus, a more strategic approach to future defence needs, through initiatives such as Shoreline Management Plans (SMP), Estuary Management Plans and catchment wide planning, will provide opportunities for improved sustainability. Floodplain and intertidal habitats have the ability to absorb energy and store water, reducing the impacts of flooding as well as flood defence costs. If coastal and riverine processes are ignored and defences are continually raised to give greater protection from flooding, then future maintenance costs will increase and the effects of flooding in rare events may be more devastating.

Ideally, a new defence scheme should be of overall benefit to people, with no significant detrimental effect on the environment, and should maximise any opportunities to contribute to biodiversity targets. This will not always be possible for individual schemes, but should be a key objective at the strategic level, in relation to both short- and long-term timescales. The overall aim of a more sustainable approach is to reduce long-term costs associated with the management of defences, particularly through mitigating against significant future adverse effects which could result from present day ill-advised or short-sighted management decisions.

Wise use of resources

The sustainability of proposed defence works should not only consider the impact on the environment, but also the appropriate use of resources. In these terms, re-use of materials, such as using navigation dredgings or materials previously used for another purpose, is more sustainable than using new materials specifically won for the purpose. However, when considering the use of dredgings or other such materials, it is important to look at the environmental implications of their use as part of the environmental appraisal. In general, recycling sediment within the same coastal cell is likely to be preferable to dumping sediment at sea or importing material from offshore. When obtaining materials, care should always be taken to minimise any detrimental impacts on biodiversity and the wider environment. It is preferable to use resources that are abundant rather than those which are scarce, and to use these resources as efficiently as possible.

2.5 Biodiversity

2.5.1 Biodiversity Action Plans

The Government is committed to maintaining biodiversity (see reference 13). The overall goal is:

‘to conserve and enhance the biological diversity within the UK and to contribute to the conservation of global biodiversity through all appropriate mechanisms’.

In pursuance of this objective, the Government has set up a cross-sectoral Biodiversity Steering Group which has prepared agreed Action Plans for internationally important or threatened habitats and species. Thus, whilst compliance with nature conservation legislation is essential, flood and coastal defence schemes also provide an opportunity for operating authorities to contribute to the biodiversity targets set out in Biodiversity Action Plans.

In England, flood and coastal defence operating authorities have a specific High Level Target in relation to biodiversity (see reference 4). When carrying out flood and coastal defence works they must aim:

- to avoid damage to environmental interest;
- to ensure no net loss to habitats covered by Biodiversity Action Plans (i.e. Habitat Action Plans); and
- to seek opportunities for environmental enhancement.

They are also required to report all losses and gains to habitats covered by Biodiversity Action Plans to the Environment Agency, who will report annually to MAFF (see section 2.9.1). The National Assembly for Wales has issued similar interim targets (see reference 14).

The Habitat Action Plans (HAPs) most relevant to flood and coastal defence (see Glossary for definition of terms) are as follows:

**Relevant national
Habitat Action Plans**

- blanket bog;
- chalk rivers;
- coastal and flood plain grazing marshes;
- coastal saltmarsh;
- coastal vegetated shingle structures;
- eutrophic standing water;
- fens;
- littoral and sub-littoral chalk;
- maritime cliffs and slopes;
- mesotrophic lakes;
- mudflats;
- purple moor grass and rush pasture;
- raised bog;
- reedbeds;
- saline lagoons;
- sand dunes;

- seagrass beds; and
- wet woodlands.

Depending on the nature of the proposal (particularly for flood defence) other HAPs may also be relevant.

The UK Biodiversity Action Plan sets specific quantified targets to maintain, restore and create these habitats, and the timescale to achieve the target. The plan aims to focus and prioritise work to conserve and enhance biodiversity. Specific activities to help meet these targets through a partnership approach are identified in the plans. This includes action by MAFF, the National Assembly for Wales and the operating authorities. Operating authorities contribute to the targets through their flood and water management activities. The following section identifies how authorities can contribute to biodiversity targets through good scheme design, and how this contribution will be recorded.

There is also a wide range of Species Action Plans that are relevant to flood and coastal defence. The species that may be affected by flood and coastal defence projects are too numerous to list here, but conservation consultees will be able to advise of the presence of particular species. Some of the more important species are water vole, otter, great crested newt, natterjack toad, bittern, white-clawed crayfish, shining ramshorn snail, depressed river mussel, starlet sea anemone, ribbon-leaved water-plantain, three-lobed water-crowfoot, and various stoneworts.

Local or regional Biodiversity Action Plans are being developed which translate UK targets into local targets. Both UK and local plans may help identify which habitat or species should be the target of environmental enhancement as part of scheme design. Water Level Management Plans (WLMPs) provide a particularly good opportunity for contributing to biodiversity targets as set out in MAFF's Additional Guidance on WLMPs (see reference 15). In consultation with environmental consultees, operating authorities could, for example, include a target to restore a higher water level to x ha of grazing marsh within y years, or to create the conditions which aim to increase the number of breeding pairs of snipe by x pairs by year y. These targets should be included in the operating authority's policy statements, as required under the High Level Targets (see reference 4).

2.5.2 Scheme design and biodiversity

When a scheme is being designed account should be taken of all relevant national and local Biodiversity Action Plans. Copies of national Habitat and Species Action Plans can be obtained from English Nature/Countryside Council for Wales, who can also advise on the availability of local Biodiversity Action Plans. Again, conservation consultees will be able to provide advice on the relevant plans for a given location.

At the design phase this will mean maximising the opportunities to contribute to the targets in Biodiversity Action Plans, whilst minimising any adverse effects. When considering grant-aid applications, MAFF will consider schemes with positive biodiversity implications more favourably than schemes with negative implications.

Many of the habitats that flood and coastal defence policy affects depend on high water levels to maintain the environmental interest. It is therefore important that, during scheme design, possibilities for increasing inundation in selected areas are considered as well as the need to reduce the incidence of flooding in other areas. Washlands, which are designed to retain floodwater and prevent flooding downstream, can provide valuable wetland habitat if suitably designed and managed.

Importance of high water levels

2.5.3 Managed realignment

There are many existing sea walls that, in the face of rising sea levels, are preventing intertidal habitats such as saltmarsh, mudflat and saline lagoons from migrating landwards. This process, which is known as coastal squeeze, is resulting in substantial losses of these important habitats, and the respective Habitat Action Plans, therefore, include ambitious targets for creating new habitats. The only way in which this can be achieved is through realigning the defence. Flood and coastal defence operating authorities therefore have a significant part to play in relation to these habitats.

Coastal squeeze

Ideally, the new line of defence should be rising ground, but this is not always practical. In many cases, it will therefore be necessary to construct new counter walls to defend particular assets.

In time, the old sea wall will breach, and new intertidal habitat will be created. However, the operating authority should consider whether to make such a breach on purpose. There is, however, environmental advantage in doing so, as the new habitats will then be created earlier. Also, by managing and controlling this process, public access and safety issues can be properly managed and there may be opportunities to influence the development of the new habitat.

Managing habitat formation

Usually a realigned defence will be shorter than the original line and a well-developed saltmarsh will reduce the effect of wave action on a sea wall behind it, so providing further opportunities to reduce construction costs. There are several sites in England where managed realignment schemes have been monitored, and a number of lessons have been learnt about encouraging the formation and development of saltmarsh, as opposed to mudflat (see reference 16).

Economic benefit of saltmarsh creation

2.5.4 Rivers

When designing schemes to alleviate the effects of river flooding appropriate storage, widening of the available flood waterway, or defence set back options, which may have environmental benefits, should be considered.

Drainage activities, including provision of new drains, channel widening and dredging should be designed to protect and enhance biodiversity. There is a range of publications available that provide information on designing and maintaining watercourses to minimise damage to and enhance biodiversity (see references 17 to 19).

2.6 Historic environment

2.6.1 Designations

The historic environment comprises all traces of past human activity and includes (i) archaeological remains; (ii) historic buildings, parks and gardens; and (iii) historic landscapes. Records of archaeological remains are partial and many remain undiscovered, especially at the coast where records are particularly poor. In England, a small proportion of recorded archaeological remains on land are scheduled, and a small number of submerged historic shipwrecks are protected under the Protection of Wrecks Act 1973. A small proportion of buildings are listed or contained within designated Conservation Areas; and significant parks and gardens are contained within a published Register, as are important battlefields. PPG15 provides further information on the range of heritage designations (see reference 20), and further information is provided in Annex 2 of the *Code of Practice* (see reference 3).

When undertaking appraisal and/or assessment, not only are direct impacts to be considered, but indirect impacts on the visual amenity or the setting of historic assets should also be taken into account. In Wales, there are designated historic landscapes which also need to be taken into account.

Consents required

Works on, or affecting, scheduled monuments require Scheduled Monument Consent (SMC) from the Secretary of State for Culture Media and Sport or the National Assembly for Wales Secretary (see reference 21). Works on Crown Land which are exercised by or on behalf of the Crown do not require SMC, but a government advice note has been issued which requests Government Departments and other Crown bodies to follow a non-statutory 'scheduled monument clearance' procedure before undertaking such works. Where applicable, Listed Building Consent and/or Conservation Area Consent must be obtained through local authorities, and where planning permission is required, the procedures set out in PPG15 and PPG16 (in England) and in Planning Guidance (Wales) Planning Policy (in Wales) must be followed (see reference 22 and 23).

PPG15, PPG16 and Planning Guidance (Wales) Planning Policy provide government advice on best practice with regard to archaeological and heritage sites. Where planning permission is required, these documents provide a framework for the assessment and mitigation likely to be required by the planning authority. Whilst there is no legal obligation to protect unscheduled sites, PPG16 sets out best practice which should be followed.

2.6.2 Appraisal of historic environment

Obtaining existing information

It is important to undertake appraisal of the effect of scheme options on the historic environment at an early stage, and to consider the full range of historic environmental issues. A useful reference for coastal sites in England is the review of known sites published by English Heritage (see reference 24). The National Monuments Record can provide advice on the location of designated and undesignated sites, and English Heritage/Cadw should be consulted on strategic issues, especially in relation to schemes that may affect designated sites. The Local Authority Archaeologist should be consulted at an early stage to obtain existing

information on known sites which may be affected, since local authority records are generally more comprehensive.

Archaeological evaluation must be adequately scoped. Where desk-based assessment indicates that archaeological remains or areas of high potential are likely to be affected, field evaluation may be required to assess both the character and significance of the remains, and the likely extent of the impact. The scope of any evaluation should be devised by a qualified consultant, and agreed with English Heritage/Cadw and/or the local authority. Depending on the type of land, this may involve a walk over survey (e.g. to locate surface items on ploughed land), and possibly use of trial pits or trenches to investigate sites of likely interest.

Need for further evaluation

Where archaeological remains or historic buildings are present, these should be avoided or alternatively preserved *in situ* wherever practicable. If this is not possible, the sites should be recorded prior to undertaking the work. Decisions on preservation or the strategy for recording sites or buildings should take account of their importance, and should be taken with advice from English Heritage/Cadw and/or the Local Authority Archaeologist/Heritage Conservation Officer. For floodplain wetlands raising, the water level is unlikely to damage archaeological remains, whereas lowering the water level may result in deterioration.

Mitigation measures

2.7 Landscape

The design should take account of its setting, having regard to views both from the land and the sea. This is particularly important in areas that are designated for their landscape, including National Parks, Areas of Outstanding Natural Beauty, and heritage coasts. A useful reference is the joint guidance issued by the Institute of Environmental Assessment and the Landscape Institute (see reference 25). Another useful reference for coastal sites is *Landscape Impacts of Coastal Defences* (see reference 26). Appendix A of that document provides a useful checklist of factors to be addressed when considering visual and landscape impacts of coastal defences, but would also be useful for considering inland defences.

Both hard and soft engineering solutions can have a profound effect on the landscape, particularly for coastal schemes. A landscape assessment should be undertaken as part of environmental appraisal to provide a clear picture of the existing situation. The implications of any landscape designations need to be identified, and an attempt should be made to identify defence options that would fit well with the landscape setting. At the detailed design stage possible methods for further reducing the impacts of any detrimental effects on landscape and visual amenity should be considered. The factors that should be taken into account include scale, form, materials, and colour. Ideally, the design should allow the scheme to blend in with the existing landscape.

2.8 Earth heritage

Sites of national importance for earth science conservation are designated as geological Sites of Special Scientific Interest (SSSIs) by English Nature/CCW. It is important to get the views of English Nature/CCW where a scheme may affect such a SSSI, and to consider ways in which impacts can be avoided or reduced. A summary of the main features of earth heritage interest is provided in English Nature's *Natural Areas* series.

Nationally important geological and geomorphological sites are assessed in the *Geological Conservation Review*. The Nature Conservancy Council set out a strategy for the conservation of these sites in 1990 (see reference 27). Many of these geological and geomorphological SSSIs are on the coast, and these are often intimately associated with natural processes. Their requirements need to be recognised when considering options and developing scheme design. For example, sites with important exposures of rock can be destroyed by unsympathetic sea defences. At such sites it will usually be important to allow at least some erosion to continue.

2.9 Monitoring and post-project evaluation

The need for environmental evaluation

As noted in the *Code of Practice*, post-project evaluation provides the opportunity to audit the environmental performance of schemes in the context of the overall flood and coastal defence strategy. Further guidance on post-project monitoring and evaluation will be found in FCDPAG6. Such evaluations depend on appropriate levels of routine monitoring. Where appropriate, the requirements for long-term monitoring should be built into any scheme management plan.

Vulnerable sites

Some habitats and heritage sites will be identified as particularly vulnerable during construction and for these appropriate monitoring arrangements should be considered as an integral part of construction supervision. At the completion of construction it is good practice to produce a report on the condition of such areas on completion of works, even if this is not specified as a requirement in the environmental assessment.

Identifying an appropriate monitoring regime

After completion of any works, operating authorities are responsible for setting up and maintaining environmental monitoring of relevant factors at an appropriate frequency and level of detail to judge whether the environmental objectives of the scheme have been achieved. If monitoring suggests that these objectives are not being met, appropriate action should be identified and implemented.

In general, the environmental assessment will be the vehicle for agreement of an appropriate level of monitoring of environmental change. Where, for example, a scheme is expected to have a significant impact on flora, then key indicators should be agreed and appropriate times of year identified at which monitoring should be undertaken to determine whether or not significant change has occurred and, where possible, quantify its extent. For works which may have an impact on internationally designated sites this may have to include all those habitats and species for which the site is designated. Monitoring surveys conducted by the relevant environmental bodies responsible for management of such sites may also provide useful baseline information. It is important that the lessons learnt from all such monitoring are regularly analysed and reported for the benefit of future projects.

2.9.1 Recording losses and gains of habitats

As part of the monitoring and post-project evaluation process, each operating authority should record habitat losses and gains to allow an assessment of compliance with their biodiversity commitments, and to allow comparison with national and local biodiversity targets. This information is required under High Level Target No. 9 on biodiversity (see reference 4). In this respect, national

Biodiversity Action Plans for habitats will be particularly important. Potential losses and gains should be recorded through existing reporting procedures such as strategic flood defence plans, and Environmental Statements or reports for individual schemes. However, since actual changes resulting from works may differ from predicted changes, some degree of assessment needs to be included in post-project evaluation.

Operating authorities should forward information on losses and gains of habitats to the Environment Agency on an annual basis. The Agency will maintain a national database to track the overall impact of flood and coastal defence schemes on biodiversity, and will in turn report to MAFF annually.

3. Environmental valuation

3.1 Introduction

At the scheme design stage any environmental appraisal will need to consider which of the feasible options are best from an environmental perspective. The potential environmental impacts and benefits of the options will be considered during the environmental assessment. However, there also needs to be consideration of environmental benefits and costs when undertaking the economic appraisal of scheme options. Finally, the environmental benefits and costs must be included in the finalised scheme analysis.

Not all environmental impacts can readily be valued in economic terms. It is essential, therefore, to ensure that decisions are based on a thorough environmental appraisal and/or Environmental Impact Assessment. FCDPAG3 (section 2.3) states that:

'it is, therefore, crucial to set out project objectives and then compare the alternatives in terms of their contribution to the achievement of these objectives. If the contribution of one alternative cannot be wholly quantified in economic terms or does not affect economic efficiency, it is important to identify and to state this.'

Project objectives should, where relevant, include the biodiversity objectives set out in the High Level Targets (see reference 4 and section 2.5.1) and, where relevant, obligations in respect of Natura 2000 and Ramsar sites (section 5.1).

HM Treasury guidance indicates that benefits and costs should be measured in monetary terms where possible, but that multi-criteria analysis and descriptive approaches can also be valid provided they are undertaken properly. It is recognised, however, that in order to apply such an approach to flood and coastal defence projects further definition and development of a proposed methodology will be required. Since such studies can be both time-consuming and costly, they should only be considered where environmental issues are likely to be of particular importance, or where environmental considerations are likely to be significant in deciding between options with otherwise similar benefits.

A full assessment of the total economic value of a scheme, including all the environmental assets, would encompass each of the elements identified in Annex C of FCDPAG 3. For further discussion of this, see DETR's *Review of Technical Guidance on Environmental Appraisal* (reference 28). The decision about which methods to include in order to generate a reasonable economic appraisal of environmental costs and benefits will need to be taken in the light of the magnitude of the project and the significance of environmental issues. There will also need to be some consideration of the methods that might be productive for a given set of circumstances.

Methods available for valuation in cost-benefit analysis are listed below:

- Approximate monetary methods, the use of which is strongly recommended for use in flood and coastal defence schemes:
 - (i) avertive expenditure;

Possible methods for environmental valuation

- (ii) reference to agri-environment payments; and
- (iii) replacement costs.
- Other monetary approaches:
 - (i) revealed preference methods;
 - (ii) hedonic pricing;
 - (iii) travel cost method; and
 - (iv) expressed preference methods: contingent valuation (and its variants, e.g. conjoint analysis).
- Non-monetary methods:
 - (i) descriptive methods: unstructured description of effects;
 - (ii) structured description, e.g. descriptions based on categories of benefit (see below);
 - (iii) quantitative, non-monetary measurement, e.g. change in species populations;
 - (iv) qualitative approaches, e.g. Environmental Capital; and
 - (v) scoring: either textual or numeric scoring of options.

Environmental economists have identified different categories of environmental values in relation to the environment. These include:

- direct (use) values: i.e. the direct use of the environmental resource by humans, e.g. recreation, fishing, etc;
- indirect (use) values: these cover the value to humans of ‘background’ environmental processes, e.g. flood regulation, soil fertility, atmospheric composition, etc;
- option (future use) values: these include the desire for preservation of environmental resources for possible use in the future, e.g. plant communities for possible use as medicines; and
- existence and other non-use values: this represents human preferences for the preservation of the environment, over and above use and option values.

Use of contingent valuation

In principle, contingent valuation and related methods provide tools which can capture both use and non-use values. However, FCDPAG3 points out that such techniques would need to be designed very carefully and are often not feasible on account of their expense. Their applicability to nature conservation values, where understanding of scientific processes may be low, remains subject to controversy.

Recommended approach

FCDPAG3 sets out a basic approach for environmental valuation. This indicates that, for important environmental assets, the cost of retaining a feature *in situ* or replacing/relocating it is to be used as the principle method for identifying what can be considered as the minimum environmental value. It is recognised, however, that whilst this approach will provide a useful starting point for identifying meaningful

environmental values, the method does have its drawbacks. It therefore needs to be used with care, and other valuation methods will often be required to identify a realistic environmental value. A discussion of circumstances in which different methods may be relevant is provided in Annex C of FCDPAG3.

In certain situations, where different Biodiversity Action Plan habitats would be affected by different options, use of the Habitat Replacement Cost Method may be inappropriate. This is because this method of estimating environmental value favours retention of those habitats that are most expensive to create, and this may not accurately reflect the overall biodiversity interest. For example, where the alternatives are to maintain the existing line of defence or to retreat, and the impacts are on either saltmarsh or coastal grazing marsh, the nature conservation priority at that site must be reflected in the option choice (section 2.1.4), so that the Habitat Replacement Cost Method is not applied inappropriately.

Where a habitat that is considered to be technically irreplaceable (e.g. ancient woodland, unimproved species-rich pasture) would be lost, it is not strictly correct to use Habitat Replacement Cost as a method for identifying an environmental value. In such cases the cost of providing local protection may provide a useful starting point.

In some circumstances it may simply not be possible to identify meaningful monetary values. Where this is the case, but the environmental impacts are considered unacceptable, an alternative option should be pursued (see FCDPAG3, section 6.2). Multi-criteria analysis, based primarily on non-monetary methods of environmental valuation, could be a useful approach for such difficult sites in the future. Further information on use of multi-criteria analysis is provided in a research report to DETR (see reference 29). It may be necessary to develop a methodology for future use in flood and coastal defence schemes.

For many environmental assets, including heritage sites, it may also be possible to identify a recreational value for the site. This will give one measure of minimum economic value. Possible ways to do this are described in FCDPAG3, and are not considered here. It is important to ensure, however, that where a recreational value is identified, this is not double counted when identifying other aspects of environmental value.

3.2 Valuing nature conservation assets

In order to provide a scale of non-use values, FCDPAG3 indicates that different valuation methods may be used to estimate the minimum economic values for sites of national and international importance on the one hand, and sites of local importance on the other hand. For this purpose, all designated sites other than European sites, Ramsar sites and other Sites of Special Scientific Interest (SSSIs) are to be considered as locally important. A full list of other designations is provided in the *Code of Practice*. Other techniques are required for marginal changes in quality or in individual attributes.

For sites of local importance, the minimum lower estimate of environmental non-use value should normally be considered the same as the value of property of nearest equivalent commercial use. This will normally mean its value as grazing

**Sites of local
importance**

land or forestry. However, it may be appropriate (see above) to use additional methods to provide a reasonable estimate for decision making, though the reasons for doing so should be clearly set out.

Nationally and internationally important sites and habitats

SSSIs, SPAs, SACs, Ramsar sites and Biodiversity Action Plan habitats may be considered to have a national economic value. The lower bound estimate of this should be calculated from the minimum cost of protecting the site *in situ* or, if lower, the cost of providing replacement habitat (the Habitat Replacement Cost). Methods for identifying the cost of providing replacement habitat are discussed in chapter 4. Again, although this will provide a minimum value, other methods may also be required if a realistic estimate of the full environmental value of such sites is necessary. The full economic value of the environment will generally require a combination of monetary and non-monetary techniques, but these will not need to be evaluated in the majority of flood and coastal defence cases.

It is important to stress that calculating the Habitat Replacement Cost does not imply that habitat replacement is the most appropriate option. It is simply a way of getting what can be considered to be a minimum monetary estimate of the loss involved, or the benefit of protected habitat. In some cases, habitat replacement will be necessary, but for European sites in particular, there should normally be a presumption in favour of *in situ* protection of habitats.

3.3 Water Level Management Plans

For SSSIs sensitive to water level change a Water Level Management Plan (WLMP) should be completed and agreed with English Nature/Countryside Council for Wales before any changes are proposed. Guidance on preparing WLMPs is available from MAFF and the National Assembly for Wales (see references 15 and 30). Completed WLMPs may identify a need for the installation of structures or other capital works to enable water levels to be modified.

Calculating environmental benefits of raised water levels

Where water levels are to be raised for environmental gain, the benefit of doing this is the achievement of those gains. Ideally, these should be valued explicitly, but in view of the difficulty in doing this it may be reasonable to use payment rates for farmers in Environmentally Sensitive Areas (ESAs) as surrogates for economic value. However, it is likely to be only a rough approximation of this willingness to pay.

For sites within an ESA, the differences between actual tier payments before and after the scheme has been undertaken can be used. Outside ESAs, a figure of £175/hectare/year can be used as a measure of the environmental benefits of retaining higher water levels in designated areas (e.g. SSSIs) which are environmentally sensitive to water level management. This figure can be used as an annual benefit discounted over the scheme life in the benefit–cost analysis. However, for sites of international nature conservation importance, that is SPA, SAC and Ramsar sites, a figure of £300/hectare/year may be used. This higher rate is acceptable because the quality of the habitat can reasonably be expected to be higher in a site of international importance. An example of how to calculate the benefit–cost ratio for a scheme to implement a WLMP is provided in chapter 6.

In certain circumstances, and subject to MAFF approval, where the gain in habitat quality would be high, the higher rate can also be used for sites that are not designated for their international nature conservation importance. The circumstances where this may be acceptable include the following:

- a site containing one or more habitats which is subject to national Biodiversity Action Plans (e.g. fens, grazing marsh);
- a site containing one or more species which are subject to national Biodiversity Action Plans (e.g. water vole, otter); and
- a site where an important archaeological or geological site would also benefit from managed water levels.

NB: This will usually need to be done in consultation with the statutory consultees.

3.4 Valuing archaeological and heritage assets

The lower bound economic value of a heritage asset can be identified by considering the cost of either i) protecting the site from erosion; ii) excavation and recording (archaeological sites); or iii) moving it to another location (listed buildings). Estimates are likely to be crude if evaluation of the importance of the feature has not been carried out and will only apply to the known resources. Other resources may be located during such evaluation or during construction. For archaeological sites, an important first step is to agree on the significance of the site in national terms. This will lead to a view as to how much excavation and recording would be reasonable. A qualified archaeological consultant will be able to advise on the cost of such work. For listed buildings insured re-building values may provide a more sensitive and readily accessible guide in some cases, although a judgement must still be made on whether such rebuilding is justified.

3.5 Landscape

There are no simple methods for identifying the monetary costs and benefits of different options in terms of their landscape impacts, and it is unlikely that it will be worth doing so in most cases. However, in some cases surrogates may be available. For example, there are instances where riverside or coastal property owners have explicitly refused defences that would obstruct their views. In such cases, the value of the views to them is at least equivalent to the residual damage suffered through flooding. Where landscape is particularly important (e.g. within a National Park) it may be worth considering whether contingent valuation methods can generate figures which could be used in the benefit–cost analysis, and other monetary methods (see section 3.1) may be applicable in certain circumstances. Clearly, any such valuation is only worthwhile where it is likely to influence significantly a decision on the provision of defences or the adopted solution. Where any such options are being considered, this should be discussed with MAFF regional engineers prior to implementation.

4. Determining Habitat Replacement Costs

4.1 Introduction

Section 3 identifies Habitat Replacement Cost as a useful method for helping to identify an economic environmental value. This is different to the approach previously recommended in flood and coastal defence schemes. For this reason, this section provides guidance to operating authorities on how Habitat Replacement Cost estimates should be undertaken.

Firstly, it should be noted that Habitat Replacement Cost would need to be identified in two different circumstances:

- where habitat replacement is a necessary part of a scheme to protect a European site because it is confirmed that habitats cannot be defended *in situ* (see chapter 5); and
- as identified in chapter 3, as a proxy for the value of habitats lost or protected.

In this second situation, there is absolutely no presumption that habitat loss and replacement is the preferred environmental option. Indeed, habitat replacement should only be undertaken as a last resort. It is important that a distinction is made between economic costs required for any benefit–cost analysis and financial costs required for budget and expenditure planning purposes. FCDPAG3 provides a full explanation of the derivation of economic costs.

For whatever purpose, the Habitat Replacement Cost method should be undertaken methodically, including all relevant costs necessary to fully create replacement habitat, and comparable methods should be used in all cases. This chapter, which incorporates the recommendations of recent research (see reference 31), provides guidance on the method to be used. For further information, the research report on which this guidance is based (Report No. 345) is available free from English Nature.

Where a decision has been made that habitat replacement is required, real costs can be estimated provided that the site for the new habitat has been identified. However, where the Habitat Replacement Cost is being identified purely to establish scheme benefits a number of assumptions will need to be made. In particular, it may be helpful to have an actual example in mind for costing purposes, even if there is no intention of creating new habitat there. If applied sensibly, this will greatly assist in identifying meaningful costs.

It should be noted that where any habitat recreation or relocation project is eligible for grant the costs eligible for grant aid should be determined in relation to the appropriate memoranda. The inclusion or exclusion of particular costs in this section of the guide has no bearing on grant eligibility.

Data should be provided under each of the headings identified below, i.e. setting objectives; land acquisition; planning, assessment and design; implementation; monitoring; and additional costs.

When should Habitat Replacement Costs be determined?

Suggested approach

Data required to support Habitat Replacement Cost estimates

Data presented in the costing should be supported by the following information:

- sources of cost data or basis for the estimates used;
- the base price year; and
- timescale, including the expected duration of the aftercare period for the establishment of the replacement habitat and the expected duration of the monitoring period required to confirm successful recreation.

Use of standard costs

For many purposes, particularly where a surrogate value is required, it will be reasonable to use standard rates reflecting typical costs that would be incurred on a commercial basis using current prices. Standard costs for machinery or labour can be derived nationally or regionally.

In deriving economic values adjustments have to be made to reflect national subsidies and exclude taxation, such as VAT (see FCDPAG3 for further details). In particular, agricultural land market prices should normally be multiplied by a factor of 0.45 to derive an economic value net of subsidies.

In some circumstances, elements of the work may have an economic value, even if there is no financial cost. For example, if land, labour or machinery is donated, it will still have an economic value equal to the opportunity cost of the alternative activity that will be foregone.

Indicative costs

To give some indication of likely costs, research suggests that the overall costs of habitat creation are of the order of those shown by the representative examples in Tables 4.1–4.3, below (see also reference 31). The costs shown in these tables are for fairly simple examples of habitat creation. Where the objectives are more complex, much higher costs could be incurred. It should also be noted that available estimates for coastal lagoons are particularly variable depending on the circumstances. Note that the financial costs are the costs of actual habitat creation, whereas the economic costs should be used in the economic analysis only.

4.2 Elements of Habitat Replacement Cost estimates

4.2.1 Setting objectives

Before preparing a Habitat Replacement Cost estimate, it is important to set the objectives. These will be determined by considering the designated features of interest that would be lost. In order to identify meaningful figures, it is important to specify the features that need to be replaced, to set clear measurable targets, and to provide a time-scale for achieving them. For example, for over-wintering birds the objectives should try to specify the average number of individuals for key species over a given period. For habitats, the objective should be to try to specify the area and characteristics of the habitat types that would be needed. Where actual habitat creation occurs, this means that the scheme can be effectively monitored. The costs associated with objective setting are likely to relate primarily to staff time, including costs associated with any necessary consultation.

4.2.2 Land acquisition

Most habitat replacement schemes would require land purchase, although there may be some that can be developed through agreement with an existing landowner.

For some habitats, e.g. coastal grazing marsh, land purchase will normally be the largest cost associated with habitat replacement, unless there are likely to be high costs associated with translocation, construction or monitoring. For habitats that are more difficult to create, e.g. lagoons and some reedbeds, land purchase costs may be about half the total financial cost, though a smaller proportion of total economic value.

Table 4.1 Indicative financial and economic costs of habitat creation for coastal grazing marsh (1998 prices in £ sterling/hectare) (NB: economic values are present value costs in the initial year (year 0) of the project.)

Example 1

Item	Financial Cost	Adjustment Factor	Present Value Economic Cost
Land Purchase	4,451	0.45	2,003
Site Establishment	857	1	857
Aftercare and monitoring: year 1	49	0.943	46
Aftercare and monitoring: year 2	49	0.890	43
Aftercare and monitoring: year 3	49	0.840	41
	5,454		2,990
Less income	-111	1	-111
	5,343		2,879

Example 2

Land Purchase	6,967	0.45	3,135
Site Establishment	1,257	1	1,257
Aftercare and monitoring: year 1	12	0.943	11
Aftercare and monitoring: year 2	12	0.890	10
Aftercare and monitoring: year 3	12	0.840	10
	8,259		4,423
Less income	-195	1	-105
	8,064		4,228

Table 4.2 Indicative financial and economic costs of habitat creation for reedbed (1998 prices in £ sterling/hectare) (NB: economic values are present value costs in the initial year (year 0) of the project.)

Example 1

Item	Financial Cost	Adjustment Factor	Present Value Economic Cost
Land Purchase	2,000	0.45	900
Site Establishment	2,548	1	2,548
Aftercare and monitoring: year 1	40	0.943	38
Aftercare and monitoring: year 2	40	0.890	36
Aftercare and monitoring: year 3	40	0.840	34
	4,668		3,555
Less income	0	1	0
	4,668		3,555

Example 2

Land Purchase	3,200	0.45	1,440
Site Establishment	4,251	1	4,251
Aftercare and monitoring: year 1	94	0.943	89
Aftercare and monitoring: year 2	94	0.890	84
Aftercare and monitoring: year 3	94	0.840	79
	7,734		5,943
Less income	0	1	0
	7,734		5,943

Table 4.3 Indicative financial and economic costs of habitat creation for a saline lagoon (1998 prices in £ sterling/hectare) (NB: economic values are present value costs in the initial year (year 0) of the project.)

Example 1

Item	Financial Cost	Adjustment Factor	Present Value Economic Cost
Land Purchase	2,500	0.45	1,125
Site Establishment	3,403	1	3,403
Aftercare and monitoring: year 1	222	0.943	210
Aftercare and monitoring: year 2	222	0.890	198
Aftercare and monitoring: year 3	222	0.840	187
	6,570		5,122
Less income	0	1	0
	6,570		5,122

The area of land required for a habitat replacement scheme might not be the same as the area that would be lost. In a few cases a smaller area might be appropriate if designated features can be replaced or recreated with a high probability of success. More often a larger area may be needed to ensure the objectives are met. It may also be necessary to acquire an interest in adjacent land to provide control over external factors that may affect the successful implementation of a habitat replacement scheme. This could include control over water supply, flooding of adjacent land and prevention of disturbance. It will often be easier to evaluate such requirements for a specific real site, and for this reason, a real site should, wherever possible, be used as the basis for preparing the Habitat Replacement Cost estimate when habitat replacement would be required. If this is not possible, and in all cases where the Habitat Replacement Cost is being identified solely for the purpose of identifying scheme benefits, a best estimate contingency figure may need to be derived and justified.

The amount of replacement habitat required

Land prices obviously vary according to location and circumstances. It is possible, however, to obtain average sale values for a given year, for different land-use and grades of agricultural land on a regional basis. This will provide a guide to likely land purchase cost and is probably the best basis from which to determine economic values, using the adjusted factor noted above. Alternatively, if a real scheme is proposed a professional land valuation survey may be possible, although the costs are unlikely to be justified at appraisal stage.

Land purchase costs

Acquisition costs include legal and other professional fees, which will vary depending on the complexity of ownership and legal circumstances. All such costs associated with liaison and project supervision should be included in the costing.

4.2.3 Planning, assessment and design

All costs associated with legal and planning considerations (including footpath diversions, disposal of any excavated material, relocation of any pipelines and cables, etc) should be taken into account. It may also be necessary to include specialist surveys, e.g. archaeological investigations. The feasibility of achieving the objectives also needs to be considered in relation to site characteristics, including topography, soil type, and both existing and potential ecological interest. For wetland habitats, a hydrological assessment will usually be needed to establish potential water supply, quality and control. All professional fees, staff and equipment costs are to be included in the costing.

As with other costing exercises, the preparation of detailed project proposals and site design will need to be included, together with the costs of preparing a site management plan. Costs associated with the preparation and evaluation of tender documents should also be included.

4.2.4 Implementation

Drainage issues

Unit costs associated with habitat establishment and management will vary with the type of habitat to be created. For wetlands (e.g. reedbeds) and coastal grazing marshes, modification of drainage patterns or infrastructure construction and establishment work may include removal or relocation of flood banks, installation of water control devices, ditch construction and restoration, and removal of under drainage. Care should be taken with some works not to double count those costs, e.g. flood bank construction which are part of the actual scheme.

Aftercare costs

To establish coastal grazing marsh on sites with no existing sward (e.g. arable land) it will usually be necessary to undertake nutrient stripping and sowing. Grassland establishment is likely to require aftercare management to control invasive weeds such as thistles or ragwort. These costs should be included as aftercare costs. Where there is an existing grass sward, restoration management may be aimed at enhancing the diversity of the sward or, if grazing birds are the objective, increasing productivity.

For both restoration and creation of new habitats, any costs associated with grazing and hay meadow management during the aftercare period should be included as aftercare costs. These management activities, however, are also likely to generate revenue, which should be taken into account in the replacement costing as income.

A fixed period of aftercare should be identified and all costs and revenue associated with the establishment of the habitat during this period should be included. Once the defined aftercare period has finished, all costs and revenue are associated with site maintenance and not habitat replacement. For some actions such as grass establishment and infrastructure, there are widely accepted standard aftercare periods to ensure that establishment is achieved. In other cases, a decision will need to be taken on a case by case basis.

In some circumstances, mainly where there are relatively sedentary protected species such as rare plants or amphibians, it will also be necessary to translocate species or portions of habitat (e.g. turves). Where this is necessary there may be significant additional costs. It is important to recognise, however, that translocation should always be a last resort since there is no guarantee that a new colony will be successfully established in a new location.

Translocation of habitats/species

Allowance should also be made for the cost of any essential infrastructure such as surfaced access tracks, fencing, gates, water control structures and any buildings that would be necessary during site establishment. However, these should be limited to facilities directly required for the recreation process and items such as bird hides and interpretation facilities should not be included. Costs associated with this element include contractor fees, materials costs and staff costs.

Infrastructure requirements

The Habitat Replacement Cost should also include the cost of site supervision, any necessary staff training and provision of any additional equipment required under health and safety regulations that has not previously been required to manage the site.

Staff costs

4.2.5 Monitoring

The extent, nature and period of time over which monitoring is required will be determined primarily by the objectives of the habitat replacement, and must be clearly stated. Site monitoring as included in the habitat replacement cost should only involve the monitoring necessary to determine whether the stated objectives have been met, and to what standard.

4.2.6 Additional costs

Costs associated with project management can potentially be significant and should be included. Care should be taken not to double count costs, such as supervision of site work.

Project management

Costs associated with a habitat replacement scheme may include opportunity costs in the form of foregone revenue. However, care should again be taken to avoid double counting. Foregone revenue represents the reduction in revenue as a result of the scheme. An example would be the reduction in farm income due to replacement of arable crops with grassland. However, if the land for replacement has been purchased then opportunity associated with the foregone future revenue is assumed to be automatically included in the purchase price and should not be included in the replacement cost.

Foregone revenue

Contingency costs will be required to take account of any areas of uncertainty, especially where the Habitat Replacement Cost is being derived solely to determine scheme benefits. However, all contingency costs will need to be carefully justified in relation to likely risks. The justification of contingency costs should be linked to the probability of success (for example, a scheme with a low probability of success could justify a higher contingency).

Contingency

Income generated	The costing exercise should also consider and include potential income or ‘negative, costs’, including one-off income arising from sale of any top-soil or minerals, or revenue generated from grazing or the sale of hay during the aftercare period, and specifically attributable to the site establishment process. This income should be set against the cost of the replacement scheme. Income from grants or agri-environment payments should be excluded from any cost-benefit analysis, but may be relevant for financial calculations and budgets.
Use of Habitat Replacement Cost estimates in cost-benefit analysis	The economic costs of replacing or recreating a site or asset need to be discounted to a present value that can be used as a meaningful input to any cost-benefit analysis. In particular, a common valuation date needs to be established, usually the middle of the current year (year 0). This subject is discussed in section 5.4 of FCDPAG3.

5. Schemes involving SPAs, SACs and Ramsar sites

5.1 Background

The Government has accepted that it has a duty to maintain the integrity of designated sites of international importance. For flood and coastal defence schemes this means protecting such sites against inappropriate water level or river management and conserving the interest of such sites where there are management implications as a result of coastal erosion or flooding. There will normally be a presumption in favour of protecting such sites *in situ*, but where it is not sustainable to do so (see below), replacement habitat may be required. Where inter-tidal habitats are under pressure from coastal erosion and/or sea level rise, this will often be impossible. In this case, opportunities for managed realignment to increase the inter-tidal area will need to be sought.

EC Directive 79/409 on the Conservation of Wild Birds (the Birds Directive) requires Member States to take special measures to conserve the habitat of certain bird species. In the UK, these designated areas are known as Special Protection Areas (SPAs). EC Directive 92/43 on the Conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats Directive) requires Member States to protect certain habitats and species by designating Special Areas of Conservation (SACs). The Habitats Directive incorporates important aspects of the Birds Directive, but there are other measures in the Birds Directive which are not incorporated. However, the legal status of SPAs and SACs is effectively the same, and they are collectively referred to as either European sites or Natura 2000 sites.

Ramsar sites are also of international importance. Whilst not covered by the Habitats Directive, it is government policy to treat Ramsar sites in the same way as European sites when considering development proposals. Ramsar sites should therefore be considered in the same way as European sites when appraising flood and coastal defence proposals. In fact, nearly all Ramsar sites are also designated as European sites, and there are very few sites where this will be a separate consideration. It should be remembered, however, that where a European site is also a Ramsar site, there will often be additional interest features that require separate consideration and may have separate requirements for their conservation.

The Habitats Directive is transposed into law in Great Britain by the Conservation (Natural Habitats, &c.) Regulations 1994, which are normally referred to as the Habitats Regulations. Guidance on interpreting these Regulations is provided in PPG9 (see reference 8) and TAN (Wales) 5 (see reference 9). This makes it clear that potential SPAs are to be treated in the same way as designated sites. The Conservation (Natural Habitats, &c.) (Amendment) (England) Regulations 2000, and the equivalent Welsh legislation, give the same level of protection to candidate SACs (cSACs) as SACs.

International obligations

**Natura 2000/
European sites**

Ramsar sites

**The Habitats
Regulations**

Requirement for Environmental Statement A formal Environmental Statement, as required under Statutory Instrument 1999 No. 1783 the Environmental Impact Assessment (Land Drainage Improvement Works) Regulations 1999 or other Regulations implementing EC Directive 85/337, should be prepared for all proposals which are likely to have a significant effect on a European site or Ramsar site.

5.2 Implications for scheme design

5.2.1 Responsibilities

Competent authority The Habitats Regulations require the implications to be considered for any ‘plan or project’ that is likely to have a significant effect on a European site. In relation to flood and coastal defence projects, a ‘plan or project’ should be taken to include any proposed scheme that requires consent from a ‘competent authority’. A competent authority is defined in the Habitats Regulations as any Minister, Government Department, public or statutory undertaker, public body of any description or person holding a public office. For a flood or coastal defence project, this includes at least the following organisations: (i) the local planning authority (which decides on planning permission); (ii) the operating authority (which makes decisions about the design); and (iii) if it has to decide whether to fund a scheme, MAFF/National Assembly for Wales.

It should be noted that all decision-makers identified in the above paragraph are defined as competent authorities by the Habitats Regulations, and that under Regulation 48 they are required to undertake an Appropriate Assessment. However, only one Appropriate Assessment needs to be prepared, provided that all the competent authorities involved agree and so long as it covers all the relevant issues. Where more than one body is involved in decision making, it is therefore important to decide which organisation will be the lead competent authority, and will prepare the Appropriate Assessment (see section 5.2.2 below for further information).

Operating authorities are also required to consider the implications of a proposal in combination with other plans or projects. Further guidance on this is provided in the Environment Agency’s guidance for new consents (see reference 32). For flood and coastal defence schemes it is important to demonstrate that such a strategic approach has been undertaken. The best way to do so is to prepare a Habitat Management Plan (see section 5.2.3), but it could also be achieved by taking full account of the implications of the Habitats Regulations when preparing a Strategic Implementation Plan for flood and coastal defence (see FCDPAG2).

5.2.2 Procedure for schemes affecting a European site

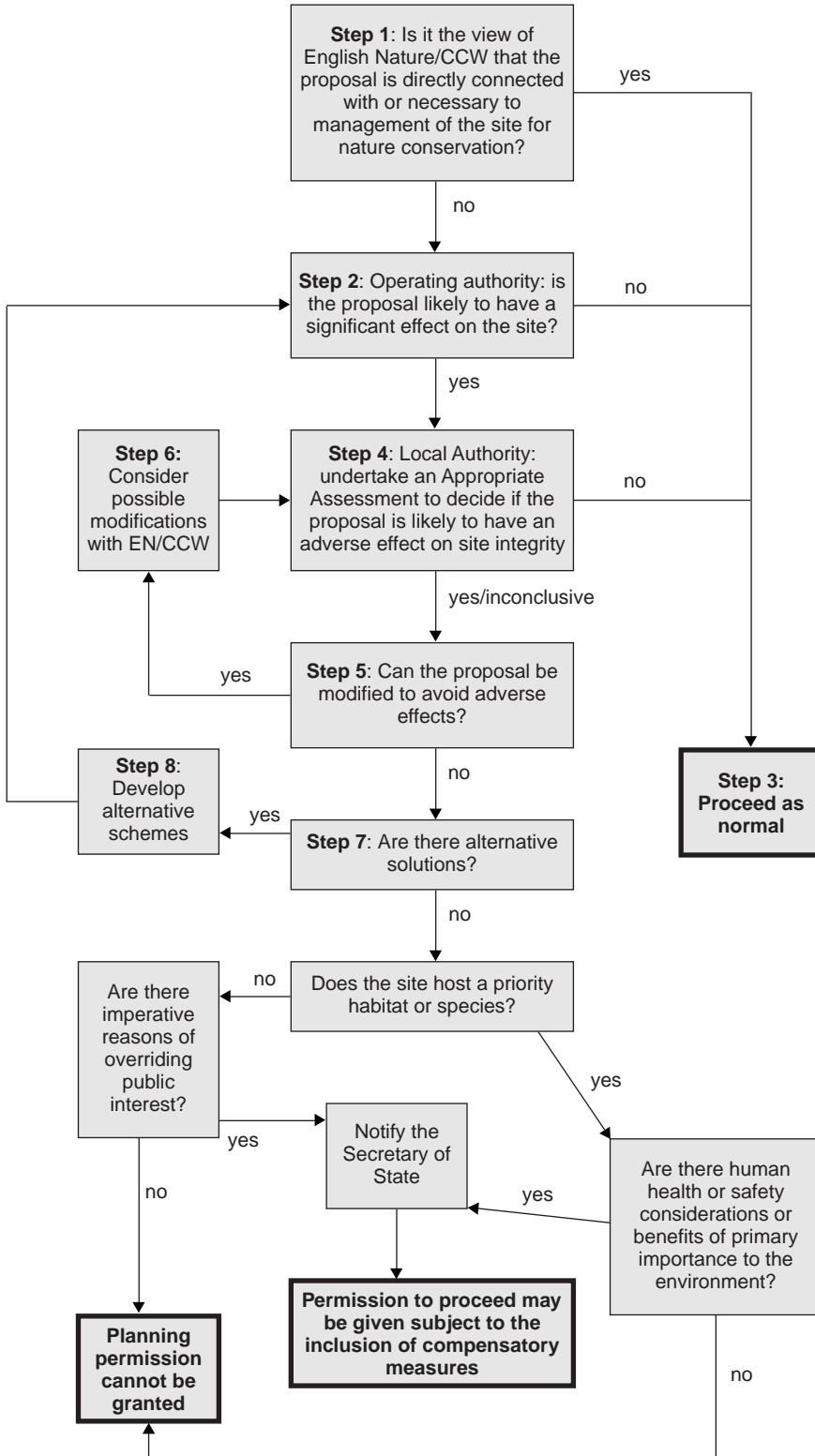
Figure 5.1 sets out the processes that need to be followed where a scheme may affect a European site.

Schemes necessary for nature conservation Where a scheme that may have some effect on a European site is considered to be necessary for the management of the site for nature conservation, and this is confirmed by English Nature/Countryside Council for Wales, no special measures need to be taken and the scheme can proceed as normal (**step 1**). However, this can only apply if the plan or project will not harm any of the interest features of the site.

If the scheme is not directly connected with or necessary for the management of the nature conservation of a European site, the operating authority must determine whether, either alone or in combination with other plans or projects, it is likely to have a significant effect on the site (**step 2**). It must be emphasised that this step is a coarse filter and should not be time consuming. If there is likely to be an adverse effect, then further detailed studies will be undertaken (see below).

In determining whether a scheme is 'likely to have a significant effect' the key consideration is whether the scheme may affect, either positively or negatively, the habitats and species for which the site was designated and their conservation objectives. This must be considered on a case by case basis. However, very short-lived impacts would not normally be significant unless, for example, they interrupted the breeding cycle of a species and thereby had a lasting effect on its population. Operating authorities should seek the opinion of English Nature/Countryside Council for Wales to assist with this decision. Advice on this issue is available from English Nature (see reference 33).

Figure 5.1 Procedure for a proposal that affects a European site



In **step 3**, i.e. if the scheme is either necessary for nature conservation or it is not likely to have a significant effect on the site, then the scheme can proceed as normal. Coastal protection works (with the possible exception of emergency works) and new flood defence capital works require planning permission. For these schemes, step 3 is to proceed towards a planning application as normal. However, flood defence and land drainage improvement works (including maintenance works) have deemed planning permission under the Town and Country Planning (General Permitted Development) Order 1995. For work that would normally be covered by this Order (i.e. permitted development) step 3 is to proceed without the requirement for planning permission.

Procedure where no significant effect is likely

Whether or not the scheme would normally be considered as permitted development, if it is not necessary for nature conservation management, and is likely to have a significant effect then prior approval of the local planning authority will be required. The local planning authority must undertake an Appropriate Assessment (**step 4**) with the assistance of the operating authority (see below). If the Appropriate Assessment for a scheme that would normally be permitted development is unable to ascertain that there will be no adverse effect on site integrity, then a planning application is required. This means that there is therefore no difference from this stage onwards between such a scheme and a scheme that would normally require a planning application.

Permitted development and the need for an Appropriate Assessment

The sole purpose of the Appropriate Assessment is to determine whether the proposal is likely to have an adverse effect on site integrity. PPG9 defines the integrity of a site as:

Content of an Appropriate Assessment

‘the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified’.

The Appropriate Assessment must contain sufficient information to confirm that the proposed scheme will **not** have an adverse effect on the integrity of the European site in question. If there is insufficient information then a precautionary approach should be taken.

The essential information to be included in an Appropriate Assessment is:

- the reasons for designation;
- the conservation objectives for the site;
- the habitats and species that may be affected by the scheme; and
- information on the measures that will be taken to maintain site integrity (this will include finalised habitat creation proposals where necessary).

In some cases, the Appropriate Assessment may consist of a few pages of text, but in others, especially where significant mitigation is involved, a more substantial document will be required. It should draw on relevant information contained in the Environmental Statement, but it is not acceptable to present the Environmental Statement as the Appropriate Assessment. A suggested scoping framework for an Appropriate Assessment is provided in Appendix 11 of the Environment Agency’s guidance on applying the Habitats Regulations (see reference 32).

**Undertaking an
Appropriate
Assessment**

Where a planning application is required, the local authority must prepare an Appropriate Assessment before deciding whether to grant planning permission. The operating authority that submits the application should ensure that the local authority has all the relevant information to enable it to complete the Appropriate Assessment, and should preferably do so by preparing a document on the lines of an Appropriate Assessment. However, as a Competent Authority as defined by the Habitats Regulations, the local authority must satisfy itself that there will be no adverse effect on site integrity. Guidance on preparing an Appropriate Assessment is available from English Nature and the Environment Agency (see references 32 and 34). There is a duty to consult English Nature/Countryside Council for Wales to obtain their views when undertaking an Appropriate Assessment, and other relevant consultees should also be consulted.

When MAFF/Office of the National Assembly for Wales or any other competent authority decides whether to provide grant aid for a scheme affecting a European site, it must consider whether the Appropriate Assessment is acceptable. This must include consultation with English Nature/Countryside Council for Wales. All applications for grant aid for schemes that are considered likely to have a significant effect on a European site must therefore be supported by an Appropriate Assessment.

**Avoiding negative
impacts**

Where the Appropriate Assessment confirms that there would be no adverse effect on site integrity, the scheme can proceed as normal. However, if it concludes that a scheme is likely to adversely affect the integrity of a European site, or if there is any uncertainty, the next step (**step 5**) is to consider whether the scheme could be modified to avoid negative impacts. If so, (**step 6**) is to consider possible modifications with English Nature/Countryside Council for Wales and to undertake an iterative process, the objective of which is to end up with a scheme for which a more positive outcome can be identified. The Appropriate Assessment must then be repeated.

If, after considering possible modifications, it is not possible to identify a scheme that would not have a negative impact on site integrity, it is necessary to consider whether there are alternative solutions (**step 7**). If there are, then an alternative scheme should be developed (**step 8**). Note that this alternative will need to go through steps 2–6 again.

**Procedure where a
negative impact on
site integrity cannot
be avoided**

If there are no alternative solutions, the scheme can only be approved if there are imperative reasons of overriding public interest. If the site contains priority habitats or species (identified in the Annexes to the Habitats and Birds Directives), the work can only be granted planning permission if there are no alternative solutions *and* there are human health or safety considerations, or benefits of primary importance to the environment. In most circumstances, there are alternative solutions to a flood or coastal defence proposal, and it is therefore unlikely that planning permission will be obtained for a project which would adversely affect the integrity of a European site.

**Overriding public
interest**

Where it is concluded that there will (or may) be an adverse effect on site integrity but a competent authority is satisfied that, there being no alternative solutions, the plan or project must be carried out for imperative reasons of over-riding public interest, it must notify the Secretary of State for the Environment (England)/Assembly Secretary (Wales). The proposal must not be pursued for 21 days, pending his response. If, subsequent to this decision, a proposal does proceed

despite adverse effects on the integrity of the site then compensation measures will need to be included as part of the scheme. It should be remembered that the compensation measures may require a separate planning application and/or consents from other Competent Authorities. Approval for MAFF grant aid in England, and National Assembly for Wales grant aid in Wales will not be forthcoming until compensation issues have been resolved.

A position statement issued by DETR in May 1998 provides clarification as to what is likely to be considered as imperative reasons of overriding public interest. This states that the Government expects there to be few cases where it is judged that imperative reasons of overriding public interest will allow a development to proceed which will have an adverse effect on the integrity of a European site, and that developments must pass the most stringent tests. The guiding principles which will be used to decide whether there are imperative reasons for overriding public interest include:

- a need to address a serious risk to human health and public safety;
- the provision of a clear and demonstrable direct environmental benefit on a national or international scale; and
- where failure to proceed would have unacceptable social and/or economic consequences.

Projects of national importance are most likely to be judged as giving rise to imperative reasons of overriding public interest. Important regional projects may also be so judged. For projects of more local significance, it is less likely that the potential benefits will be considered to override the nature conservation value of the site.

Further detailed guidance on the impact of the Habitats Regulations on flood and coastal defence projects is available from the Environment Agency (see reference 32), and should be used by Agency staff in addition to this document.

5.2.3 Coastal Habitat Management Plans

Whilst the Habitats Regulations may affect the choice of options for flood and coastal defence works within or in the vicinity of designated sites, flood and coastal defence works will often also be necessary to maintain the designated interest of European sites. This is particularly likely for the following types of sites:

- coastal freshwater wetlands and permanent grassland protected by existing sea defences;
- intertidal saltmarshes and mudflats backed by existing sea defences; and
- inland wetlands dependent on appropriate water level management.

In England, Coastal Habitat Management Plans (CHaMPs) are to be developed for many coastal sites. These will help to ensure that appropriate schemes are developed where coastal SPAs and SACs are involved, and similar documents may be useful for inland wetlands.

Where will CHaMPs be required?

A CHaMP should be prepared by the operating authority, in conjunction with English Nature, for a European site (or group of sites) where either:

- there are flood and coastal defence works likely to have an adverse effect on the integrity of a site in the next 30-100 years; or
- it is likely to be impossible/unsustainable to conserve the designated features of conservation interest *in situ*; or
- it is difficult to reconcile the different conservation objectives for an overlapping SPA/SAC/Ramsar complex for reasons that relate to the management of flooding and/or coastal processes.

A list of sites where CHaMPs are required is available from English Nature.

Objectives

The objective of these plans is to identify the flood and coastal defence works that may be required in a given area to conserve the nature conservation interest of a European site or group of such sites, particularly where the current defence line may be unsustainable. Where flood and coastal defence works are likely to have an adverse effect on the integrity of a site they will also identify the amount of replacement habitat that is required to maintain nature conservation status, and should ideally indicate where this new habitat will be created.

Relationship to SMPs and strategy documents

The CHaMP will draw on information presented in the relevant Shoreline Management Plan (SMP), but will revisit the preferred options for each section of coast having regard to the need to conserve SPAs and SACs *in situ* where it is sustainable to do so. The level of detail in a CHaMP will be much greater than in the SMP, but relevant information in the CHaMP will need to be incorporated in future revisions of the SMP. A CHaMP will contain a similar level of detail to a strategic implementation plan for flood and coastal defence, and in time it should be possible to merge the two processes to produce a single, all encompassing strategic plan.

The area to be covered by a CHaMP will normally be the relevant SPA/SAC complex within a coastal sediment cell. Generic guidance on preparing CHaMPs is available from English Nature (see reference 35).

Obtaining scheme approval

A proposed scheme within a European site should comply with the CHaMP if one has been prepared. However, at the scheme design stage there will still be a need to ensure that the scheme complies with the Habitats Regulations. This means that the procedure set out in Figure 5.1, must still be followed. However, if the scheme complies with a finalised CHaMP, it is likely that the scheme will be considered necessary for management of the site for nature conservation. If English Nature/Countryside Council for Wales confirms this, there will be no need to complete an Appropriate Assessment. Where a CHaMP is required but has not yet been prepared, a scheme may still be designed and promoted, but it is likely to prove more difficult to obtain the necessary approvals.

Requirement to maintain favourable condition

Where a sustainable flood or coastal defence proposal compatible with a CHaMP fails to meet normal funding requirements, the scheme will still be eligible for funding if the work is necessary to maintain the favourable condition of designated habitats/species within a European site. There must, however, be an economic appraisal to demonstrate that the proposed option is the least cost method for maintaining the interest features.

Whilst the CHaMP will provide an overview of the reason for the works, further information will be needed in support of scheme proposals, including an Environmental Statement and an Appropriate Assessment if required. The full involvement of English Nature in the decision-making process will be essential. Relevant non-statutory organisations should also be consulted, and it may be useful to establish a Management Group for each CHaMP, to ensure that relevant organisations are fully involved. Where a European Marine Site is involved, early consultation with the Marine Site Management Group will also be essential, and any management decisions made through the CHaMP process will need to be incorporated in the site's Scheme of Management.

Supporting information and consultation

Having regard to the requirements set out in the Habitats Regulations, where a sea defence protects internationally designated terrestrial or freshwater habitat, the option to hold the line will be the preferred option. The alternative option of habitat creation can only be entertained where to hold the line is not sustainable (see below).

Scheme design objectives

Where the designated habitat is intertidal habitat such as saltmarsh and mudflat, it may, in the face of rising sea levels, be necessary to retreat the line in order to maintain site integrity. However, the situation becomes more complicated when both the intertidal habitat and the landward habitat are European sites or Ramsar sites. A CHaMP will be particularly valuable in deciding how to proceed in such cases.

The finalised scheme will therefore be determined by balancing the need to protect habitats and the sustainability of defences. Sustainability of the proposed defences should normally be considered over the probable design-life of a structure: between 30 and 100 years depending on the type of scheme and in the context of the likely coastal evolution of the whole site complex.

Sustainability

In general, it will be sustainable to protect features *in situ* where to do so would (i) not result in an adverse effect on the integrity of the designated site or any other European or Ramsar site; and (ii) would work with rather than against coastal processes. It must also be technically feasible and should not require excessive capital expenditure or maintenance costs. Where there is more than one technically and environmentally acceptable solution, the lowest cost method should be chosen.

Where full or partial realignment over a European site is proposed, and there is no means of avoiding an adverse effect on the integrity of the site, there will be a need to consult DETR/the National Assembly for Wales Secretary (Assembly Secretary) (see section 5.2.2, above). For those site complexes for which a CHaMP has been prepared, the CHaMP will assist in these decisions.

Whether replacement habitat is created as part of mitigation or compensation, it must be clear that the provision of these new habitats is deliverable within the required time-scale, and where possible, in advance. Operating authorities are therefore encouraged to consider, in conjunction with relevant nature conservation organisations, the early establishment of new habitat to offset future losses identified in CHaMPs. Such actions could assist the processing of future schemes. The sustainability of the any new habitat also needs to be considered, both in terms of the medium/long-term effects of riverine and coastal processes, and also in terms of the resources required to ensure the development of suitable replacement habitat.

Provision of replacement habitat

5.2.4 Emergency works

From time to time, an operating authority needs to undertake emergency works which affect a European site or Ramsar site. Where this occurs, an Appropriate Assessment should be undertaken immediately afterwards to determine whether there has been any effect on site integrity. Where the assessment shows that this is the case, it will be necessary to undertake mitigation/compensation works. The Appropriate Assessment should also include a section on methods of working that may be helpful if similar emergency works are necessary in the future.

6. Worked examples

6.1 Introduction

This section presents theoretical examples of issues that require particular care to ensure an environmentally acceptable solution is adopted. It is not intended as a comprehensive guide to environmental best practice, but will hopefully provide some assistance in making decisions.

Example 1: urban river

Scenario

The strategic implementation plan for an urban catchment identified that the optimum solution to urban flooding problems was to divert additional floodwater into an existing river in the adjacent catchment that passes through informal parkland. Without the diversion scheme the urban area floods regularly. If the diversion was undertaken without the capacity improvements through the park, then a significant number of properties and a road upstream of the park would flood regularly. At the strategic study stage it was noted that there could be environmental concerns about the section through the parkland, so a contingency of 25% was allowed on the estimated costs of the engineering works (£0.4m) to increase capacity.

The parkland reach (phase 3) was considered in detail at the design stage. On the left bank there is a line of mature willow trees that are valued for their contribution to the landscape setting. On the right bank there is an area of scrubby woodland and a pond that is known to contain Great Crested Newts. The newts breed in the pond but hibernate in the scrubby woodland. This species is afforded special protection under both the Wildlife and Countryside Act 1981 and the Habitats Regulations 1994. There is also a well-used public footpath on the right bank, which provides local residents with their only access to public open space.

Issues

English Nature confirmed that there was a statutory duty to protect the newts, preferably by retaining the breeding pond and scrubby woodland *in situ*, or if this was not possible, by creating a new pond nearby.

In order to increase the capacity of the river, it was necessary to widen (and reprofile) the channel. In doing so, there would inevitably be an impact either on the line of willows or the footpath. A consultation exercise confirmed a preference for retaining as many of the trees as possible and realigning the footpath, provided that the footpath was improved.

The purpose of the scheme was the protection of assets and property. The overall strategy identified estimated present value damages of £2.5 million for the 'do-nothing' scenario. However, in considering options for phase 3 (diversion of floodwater through the parkland), social and environmental issues were particularly important. The main options considered for the parkland reach were:

- do nothing;

- option 1: widen the channel on the right bank along its existing alignment, thereby retaining the willows and reinstating the footpath on the new bank;
- option 2: as in option 1, but providing additional environmental interest by reinstating a meander along an old river channel line through the site of the newt pond and scrub;
- option 3: as in option 1, but reinstating a meander to the left of channel; or
- option 4: reinstate both meanders.

Although environmental issues were important, in view of the size of the scheme it was decided not to undertake detailed environmental economic studies such as contingent valuation. All of the above options would provide the same channel capacity as this was the optimum determined from pre-feasibility studies. In each case the benefits to property would be the same. It was therefore decided that in view of the importance of the area for local recreation, an objective decision would be made on the most appropriate environmental enhancement to include. These environmental considerations were taken into account through detailed consultation with local residents and interested organisations.

Selection of the preferred option

The 'do-nothing' option had the advantage of having no impact on the pond, scrub and line of willows. However, it was eliminated because of the flood impact on roads and residential property upstream. If the diversion strategy was implemented without the channel improvements then it was estimated that present value flood damages would exceed £1.2m.

Option 1 would cost £450,000. It provided no environmental benefits.

Option 2 would cost £490,000 to construct. However, both a new pond and new hibernating sites would then be required for the newts, and a translocation programme would also be required. This was an additional cost of £50,000, bringing the total cost to £540,000. Local residents preferred this option because of the additional interest on the realigned footpath and the retention of the mature trees. However, it was strongly opposed by both English Nature and the local wildlife trust, and was their least favoured option.

Option 3 would also cost £490,000. It avoided the newt habitat, but resulted in the loss of six of the willows. This was the favoured option of English Nature and the local wildlife trust. However, local residents were opposed to this option because: (a) six mature trees were to be lost; and (b) the alignment of the footpath was not favourable. Given this lack of consensus it was difficult to justify the additional £40,000 cost.

Option 4, would cost £530,000 to construct, with the additional £50,000 for the newt relocation work. It was the most expensive option, and also had all the environmental disadvantages. It was therefore rejected.

As a result of this, option 3(b) was developed. This was to reinstate the meander on the left bank only, but to relocate the footpath along the old meander on the right bank. It would then pass the pond and through the scrubby area. The resulting impact on the scrub habitat was acceptable to English Nature, and local residents

agreed that the new footpath route was better. They insisted, however, that a tree planting programme should be implemented as part of the project to mitigate for the loss of six trees. In fact, by careful planning and site supervision, it was found that two of the trees could be retained, and it was agreed that planting four groups of three new willows was adequate.

The finalised scheme cost £500,000. This delivered the same flood defence benefits as option 1, but for an additional £50,000 also delivered the following environmental/social benefits:

- more varied channel profile (in the reinstated meander) of benefit to wetland plants and animals; and
- a more interesting footpath for local residents.

The decision implied that these benefits had an economic value of at least £50,000, equivalent to approximately £3,000 per year. Since it was estimated that at least 100 people per day used the public footpath this was probably less than 10p per park visit, over the 50-year scheme life, and this alone was considered reasonable compared with other expenditure of the local authority on comparable recreational facilities. The residual environmental impacts of the scheme were considered acceptable by all consultees.

It should be noted that a detailed environmental economics study would have cost around £15,000. It is not clear that the outcome of such a study, which would have faced difficulties in evaluating the specific attributes that differentiated the options, would have made the choice of options any easier.

Example 2: water level management

Scenario

A lowland pump-drained catchment in an Environmentally Sensitive Area (ESA) requires high water levels to allow traditional grazing of the marshes to continue. Water is required for wet fences, for cattle drinking and to maintain and enhance the conservation importance of this internationally designated area of grazing marshes. Part of the area is designated a candidate Special Area of Conservation (cSAC), a Special Protection Area (SPA), a Ramsar site and a Site of Special Scientific Interest (SSSI). Water management works are required on the site to ensure that water can be maintained at levels suitable to qualify for ESA payments and to maintain the site at 'favourable conservation status'.

Issues

Water was taken from the tidal river on an immediate need basis. The operation was manually controlled and was dependent upon salinity levels in the river. The major constraint on maintaining the site in favourable condition is obtaining sufficient water of good quality to ensure that the conservation objectives can be met. Without an adequate supply of 'fresh' water the grazing marshes would dry out and their special interest features would be lost or severely damaged.

Selection of the preferred option

A series of options were identified, which provided increasing probabilities of success, with the need for subsequent options determined to a large extent by the

success (or otherwise) of preceding options. There were also a number of varying target water levels which some landowners would like to achieve, but which would only become attainable upon completion of successive options.

The possible options were:

- do nothing;
- current management methods;
- option 1: improve management methods through water intake automation and upgrading of feeder dykes;
- option 2: as in option 1, plus enlargement of the intake and dykes; or
- option 3: as for option 2, plus creation of reservoir.

In order to understand how much water was required, it was necessary to have a full understanding of the water balance, i.e. the volumes of water involved in natural systems such as rainfall, evaporation and evapotranspiration. Management of water in the system, particularly volumes pumped out and let in via sluices, for example, was also important in gaining an understanding of how water levels in the dykes could be controlled. Obtaining a valid water balance was, therefore, one of the most important steps in the project appraisal.

Economic justification of the phased approach

The economics associated with the justification of each part of the phased approach were complicated by a high degree of uncertainty associated with the amount of water available in the river (at suitable salinities). Table 6.1 presents a summary of the probabilities calculated that each option would allow the ESA prescription levels to be met.

Table 6.1: Summary of probabilities of reaching ESA prescription levels for each option

Option	Minimum*	Best estimate	Maximum*
do nothing	0.0	0.0	0.0
current management methods	0.0	0.2	0.3
option 1: improved management and short-term measures	0.3	0.7	1.0
option 2: as option 1, plus long-term measures	0.8	0.9	1.0
option 3: as option 2, plus construction of a reservoir**	1.0	1.0	1.0

* estimated using probabilistic analysis; best estimate is based on experience with the site and its management

**Option 3 will also allow higher ESA prescription levels to be met

The benefits were calculated using a value of £175 per hectare per year (see section 3.3) for land complying with the ESA prescription levels for all options up to option 2. A higher value, of £300 per hectare per year, was taken for option 3 since this allowed higher water levels to be maintained over part of the site, increasing the conservation importance of the area. Table 6.2 summarises the results from these methods of determining the preferred option.

Table 6.2: Determining the preferred option

Option	Benefits £m	Costs £m	Net present value £m	Benefit –cost ratio	Incremental benefit–cost ratio
do nothing	0.0	0.0	0.0	0.0	N/A
current management methods	1.2	0.6	0.8	2.0	2.0
option 1: improved management and short-term measures	3.5	1.3	2.2	2.7	3.3
option 2: as option 1, plus long-term measures	4.7	1.5	3.2	3.1	6.0
option 3: as option 2, plus construction of a reservoir	5.3	4.2	1.1	1.3	0.2

Option 2 had the highest net present value and highest benefit–cost ratio. The incremental benefit–cost ratio also indicated that it was worth moving from option 1 to option 2 (since the incremental benefit–cost ratio is greater than one), but not worth moving to option 3 (as the incremental benefit–cost ratio is less than one). Therefore, option 2 is the preferred option. However, by adopting this option there is only a 0.9 probability that water can be supplied to the whole area, therefore, in times of drought it would be necessary to direct water to the SPA and cSAC areas as a priority.

A Water Level Management Plan (WLMP) was then prepared in consultation with English Nature, the landowners and other interested bodies. This set out the proposed future water management regime and identified the necessary additional structures. The plan was approved by English Nature.

Figure 2.1 (see chapter 2) considers the need for an Environmental Statement. In this instance, an Environmental Statement was required. Following the requirements of Statutory Instrument 1999 No. 1783 the Environmental Impact Assessment (Land Drainage Improvement Works) Regulations 1999, the drainage body advertised in two local newspapers. A copy of the advertisement was also given to all parties with an interest in the improvement works. This included English Nature, National Parks authorities, Countryside Commission, RSPB, Environment Agency, and the Local Wildlife Trust. There were no objections.

The scheme affects both a SPA and a SAC, and it was, therefore, also necessary to consider the flowchart in Figure 5.1 (see chapter 5). In this instance, it was considered necessary to undertake an Appropriate Assessment, and this confirmed

that the proposed works, as identified in the WLMP were not likely to have a significant detrimental effect on the favourable condition of the SPA and SAC. Indeed, it was considered that the works would improve the conservation value of the site.

Example 3: coastal cliff site

Scenario

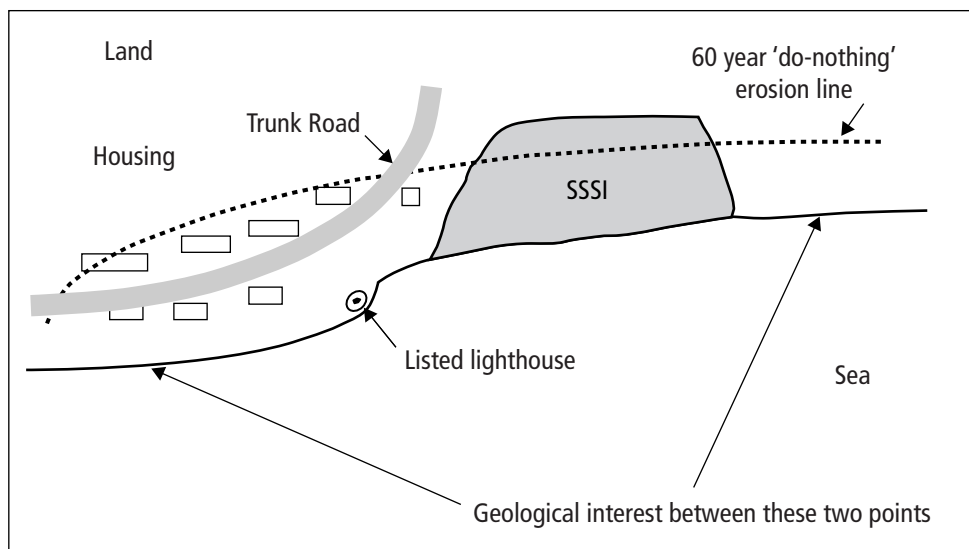
As a result of human intervention further along the coast, a decline in beach volume had reduced the protection of cliffs from wave erosion, lowering overall stability and resulting in a rate of erosion that was steadily increasing. Sea walls to the east of the site experienced knock-on effects and were showing signs of distress. If the erosion were not checked, the following would be lost over the next 60 years:

- forty properties;
- infrastructure including a main coast road;
- a Grade II* listed building;
- amenity; and
- conservation interest, including a site of national geological importance and a Site of Special Scientific Interest (SSSI) on top of the cliff.

Issues

Continued erosion was predicted to potentially impact upon 21 hectares of land over the next 60 years. The present value do-nothing losses based on market value of the houses lost between years 20 and 60, as well as the diversion of the trunk road in year 30 and the loss of the listed lighthouse in year 15 amounted to some £1.1million.

For this purpose a valuer's estimate of the market value of the lighthouse was used though it was noted that the Grade II* structure was of significant historic importance, as an example of a Georgian lighthouse built early in the eighteenth century. The structure has a commanding presence over the surrounding area and may also provide a focus for visits to the area that would generate significant recreational benefits. However, it was not considered appropriate to attempt to value these intangible benefits.



Whilst English Nature did not agree that relocating the habitats within the SSSI was a viable option, as an absolute minimum valuation the loss of the SSSI was equated to the purchase of an equivalent area of cliff top arable land. Initial management costs estimated at £500 per hectare were added to the land value to take account of the need to manage the transition to a more natural habitat through accelerated nutrient stripping and relocation of key plant species. This gave an economic value of some £3,000 per hectare for the 8 hectares that would be lost but assuming a gradual loss over the period produced a minimum additional economic loss over 60 years of only £10,000 for erosion of the SSSI.

No attempt was made to value the geological interest, although the cliffs are designated as an internationally important geological site. Some level of erosion is required to continue to expose the fossils. However, the rate of erosion was causing rapid destruction of the site, which was described by English Nature as one of the most important geological sites in Europe. Hence, some reduction in the rate of erosion was desirable to extend the life of the exposure. The continued erosion of the cliffs also produces bare ground which provides essential breeding grounds for the high diversity of invertebrates and, in particular, varieties of rare bee and wasp species. Some trade-offs were required, therefore, between preventing erosion and allowing some (limited) erosion to occur to ensure that fossils continue to be uncovered and to prevent a decline in wildlife value.

Scheme objectives

The following objectives were identified:

- extend the life of properties, the trunk road and the Grade II* listed building in the area;
- extend the life of the geological site;
- continue to provide habitats for the high diversity of invertebrates; and
- minimise impacts on the environment, including the SSSI.

Selection of the preferred option

After an initial consideration of several options, the following primary alternatives were considered:

- option 1: do nothing;
- option 2: extensive concrete walls and cliff stabilisation in the areas adjacent to the housing and the lighthouse with no protection works elsewhere; or
- option 3: beach recharge and subsequent management across the whole frontage with limited rock revetment at the base of the cliff in areas adjacent to property, including the lighthouse.

A statutory Environmental Statement was prepared. The essential elements of the option choice are shown in the tables below. The first sets out the economic parameters and the second describes the environmental gains and losses from each of the options.

Table 6.3: Summary of present value costs and benefits

Option	Present value costs £m	Present value benefits £m	Benefit–cost ratio	Net present value
option 1: do nothing		-1.10		
option 2: concrete wall, etc	0.60	1.09	1.82	0.49
option 3: beach management and rock revetment	0.70	0.90	1.29	0.20

Table 6.4: Summary of unvalued environmental gains and losses

Option	Environmental benefits	Environmental losses
option 1: do nothing	ongoing geological exposure	80% of SSSI lost in 60 years, landscape degraded through loss of lighthouse
option 2: concrete wall, etc		50% geological exposure lost, 80% of SSSI lost in 60 years
option 3: beach management and rock revetment	natural processes and landscape largely preserved	some reduction of cliff exposure, but still 20% of SSSI lost in 60 years

The preferred option, based on economic grounds alone, would have been option 2, since this produced higher monetary benefits with lower investment costs. However, in view of the clear reduction in environmental losses resulting from option 3 this was agreed as the most appropriate option. It was noted that there were certain risks associated with beach management, including some possibility of long-term property loss (reflected in the reduced benefit due to the possibility of residual damage) and there was also some doubt about future availability of

dredged material for beach replenishment. A formal monitoring and review procedure was therefore established to continually assess these and similar risks.

The decision implied that the unvalued aspects of the geological exposure, amenity considerations and integrity of the SSSI were worth at least £0.29 million in present value terms (the difference in the net present values of the two options) equivalent to some £18,000 per year over the life of the scheme. This was judged to be reasonable in the context of other environmental valuation studies carried out in the area.

Example 4: sea defence – managed realignment

Scenario

A 5km shingle ridge protects a rural coastal area from flooding. The assets at risk include more than 40 properties, the main coast road, and an area of freshwater marshes of high national and international conservation importance. The area is also an important tourist attraction due mainly to the large number of bird species it supports.

Issues

In addition to the properties and infrastructure at risk from flooding, the area is protected by a wide range of national and international designations, including:

- Special Protection Area (SPA) and candidate Special Area of Conservation (cSAC);
- Site of Special Scientific Interest (SSSI);
- Ramsar site;
- Area of Outstanding Natural Beauty;
- Biosphere Reserve; and
- Heritage Coast.

Selection of the preferred option

Following initial scoping, five options were considered as being suitable for appraisal:

- option 1: do nothing;
- option 2: emergency response (for example, repair breaches);
- option 3: ring banks;
- option 4: managed realignment; or
- option 5: shingle nourishment.

The options were costed and damages assessed. This information is summarised in Table 6.5.

Table 6.5: Results of the cost–benefit analysis (all figures in £m)

Option	Benefit	Cost	NPV*	B/C**	IB/C†
option 1: do nothing	0.0	0.0	0.0	0.0	n/a
option 2: emergency response	1.2	0.16	1.0	7.5	7.5
option 3: ring banks	1.8	1.6	0.2	1.1	0.4
option 4: managed realignment	4.0	3.1	0.9	1.3	2.1
option 5: shingle nourishment	4.1	6.9	-2.8	0.6	0.03

NB: all values given to two significant figures; n/a not applicable

* Net present value (benefits minus costs)

** Benefit–cost ratio (benefits divided by costs)

† Incremental benefit–cost ratio (additional benefits of moving from one option to the next divided by additional costs)

Table 6.5 shows that the preferred option, in economic terms, is option 2 (Emergency Response). However, an initial investigation into each of these options concluded that partial realignment (option 4) should be the preferred option because it was the only option that satisfied the flood defence and environmental objectives (i.e. protected the SPA/SAC). In order to determine the impacts of this option, technical and economic appraisals, as well as an Environmental Impact Assessment were undertaken. The objectives of the Assessment included the identification of the most environmentally acceptable alignment for a secondary embankment and mitigation and enhancement measures. An Environmental Statement was produced to support the application for planning permission.

The scope of the assessments was determined through discussions between the Environment Agency, landowners and other interested parties, and from responses to consultation. Consultees included English Nature, local Wildlife Trusts, RSPB, the County Council, local Coast Project and Landscape Archaeology groups as well as the local community.

The Environmental Impact Assessment included four different alignment options that were compared against the environmental objectives. The preferred option was managed realignment, which was the most acceptable in terms of the overall environment, including landtake, impacts on breeding and overwintering birds, and landscape. Mitigation works were also incorporated into the design, and included:

- timing of works to minimise impact on the human and physical environment;
- use of pre-existing access tracks to avoid damage to the marshes;
- production and implementation of a Water Level Management Plan (WLMP) to ensure that optimum environmental conditions were created; and
- continual monitoring to safeguard archaeological interests.

Despite these mitigation measures, there were some impacts which required addressing before the scheme could be finalised. These included:

- changes to existing salinity, including a reduction in the size of the brackish area;
- loss of habitat on the line of the proposed embankment;
- problems caused by the embankment, which acts as a barrier across the marshes and may reduce views of the birds; and
- in the long term, loss of all habitats currently seaward of the embankment.

One of the major problems with the preferred option was that, whilst it maintained some of the most important bird breeding areas of the SPA, it resulted in loss of 10 ha of the cSAC. This meant that an Appropriate Assessment was required (which relied heavily on the Coastal Habitat Management Plan (CHaMP)). This assessment is designed to ensure that the cumulative impacts of a proposed option are compliant with the Habitats and Birds Directives and that appropriate mitigatory measures are adequately addressed and implemented.

The proposed approach to mitigate for the loss of lagoons was to develop additional lagoons landward of the area that would eventually be lost. These additional lagoons were developed within the boundary of the cSAC. Including these measures ensured that there was an overall positive impact on the cSAC. In addition, replacement grazing marsh was developed within the boundary of the SPA to mitigate against losses due to construction of the embankment and material sourcing areas.

Example 5: washlands

Scenario

An increase in the frequency and duration of summer flooding in a washlands area has impeded the use of land for traditional grassland management allowing scrub and carr to develop. This change in the vegetation will, in the long term, mean that the flow capacity of the washlands will reduce, thus reducing the level of protection to surrounding areas. The area is also of international importance for wintering and breeding birds, and has been designated a Special Protection Area (SPA). Increased flooding has also affected vegetation and bird diversity and may, if uncorrected, result in serious deterioration of the SPA.

Issues

The washlands protect 29,000 ha of agricultural land, more than 800 properties and infrastructure (including both road and rail). The international importance of the site from an environmental perspective and the statutory duty to protect the site under the Habitats Regulations means that there were two objectives which had to be met when identifying the appropriate flood control strategies:

- significant reductions in the frequency of summer flooding to ensure that the washlands could continue to perform a vital role as part of the flood defences; and
- conservation of the natural environment of the washlands.

Selection of the preferred option

Five different options were identified:

- option 1: do nothing;
- option 2: maintain existing conditions;
- option 3: improve to sustain existing land management;
- option 4: improve existing conditions to protect grassland; and
- option 5: undertake significant improvements to protect the environment.

This preliminary list of potential flood control options was assessed during an Environmental Impact Assessment. Those options identified as having obvious adverse effects on the environment were not considered further:

- option 1 was considered unacceptable since it would result in major deterioration of the SPA and increase the risk of flooding; and
- option 2 would neither maintain the flood defence standard or the environmental conditions and would present a long-term risk of increased flooding and environmental degradation.

The next stage was to undertake a more thorough investigation that was subject to review by all the interested parties (including English Nature, RSPB, Wildfowl and Wetlands Trust, Graziers and Wildfowlers). An Environmental Impact Assessment was then carried out to investigate the effects associated with the other three options:

- option 3 would maintain flood defence standards and allow traditional grassland management to continue. This would be achieved by adjusting the operating regime and making major improvements to flood evacuation, which would benefit breeding birds and prevent deterioration of vegetation. Minor adverse effects on the environment could occur during construction but, overall, this option offered long-term environmental benefits;
- option 4 included major engineering works, which could have moderate adverse effects during construction. This option included the opportunity for environmental enhancement through a reduction in flooding frequency and improved evacuation. Continued flooding during April, however, would limit the environmental benefits; and
- option 5 is the only option that met both the flood defence and nature conservation objectives. However, it included significant disturbance during construction and, possibly, moderate loss of arable land, property and infrastructure. It included the potential for recreation of fenland habitats, and was the only option in which populations of breeding birds would become sustainable.

An outline assessment of these options was made using a qualitative analysis of the impacts, as shown in Table 6.6.

Table 6.6: The implications of the options

Option	Construction disturbance of wildlife or residents	Changes to existing habitats or species	Loss of arable land	Loss of property and infrastructure	Cost £m
option 1	0	--	--	--	0.0
option 2	0	-	-	-	4.2
option 3	(-)	(+)	0	0	5.1
option 4	-	+	0	0	16.0
option 5	-	++	-	-	32.0

-- = significant effect; - = moderate adverse effect; (-) = minor adverse effect; 0 = no appreciable positive or negative effects; (+) = minor environmental enhancement; + = moderate environmental enhancement; ++ = significant environmental enhancement

A cost–benefit analysis was also undertaken (Table 6.7). The benefits are estimated from damages avoided and include the following:

- agriculture (reduced summer flooding);
- property (shooting and fishing rights);
- recreation (birdwatching, walking, horse riding, etc); and
- environment (estimated from current management costs).

Table 6.7: Economic assessment of the options

Option	Benefit £m	Cost £m	Net present value £m	Benefit–cost ratio	Incremental Benefit–cost ratio
option 1	0.0	0.0	0.0	0.0	n/a
option 2	70.0	4.2	66.0	16.0	16.00
option 3	71.0	5.1	65.0	14.0	1.10
option 4	72.0	16.0	56.0	4.5	0.09
option 5	73.0	32.0	41.0	2.3	0.06

The economic appraisal concluded that option 2 was the preferred option, but this had already been eliminated as it would have significant adverse effects on the environment and would not maintain the flood defence standard. When compared with option 3, options 4 and 5 could not be justified from an economic viewpoint. For option 4 (and/or 5) to be economically justified, the additional benefits from changes to existing habitats or species would have to be very large (at least £184 million for option 4 to have a benefit–cost ratio of 16). Option 3 could be immediately implemented, had only minor adverse effects on the environment and

was the most attractive in terms of capital and revenue cost. Option 3 was, therefore, the preferred option when all engineering, environmental and economic considerations were taken into account.

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Glossary of terms

Appropriate Assessment	A self-contained step in the wider decision making process required under Regulation 48 of The Conservation (Natural Habitats, &c.) Regulations 1994. An Appropriate Assessment must be undertaken in respect of any plan or project which, either alone or in combination with other plans and projects, would be likely to have a significant effect on a European site, and is not directly connected with or necessary for the management of the site for nature conservation. The purpose of the Appropriate Assessment is to determine whether the proposals would adversely affect the integrity of the European site in regard to the habitats and species for which the site was designated.
Blanket Bog	Peatlands fed exclusively by precipitation, and found in the wetter parts of the UK.
Coastal Habitat Management Plan (CHaMP)	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 group of such sites, particularly where the current defence line may be unsustainable.
Competent Authority	In relation to the Habitats Regulations, a Competent Authority is any Minister, Government Department, public or statutory undertaker, public body of any description or person holding a public office. For a flood or coastal defence project, this includes at least the following organisations: the local planning authority (which decides on planning permission), the operating authority (which makes decisions about the design), and, if it has to decide whether to fund a scheme, MAFF/National Assembly for Wales.
Contingent Valuation Method	A valuation methodology which uses questionnaire techniques to elicit valuations using respondents' willingness to pay for an environmental improvement.
Discounting	The procedure used to arrive at the sum of either costs or benefits over the lifetime of a project using a discount rate to scale down future benefits and costs. The effect of using a

	discount rate is to reduce the value of projected future costs or benefits to their values as seen from the present day. The test discount rate established by the Treasury, for government-funded flood and coastal defence schemes, is currently 6%.
Environmental Appraisal	The process whereby the environmental effects of a proposal are identified, measured, and assessed to determine their significance.
Environmental Impact Assessment	The specified process for undertaking the environmental appraisal when a proposed scheme is covered by The Environmental Impact Assessment (Land Drainage Improvement Works) Regulations 1999 or other Regulations implementing EC Directive 85/337, and the amending EC Directive 97/11.
Environmental Statement	A document that sets out the findings of the Environmental Impact Assessment, and is submitted with the planning application and/or grant application.
European site	A site that has been designated as a site of international nature conservation importance either as a Special Protection Area (SPA) or a Special Area of Conservation (SAC).
Eutrophic Standing Water	Nutrient rich lakes, meres and pools (either natural or man-made), ranging in size from a few metres across to many hectares. They are typically found in lowlands, and support large amounts of vegetation and a wide variety of animals.
Fens	Peatlands that receive water and nutrients from the soil, rock and ground water as well as from precipitation.
Habitat Replacement Cost	The full cost of recreating a habitat that would be lost as a result of one of the options being considered, e.g. do nothing.
Improvement Works	Improvement works are defined in the Environmental Impact Assessment (Land Drainage Improvement Works) Regulations 1999 as '(i) the subject of a project to deepen, widen, straighten or otherwise improve any existing watercourse or remove or alter mill dams, weirs or other obstructions to watercourses, or raise, widen or otherwise improve any existing drainage work; and (ii)

	permitted development by virtue of Part 14 or 15 of Schedule 2 to the Town and Country Planning (General Permitted Development) Order 1995(a)'.
Integrity of a Natura 2000 site	PPG9 defines the integrity of a site as 'the coherence of its ecological structure and function, across its whole area, which enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified'.
Managed realignment	The management of a process of establishing a new defence line, often set back from the existing position, with the aim of improving the long-term sustainability of the defence, or contributing to other aims such as habitat creation.
Mesotrophic Lakes	Lakes that are characterised by having a narrow range of nutrients, especially inorganic Nitrogen and total Phosphorus (typically 0.3-0.65mgNI ⁻¹ and 0.01-0.03mgPI ⁻¹). They are largely confined to the margins of upland areas in the north and west.
Natura 2000 site	A site which is either a SPA or a SAC. Also referred to as European sites. See also <i>Integrity of a Natura 2000 site</i> (above).
Non-use value	The value that people hold for an environmental resource which is not attributable to their direct use of the resource for commercial or recreational purposes. Otherwise known as intrinsic value.
Permitted Development	Works which would normally have deemed planning permission under the Town and Country Planning (General Permitted Development) Order 1995.
Present Value (PV)	The value of a stream of benefits or costs when discounted back to the present time.
Raised Bog	Gently sloping raised mounds of peat, consisting of a deep accumulation (up to 10m) of waterlogged peat and, when intact, a surface covered by a living layer of plants (including mosses). Precipitation is the only source of water and nutrient feeding the bog.
Ramsar site	An internationally important wetland, designated under the Convention on Wetlands of International Importance especially as

	<p>Wildfowl Habitat (Ramsar, Iran) 1971 and, as a matter of government policy, are afforded the same protection as a site designated under the EU Habitats and Birds Directives.</p>
Special Area of Conservation (SAC)	<p>An internationally important habitat or species designated under the EU Habitats Directive. A cSAC is a candidate site, but is afforded the same status as if confirmed.</p>
Scheduled Monument	<p>A feature of historic importance designated under the Ancient Monuments and Archaeological Areas Act 1979.</p>
Significant effect	<p>Where a plan or project <i>is likely</i> to affect a European site, it is necessary to decide whether or not it would have a significant effect. If there is any doubt, the operating authority must consult English Nature/Countryside Council for Wales. They will advise whether, in their view, the proposed scheme would be likely to have a significant effect.</p>
Special Protection Area (SPA)	<p>An Internationally important site designated under the EU Wild Birds Directive. A pSPA is a proposed site, but is afforded the same status as if confirmed.</p>



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