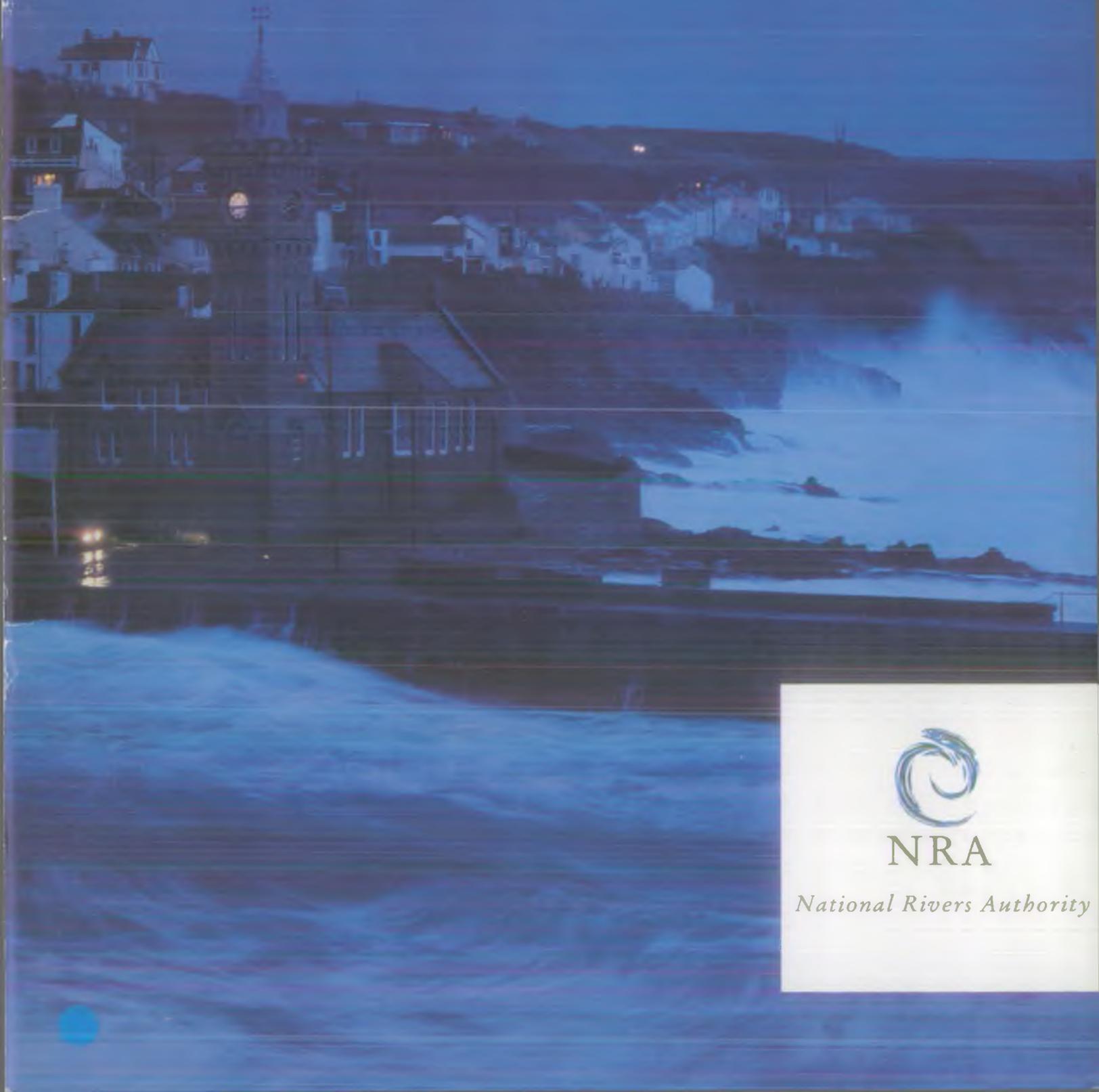


NRA FLOOD DEFENCE STRATEGY



NRA

National Rivers Authority

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This document is one of a series, the others in the series are:

NRA Water Quality Strategy
NRA Water Resources Strategy
NRA Fisheries Strategy
NRA Conservation Strategy
NRA Navigation Strategy
NRA Recreation Strategy
NRA R&D Strategy

Other publications are available from the NRA. These include the following:

NRA Annual Report and Accounts
Policy and Practice for the Protection of Groundwater
Water Quality Series
Low Flows and Water Resources
Annual R&D Review
Conservation & Fisheries Technical Handbooks

Publication catalogues are available from all the NRA Offices.

The addresses and telephone numbers for all NRA offices are listed on the inside back cover of this document.

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MISSION AND AIMS

The NRA's mission is:

- “We will protect and improve the water environment by the effective management of water resources and by substantial reductions in pollution. We will aim to provide effective defence for people and property against flooding from rivers and the sea. In discharging our duties we will operate openly and balance the interests of all who benefit from and use rivers, groundwaters, estuaries, and coastal waters. We will be businesslike, efficient and caring towards our employees”.

Our aims are to:

- Achieve a continuing overall improvement in the quality of rivers, estuaries, and coastal waters, through the control of pollution.
- Manage water resources to achieve the right balance between the needs of the environment and those of the abstractors.
- *Provide effective defence for people and property against flooding from rivers and the sea.*
- *Provide adequate arrangements for flood forecasting and warning.*
- Maintain, improve and develop fisheries.
- Develop the amenity and recreational potential of inland and coastal waters and associated lands.
- Conserve and enhance wildlife, landscape, and archaeological features associated with inland and coastal waters of England and Wales.
- Improve and maintain inland waters and their facilities for use by the public where the NRA is the navigation authority.
- Ensure that dischargers pay the costs of the consequences of their discharges, and, as far as possible, to recover the costs of water environment improvements from those who benefit.
- Improve public understanding of the water environment and the NRA's work.
- Improve efficiency in the exercise of the NRA's functions and to provide challenge and opportunity for employees and show concern for their welfare.



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FOREWORD

This document sets out the National Rivers Authority's strategy for flood defence. It forms part of a series of published documents, covering all the NRA's main functions.

The documents are intended to make the NRA's approach to the integrated management of the water environment plain to all interested parties, whether their interest is private or professional. This is in recognition of the stake that individuals have in the environment, both as taxpayers and water users.

The strategies have been developed as internal drafts over a period of time with much constructive input from a wide range of interest groups, including those represented on our Regional Committees. This consultation demonstrates our commitment to working in response to and influencing public opinion.

The strategies have already served to direct the NRA's policy development over the last two years. Their publication at this point reinforces the essential inter-relationships between the NRA's individual functions, as

preparations for the Environment Agency continue. When considered together they present a strong case for the continuing integration of all NRA functions. This argument becomes still more convincing when applied to the management of water, land and air proposed for the new Agency.

The overriding aim directing the NRA's work is the protection and improvement of the water environment. We are determined to make a real and positive difference to the rivers, estuaries and underground and coastal waters of England and Wales. This resolve will be strengthened by the inclusion of the NRA's integrated approach into what promises to be among the most effective forces for environmental good in Europe.



Ed Gallagher
Chief Executive

AN INTEGRATED APPROACH TO THE ENVIRONMENT

Vision and Reality

When we think of the water environment, most of us would conjure up a vision of an unspoilt river in its natural state, meandering across open countryside, its banks rich with flora and fauna, its waters teeming with aquatic life.

In fact, very little of our water environment remains unaffected by human activity. Alterations to rivers probably started with forest clearances about 3000 BC. The subsequent development of water-milling, navigation and drainage and irrigation systems caused major and lasting changes to habitat, vegetation and the shape of rivers. Flood Defence has evolved over hundreds of years from the initial drainage of land for agriculture and community purposes, carried out either by the church or through cooperatives set up by landowners.

In more recent times, Flood Defence has emphasised the need to protect people and property from flooding, which although rare, is catastrophic when it happens.

Sustainability - a Balancing Act

The NRA has continued to maintain this strong local interest and input into the management of flood defence and land drainage. The challenge for the NRA as "Guardian of the Water Environment" is to ensure that the necessary work is carried out to continue to protect people and property in the face of climate change and rising sea levels.

We make increasing - and sometimes conflicting - demands of our natural environment. These demands, working in concert with natural phenomena, can result in serious environmental problems. Water quantity, already reduced by abstraction, is further reduced by drought. Water quality, affected by low river flows, is at greater risk from pollution by industry and agriculture. Polluted water puts aquatic life and abstraction for public supply at risk.

Similarly complex interactions exist between river flow and flooding, channel morphology and navigation, and water quality and water sports. These demands and their interactions make the protection and improvement of the water environment, the NRA's core business, an increasingly delicate balancing act. The use of economic cost-benefit analysis, amongst others, offers a rational approach to the balancing process.

The Answer - an Integrated Approach

The NRA believes that the best way of arriving at sustainable solutions is to take an integrated approach to river management. This treats a river, together with the land, tributaries and underground water connected with it, as a discrete unit or catchment.

This approach is not new - the NRA and its predecessors have lain the foundations for it over a period of time - but the means of achieving it *is* new.

The NRA's approach is called *catchment management planning*. Under this system, the major uses within a catchment - such as abstraction and discharge needs, recreation and navigation use, areas of special conservation interest or in need of flood protection - are investigated and a *catchment management plan* is devised in consultation with interested bodies and the public. These plans present catchment issues, address conflicting uses and identify actions needed by the NRA and others to ensure that use-related environmental objectives are met.

In this way, management decisions take individual catchment needs into account, balancing these with the national aim to provide effective defence for people and property against flooding from rivers and from the sea.

This allows us to operate as a flexible national organisation, making real improvements at local level that meet the community's needs. This is a clear demonstration of our commitment to the principles of the Citizen's Charter.

Targeting the Resource

Increased awareness of these local needs puts the emphasis on the real world outcome of our work - the NRA has to be seen to be using money from taxpayers and industry in a cost-effective way, to make a tangible difference to the quality of our water environment. The NRA's system of integrated catchment management will achieve this by targeting resources to areas where they are most needed.

The NRA's drive for efficiency and increased value for money will bring added benefits. Our review of activities to see whether there is further scope for market testing - the process of exposing in-house functions to competition from the private sector - forms an integral part of this efficiency drive.

Towards an Integrated Agency

This move towards closer integration of all our functions will be a cornerstone in our preparations for the Environment Agency. The new Agency's responsibilities will embrace air, land and water and will incorporate functions currently performed by NRA, Her Majesty's Inspectorate of Pollution and Local Waste Regulatory Authorities.

The Agency promises to be one of the most effective powers for environmental improvement in Europe and as strong a regulator as any in the world. These preparations will ensure a firm foundation for safeguarding the environment of England and Wales for future generations.

THE NRA'S STRATEGY WILL ENSURE THAT
PEOPLE AND PROPERTY CONTINUE TO BE
JUSTIFIABLY PROTECTED.

THE ENVIRONMENT - A FINITE RESOURCE UNDER PRESSURE

Use of our Environment

The uses we make of our environment include:

- water abstraction for public and private water supply, industry, agriculture and navigation;
- effluent discharge from sewage treatment works, industrial processes and farms;
- development needs for housing, industrial parks and new infrastructure;
- waste disposal ranging from land-fill of domestic waste to the disposal of sewage/agricultural sludge;
- emissions to air from industrial processes and vehicle exhausts;
- mineral extraction from coal and other mineral and quarry workings;
- recreation in the form of walking, bathing, fishing and a whole range of other outdoor activities;
- commercial harvesting of fish and shellfish.

These uses are legitimate and necessary for the continuance of our way of life. Sometimes they are of positive benefit but the evidence of the pressures caused by our needs is clear:

- global warming contributing to sea levels rising at a greater rate than previously experienced;

- development in the catchment causes increased runoff detrimental to parts of the floodplain;
- people in flood risk areas demand to know the risk they are facing and be warned in advance;
- options for providing defences need to consider the benefits of enhanced wetland and coastal habitats;
- litter and debris thrown in our rivers causes blocked culverts and flooding;
- changes to agricultural support payments reflect different priorities leading to farming practices requiring different standards of drainage.

Table 1 illustrates the use of our environment in general terms and highlights some uses of particular relevance to flood defence.

The need to balance these uses against environmental pressures will require the quantification and evaluation of a range of policies, projects and courses of action. Economic analysis will help reveal the most efficient use of the increasingly scarce resources within an overall strategy for sustainable use.

As flood defence is an intervention in natural processes, a balance needs to be maintained between the duty to enhance the environment

Table 1 - Use of our Environment

GENERAL		
● Total Abstraction Licences in Force		48,000
● Total Water Abstracted [#]		59,200 Megalitres/day*
● Water put into Public Supply		18,000 Megalitres/day
● Approximate Number of Angling Licences Sold		1,000,000/year
● Estimated Number of Recreational Walkers		20,000,000/year
● Number of Farming Units		186,000
● Total Discharge Consents in Force		110,000
KEY FLOOD DEFENCE STATISTICS		
● Floodplain Area (Unprotected)		850,000 ha
● Land protected		1,200,000 ha
● Length of Main River		36,000 km
● Length of NRA Sea Defences		805 km
● Property on the Floodplain (Houses Protected)		850,000
● People protected		> 2,000,000
● No. of applications for works on main river each year		6,000

Notes:

This figure, when compared with recent publications, is higher due to a re-definition of the calculation

* Megalitre = 1 million litres

and support natural processes and the amount of intervention required to alleviate the risk of flooding.

Effective defence does not necessarily mean construction of flood embankments or increased maintenance of natural channels. This approach may not be justified on cost or conservation grounds. Effective defence encompasses a range of actions including flood forecasting and warning, as although preventing flooding may not be possible, people and property can be saved when a warning is given.

Present Status of Flood Defences in England and Wales

Reason for Optimism

Despite the competing demands on the water environment, there is reason for optimism. The Sea Defence Survey, completed in 1991, showed that only 2% of NRA defences required major works (see Figure 1) and these have been incorporated into our work programmes. Less urgent works are included in later years of the programme. Figure 2 shows the type of development protected by sea defences. The adequacy of defence relates to its condition. The risks are associated with land use. Figure 3 shows the length of defences maintained each year.

Figures 4 and 5 relate to the effectiveness of defences, showing what percentage of defences protect a floodplain adequately and the amount of protection given. For example 90% of sea defences are protected to standard.

In addition, a strategic supporting framework to improve the objective identification and justification of works has been set up. Surveys of floodplain, condition of defences and areas at risk of flooding are continuing as an integral part of this framework.

No Room for Complacency

Over £230 million per annum is spent on maintaining and improving defences and regulating the activities of others. Potential efficiency savings are possible from improved planning and maintenance techniques and targeting of resources to areas of greatest need.

Expenditure on flood alleviation or defence schemes is less effective when development in the floodplain and other parts of the catchment creates or extends flood risks. The NRA's ability to influence local planning policy is focused through the Government circular "Development and Flood Risk". The NRA can act positively and use all the opportunities provided by the local plan process to ensure that the benefits of expenditure are not eroded, putting people and property at risk.

The NRA regards its flood-warning and operational role as the heart of its flood defence work, and is providing an expanding service in identifying and assessing potential flood events. This service can be enhanced by improving forecasting techniques, and by targeting warnings at the people and property at risk. Forecasts of rainfall and tidal conditions allow potential flooding to be forecast earlier and the police and local authorities alerted.

The police and local authorities have key roles in flood warning and emergency response, but changing circumstances make it more difficult for them to fulfil these. The NRA is not intending to assume their roles, but will continue to enhance liaison with them as part of the general supervisory duties on behalf of those people likely to be affected by flooding.

The environment requires continuing careful management to maintain the status quo and make improvements where risks are present. Improving the effectiveness of flood defence will require positive and concerted action from a range of organisations. There is certainly no room for complacency.

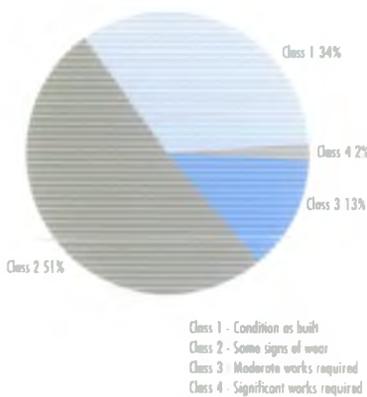


Figure 1 - Sea Defence Survey
Condition of NRA Defences.

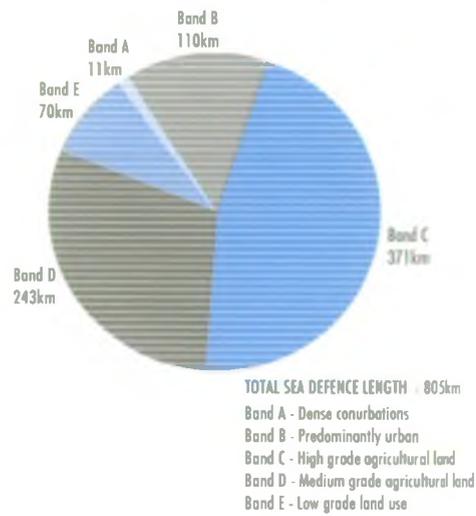


Figure 2 - Type of Land Use Protected by Sea Defences.

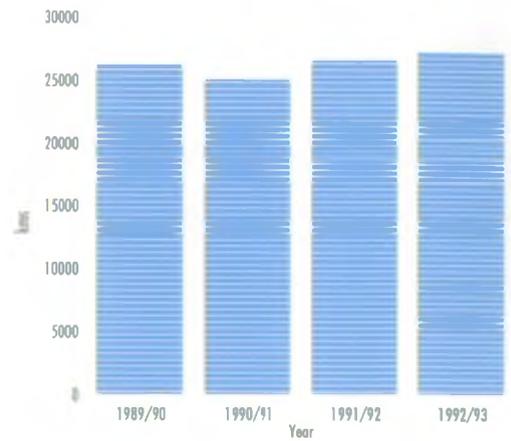


Figure 3 - Length of Defences Maintained/Improved.

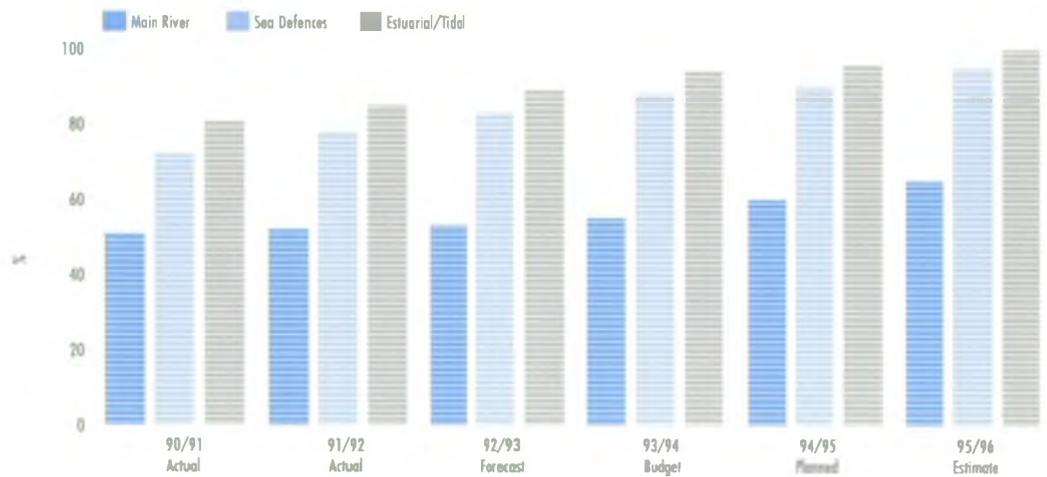


Figure 4 - Effectiveness of Defences: Defences Protected to Standard.

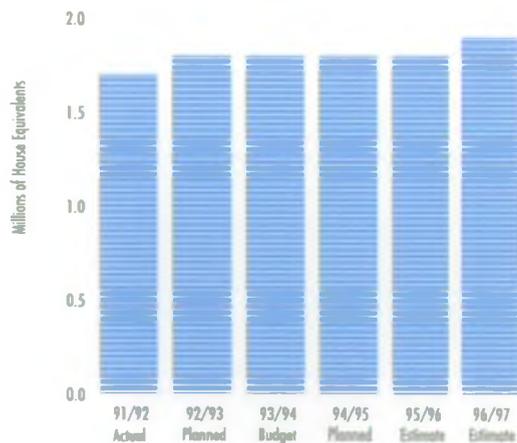


Figure 5 - Effectiveness of Defences: HEs Benefiting from Maintenance
 One House Equivalent (HE) is the average damage caused to a house during a flood. It can be used to reflect damage to non-residential property and agricultural land.

LEGISLATIVE, FINANCIAL AND INSTITUTIONAL FRAMEWORK

Legislative Framework

The NRA's ability to act to maintain and, where necessary, improve the water environment is dictated by European Community (EC) and domestic legislation.

At National Level

The NRA was formed as a result of the Water Act 1989. Those aspects of the 1989 Water Act which concerned the NRA were later consolidated into the Water Resources Act 1991 (WRA 1991) and the Land Drainage Act 1991. (LDA 1991).

Under the Water Resources Act, the NRA has a duty to exercise a general supervision over all matters relating to flood defence and has been given a duty to carry out surveys of the areas in relation to which it carries out flood defence functions. The NRA may also construct new works and undertake improvement and maintenance works on, or in connection with, main rivers and sea defences.

Main river is that part of the river system that is defined on statutory main river maps held by the Ministry of Agriculture, Fisheries and Food (MAFF), the Welsh Office (WO) and the NRA. All other river systems are defined as ordinary watercourses (LDA 1991) unless they have been registered as surface water sewers. Main river maps serve to define the boundaries where the NRA has permissive powers and where other authorities may exercise their powers. The Act provides the NRA with strong control over main river but weaker control over ordinary watercourses.

Sea defences are constructed to prevent flooding of land by the sea. The NRA has responsibility for carrying out sea defence works except where defences are privately or local authority owned. Coast protection, carried out by Maritime District Councils, is the protection of land from erosion or encroachment by the sea. The term coastal defence embraces both.

Planning legislation gives the NRA an important role as a consultee in relation to applications for planning permission.

This means that the NRA's views and advice on these applications are taken into account by the appropriate authority.

The NRA may take enforcement action on both main river and other watercourses. It is responsible for issuing consents for the construction of all works in, over or under main river and for certain works on ordinary watercourses (with the exception of those in Internal Drainage Districts). The Authority is empowered to make a charge for the issue of a consent.

The NRA has general environmental duties, in relation to all of its functions, including the need to further conservation. The NRA also has a duty generally to promote conservation and the use of inland and coastal waters and associated land for recreational purposes. Details of these can be found in the NRA's Conservation and Recreation Strategies.

Legislation in Practice

The legislation imposes duties on the NRA that it must carry out. Other provisions take the form of powers that the NRA uses to fulfil its duties and meet its aims. This combination of duties and powers determines the broad allocation of effort and resource.

Table 2 shows that, in the main, activities relating to the majority of flood defence are carried out using permissive powers. The NRA sets appropriate standards of service for its own work so that the most needed projects are tackled first. The NRA's supervisory duty enables information on the requirements for works to be gathered.

Financial Framework

The NRA Flood Defence function is funded by a combination of Government grant-aid and levies raised on local authorities and Internal Drainage Boards.

Regional and Local Flood Defence Committees include appointees of the agencies who contribute to the funding and determine the appropriate levies each year.

Table 2 - Duties and Powers

Flood Defence Duties

The Water Resources Act 1991 gives the NRA an overall supervisory duty over all matters relating to flood defence both for inland flooding and inundation by the sea. To support this supervisory duty, the NRA is required to carry out surveys for the purpose of carrying out its flood defence functions.

Regulation and Enforcement

Under the Water Resources Act S.109 & 110, prior consent must be obtained from the NRA before any structure in, over or under a watercourse which is part of main river is erected. Regional byelaws can determine a width of land for which consent is also obligatory. The NRA's permissive powers are to alleviate flooding of existing development not proposed development.

Maintenance of Existing Defences

The NRA may undertake maintenance works on main river and on sea defences to reduce the incidence of flooding to property. Maintenance work is undertaken inline with the NRA's duty towards conserving and enhancing the aquatic environment.

Improvement and Development of Defences

The NRA is empowered to improve defence systems on main river and the coast to reduce the incidence of flooding to property. In such instances, it must ensure all works comply with environmental requirements.

Flood Emergency Services

The NRA has powers under WRA 1991 to provide and operate flood warning systems on all watercourses and tidal/sea defences in England and Wales, and to provide and maintain apparatus and engineering works appropriate to this effect. When these powers are exercised, adequate procedures should be in place to disseminate warnings effectively, as the NRA takes on a duty of care when exercising its permissive powers.

Functional Management

The Regional Flood Defence Committees are responsible for the discharging of all flood defence functions, with the exception of the general supervision of all matters relating to flood defence, the raising of drainage charges, levying of precepts and the borrowing of money.

Flood Defence levies raised in any committee area are required by statute to be spent within the area from which they have been raised. Exceptions are made for the funding of NRA Head Office and R&D, to which each committee contributes.

Income for flood defence is raised as follows:

- Local Authority Levies 73%
- Capital Grants and Contributions 15%
- Interest Receivable 6%
- Internal Drainage Boards 3%
- Other Income (including consents) 2%
- General Drainage Charges 1%

Institutional Framework

The NRA and Government

The NRA is a non-departmental public body, sponsored by the Department of the Environment (DoE). It also has important policy links with the Ministry of Agriculture, Fisheries and Food (MAFF) and the Welsh Office (WO).

The Other Players

In addition to the NRA, there are many other bodies and organisations which have a role to play in improving the water environment. The NRA can influence their activities by its actions and vice versa. Effective liaison with the following organisations is key to the success of the NRA's flood defence strategy.

- **Commission for the European Communities (CEC):** sees environmental legislation as being of primary importance. Much recent UK environmental law has been determined by EC Directives.

The NRA is taking a more active role in influencing the science that lies behind EC legislation in its early stages.

- **Department of the Environment:** are sponsors of the NRA.
- **Ministry of Agriculture, Fisheries and Food (MAFF):** are responsible for determining Flood Defence Policy. The Minister appoints the Chairmen and some members of Regional Flood Defence Committees (RFDCs). MAFF, through a network of Regional Engineers' offices, assesses and appraises proposed capital flood defence works, approves those which comply with national technical, economic and environmental criteria and provides substantial sums in grant aid. In areas of research and development (R&D), strategic research carried out in MAFF commissions is integrated with NRA research to provide an operationally useful output. MAFF also has an important role in relation to other NRA interests including fisheries, agricultural pollution and marine sludge disposal and dredging.
- **Welsh Office (WO):** carries the policy and funding responsibility for flood defence in Wales. The Secretary of State for Wales appoints the Chairman and some members of the RFDC in Wales.
- **The NRA's Statutory Regional Committees:** except for the general supervisory duty, the issuing of levies and the making of drainage charges, all of the NRA's functions relating to flood defence are carried out through RFDCs. RFDCs consist of members appointed by MAFF or WO, representatives of the County and Metropolitan District Councils and the London Boroughs who finance the Flood Defence levy, and two members appointed by the NRA.

At least one of the MAFF or WO appointees is chosen for specialist knowledge and experience of conservation issues.

- **Local Flood Defence Committees (LFDC):** RFDCs may, with MAFF approval, set up and empower LFDCs to undertake some or all RFDC functions within discrete districts of their region. LFDC's cover typically a catchment area or group of catchment areas within a region.
- **Local Authorities:** have powers to undertake works on ordinary watercourses, under the general supervision of the NRA. Liaison with local authorities by NRA on planning developments is critical in the proactive role of preventing the creation or extension of flooding risks. Local authorities also play a key role in flood warning and emergency response by helping to warn those likely to be affected and assisting in evacuation when necessary. Levies to fund flood defence are raised on local authorities.
- **Maritime District Councils:** carry out coastal protection and some sea defence works. They liaise closely with the NRA in coastal cells. It is recognised that defences or protection works cannot be constructed in isolation as each has an effect on the other.
- **Internal Drainage Boards:** were originally set up to deal with specific problems, in identifiable areas. They now have a duty to exercise general supervision over all matters relating to the drainage of land within a defined internal drainage district.
- **The Police:** the NRA passes flood warnings to the police who inform the public and if necessary initiate and coordinate evacuation and help to the public.
- **Meteorological Office:** provides warnings of severe weather and forecasts surges through the Storm Tide Warning Service sponsored by MAFF.

The NRA has collaborated with the Met Office in erecting many weather radar stations in England and Wales.

- **Research Establishments:** including Institute of Hydrology, HR Wallingford and Proudman Oceanographic Laboratory, play an important role in solving flood defence issues and seeking innovative approaches.
- **English Nature and Countryside Council for Wales:** are statutory consultees in the environmental assessment of proposed works and the protection of designated conservation sites.
- **Angling Organisations and Water Recreation Groups:** act as vital watchdogs. Their collaboration and support is essential.
- **The Media:** readily influence public opinion. Their interest in news - good and bad - must be focused by NRA to ensure that policies and points of view are placed before the general public in an objective and clearly understood manner.

- **Voluntary Groups:** many national groups - the Royal Society for Nature Conservation - as well as local groups are influential. Friends of the Earth, Greenpeace, Tidy Britain Group and the Marine Conservation Society all influence public opinion on environmental matters and help produce the climate in which the NRA operates.

- **The Public:** millions of people enjoy using, and have a great interest in, the water environment. People are often the NRA's eyes by reporting pollution and flooding.

All these interested parties have a stake in the water environment.

The strategy for Flood Defence set out in the following pages will require co-operative action from some and support from others for its successful implementation, but - most importantly - the commitment of all if we are to maintain and improve standards.

THE NRA WILL CONTINUE TO MAINTAIN
STRONG LOCAL INTEREST AND INPUT
INTO THE MANAGEMENT OF FLOOD
DEFENCE AND LAND DRAINAGE.

NRA STRATEGY FOR FLOOD DEFENCE

The Broad Strategy

The NRA's principal aims in relation to flood defence are to:

- provide effective defence for people and property against flooding from rivers and from the sea;
- provide adequate arrangements for flood forecasting and warning.

To achieve these aims the NRA seeks to:

- develop and implement the flood defence strategy through a systematic approach for assessing capital and maintenance requirements and develop medium and long-term plans for those defences owned and maintained by the NRA;
- encourage development of information technology and extension of facilities which will further improve the procedures for warning of, and responding to, emergencies;
- support R&D which will assist in identifying future flood defence needs;
- review best practices for all operational methods and the identification and justification of work, thus increasing efficiency and enhancing value for money;
- heighten general awareness of the need to control development in floodplains and contribute to the development of catchment management plans;
- identify opportunities for the enhancement of environmental, recreational and amenity facilities when undertaking flood defence works.

This requires an efficient balancing of costs and benefits within an integrated system of catchment management, taking the needs of all users and NRA functions into account. To aid the completion of multi-functional Catchment Management Plans (CMP) Flood Defence will:

- provide the data needed to reflect the important issues;

- advise on the implications of proposed courses of action;
- implement CMP when published.

Activity at a catchment level falls into the main activity areas of Regulation, Monitoring, Operation and Improvement. Within Flood Defence, the maintenance of defences forms part of the monitoring activity and the important role of flood forecasting and warning and emergency response is set out as an operational task.

Effective Regulation

The NRA recognises that further information on the likelihood of flooding, the condition of river and coastal systems and the capacities of channels and defences is required to meet the general supervisory duty for all matters relating to flood defence. Equally, information is needed to manage flood defence as part of the overall management of the catchment, and to plan and monitor work programmes.

Development and Flood Risk

Circular 30/92 on Development and Flood Risk published by DoE, MAFF and WO, sets out guidance to planning authorities in formulating statutory and local plans. The NRA is expected to improve information on land at risk of flooding through carrying out surveys under S105(2) of WRA 1991.

The NRA will:

- carry out surveys of all main and ordinary rivers under S105 to provide information on land at risk of flooding;
- increase the extent and accuracy of floodplain data transferring these to a geographic information system when this becomes available;
- produce updated maps showing floodplain areas;
- provide to the public and their agents information regarding flooding, where it is available;

- make use of models where appropriate to supplement historic flooding data.

Planning Liaison and Control of Developments

Liaison with local authority planning departments on planning applications and development proposals is of paramount importance. The General Development Order (GDO) and Circular 30/92 set out the framework for consultation by planning authorities with the NRA.

The NRA will continue to:

- seek to influence structure, local and other plans to help safeguard people and alleviate flood risk;
- form model land use statements for use by planning authorities;
- seek to influence proposals for changing land use by third parties where appropriate;
- highlight areas at risk from flooding due to development elsewhere, by using CMP or other means;
- require developers to undertake mitigation works at their own cost as a pre-condition to agreement, and seek to ensure that development does not proceed until such works are implemented.

Many development schemes have significant implications for flood defence. The NRA's role as consultee in planning applications and the requirement for developers to produce environmental statements both provide the opportunity to pro-actively prevent potential problems.

The NRA will seek to:

- strengthen links with local authority planning departments;
- prevent potential environmental problems caused by developments;
- develop procedures and techniques to assess the implications of major developments and to allow audit of environmental statements.

Main River

The powers of control, maintenance and improvement that the NRA has on main river helps achieve value for money for the public and the environment generally. To ensure that the service can be provided to the greatest number of people, the NRA will:

- undertake a review of what is included as main river to work towards national consistency;
- review and clarify its flood defence role in respect of ordinary watercourses.

Byelaws

Regional variations in byelaws cause problems and confusion across boundaries. In this matter, the NRA will:

- seek to identify and clarify variations in byelaws across regional boundaries;
- review the options available for national byelaws.

Monitoring and Maintaining the Defence System

Flood Defence Management Framework

NRA flood defence services may be provided to fulfil statutory obligations or to reflect corporate aims and objectives. Where clear guidance is not given by legislation, logical and robust methods are needed to determine appropriate standards of protection. Objective identification and subsequent appraisal assures RFDCs and the NRA that the most effective use is being made of resources.

Common data will support a consistent approach to flood defence activities. Programmes of work, targeted at areas of greatest need, can be formed using this data.

Data Collection

Section 105(2) of WRA 1991 *requires* the NRA to carry out surveys of the areas in relation to which it carries out its flood defence functions. This is a powerful tool when used to gather information to objectively assess works and fulfil flood warning and development control requirements.

The Standards of Service (SoS) methodology underpins much of this work by assessing land use in the floodplain and monitoring the achievement or otherwise of a target SoS. For areas not achieving the target SoS, the possibility of remedial works is considered, where justified.

The NRA Sea Defence Survey has provided much needed information on areas at risk, and further work is proposed to expand and improve this information. This is only the first important step, and continual updating and improvement is needed. The survey forms part of the larger work to collect data on the condition of all NRA flood defence assets.

To support objective assessment, the NRA intends to:

- collect SoS data providing information of the area and floodplain, properties on the floodplain and flooding history;
- complete surveys of the condition and maintenance requirements of all constructed works or assets owned, managed or maintained by the NRA;
- use this data to advise on development control, improve flood warnings, and as an input to catchment management plans and performance measures;
- target resources where assets are in poor condition and where there is greater risk of flood damage if an asset should fail;
- hold discussions with private owners of sea defences to agree the work necessary to maintain the integrity of the defence. In some instances, the NRA may carry out this work.

Justification and Prioritisation

Those works that are identified need to be appraised to assure decision-makers that the proposed expenditure is properly justified, options are fully evaluated and the most appropriate solution to an identified problem is selected, thereby securing maximum value for money. However, if there are insufficient funds, even schemes with optimum benefit/cost ratio may not proceed.

The NRA will seek to:

- ensure that the appraisal stages as identified in Treasury guidelines are embraced;
- apply procedures to both capital and revenue projects;
- follow approved project management techniques to ensure proper use of public funds;
- consider the whole life cost of a project when appraising options.

Although the use of economic appraisal is important in obtaining value for money, overriding factors must be considered. For example, the duty to further conservation and enhance the environment may lead to a scheme with less than optimum economic benefit/cost ratio being preferred, as the additional environmental benefits are not easily quantified.

With finite available resources, not all schemes put forward can be included in works programmes in the immediate years. To ensure that the most worthwhile and urgent are carried out, the NRA will:

- assess prioritisation techniques for capital and maintenance works;
- provide an overall evaluation of the benefits of carrying out flood defence works;
- ensure that environmental, social and urgency criteria form part of the process.

It is recognised that reasons for protecting low-lying areas from flooding may change. Where justification for any defence has diminished to the point when expected benefits of maintenance and rehabilitation will not match costs, the NRA will consider the abandonment of the defence or a managed retreat incorporating ecological and landscape criteria in the assessment of the most beneficial option.

Post Project Appraisal

The NRA's post project appraisal system is designed to obtain maximum benefit from the experiences gained at all stages of projects, to improve appraisal, design, and construction. Although all schemes have a post project evaluation carried out, the NRA's post project appraisal system is a major audit of a few schemes only.

The NRA will:

- undertake a minimum of twenty post project appraisals each year across England and Wales;
- continue to work with MAFF on post project evaluation and appraisal, in order to confirm the effectiveness of expenditure programmes.

Environmental/Conservation Works

The NRA is committed to the environmental principles of stewardship and sustainability, ie, the guardianship of the present-day environment without compromising the potential for future enhancement.

The NRA is convinced that environmental consciousness must be an intrinsic part of the management system, and will encourage environmental enhancement at all levels.

The NRA will:

- comply with the requirement to promote conservation and enhancement of the natural beauty and amenity of inland and coastal waters and of land associated with such waters;
- undertake maintenance work in an environmentally acceptable manner.

Operating Defences and Emergency Response

Over time, most of the river systems in England and Wales have become dependent on the efficient operation of sluices, pumps and structures. In addition, many defences allow access to watercourses in normal conditions.

Operational Management

Complex river systems that require water levels to be controlled, require operation generally on a daily basis. The NRA will:

- continue to operate river systems as required;
- produce and agree operational procedures, and seek increased efficiency;
- take account of both flood defence and environmental considerations, and formulate and agree operational plans with English Nature or the Countryside Council for Wales to cover operations which are in, or affect, SSSI's and other environmentally important sites.

When floods or high tides are predicted, prompt and effective operation of the system is required. The detailed knowledge gained by daily operation is the key to this response.

Flood Emergency Services

The NRA operates a flood warning service which aims to provide:

- a 24 hour monitoring service of weather forecasts, weather radar, rainfall, river levels, sea levels and tidal surges to detect and forecast possible main river fluvial and tidal floodings;
- colour coded flood warnings to the police for dissemination to local authorities, other bodies and the general public.

Forecasts of adverse weather are provided by local weather centres. This data is used to forecast likely flooding and issue warnings. The Storm Tide Warning Service is funded and managed by MAFF and based at the Meteorological Office at Bracknell. The NRA receives warnings for the east coast when levels reach pre-determined thresholds and interprets these to issue the appropriate warnings.

On the west and south coasts, "Attention Drawn" messages are sent to NRA when hazardous conditions are predicted.

Monitoring the effectiveness of warning systems, the actions of all staff and the extent of flooding is an important feature in identifying improvements in the flood emergency response capability. Exercises are an important part of this monitoring.

To ensure an improved service, the NRA will:

- participate in a review of flood warning and response in order to clarify both its role and that of others;
- influence and have a role in any inter-agency co-ordination of flood emergency planning;
- determine and implement standards of service for flood warning and emergency response;
- continue to hold regular liaison meetings with local authorities and other interested parties;
- rationalise and standardise emergency procedures incorporating best practises and lessons from previous events;
- use the knowledge gained from existing, sophisticated flood forecasting systems to raise the standards of all such systems, and continually review other technical developments to enhance flood forecasting and warning;
- in conjunction with Met Office, continue to seek necessary improvements to the weather radar network;
- continue to hold regular exercises to test procedures;
- continue to develop contacts with the media and take a pro-active stance during flood events.

Improving Defences

Much of the NRA's work is directed at maintaining existing defences in an adequate condition to provide effective protection. The

importance of this maintenance should not be underestimated, nor should its resource needs. Figure 6 shows significant capital works in England and Wales.

However, with increasing demands on the water environment, the NRA continually strives to secure longer-term improvements both to the standards of defences provided, and to the way works are identified, planned and designed. The NRA will:

- ensure defences in a poor state of repair or inadequate for protection needs are included in the capital programme;
- carry out improvements to defence structures effectively to ensure value for money from capital expenditure;
- ensure opportunities for conservation and enhancement of the environment are identified and implemented where justified.

Understanding of the processes affecting rivers and coastlines has improved through research and monitoring programmes. It is recognised that engineering works should accommodate natural forces where appropriate, and that these forces operate over a wide geographical area. Consequently the NRA will:

- strategically plan works by catchment or coastal process cell;
- work with coastal groups, supporting an extended role for them;
- work towards a better understanding of natural processes;
- ensure improvements work with nature;
- promote the use of soft engineering for new work when environmentally appropriate.

On the coastline, forces and processes affect both coast protection and sea defences. Here, the need to work with nature is graphically demonstrated by the use of beaches to dissipate wave energy.

Figure 6 - Flood Defence Capital Projects 1993/94 - 1996/97.

These are anticipated spends > £2M only.



● FLUVIAL DEFENCES

- 1 River Thames: Maidenhead, Windsor and Eton (£63.0M)
- 2 River Colne Areas 1,2 and 3 (£14.6M)
- 3 Balley Beck Phase 3 and 4 (£10.2M)
- 4 River Irwell, Salford (£9.6M)
- 5 River Quaggy Flood Alleviation (£7.2M)
- 6 Crossens Pumping Station (£3.5M)
- 7 River Roch at Rochdale (£3.5M)
- 8 Pandle Water at Nelson (£3.5M)
- 9 Ely Ouse Flood Defence (£3.2M)
- 10 Charlton Brook (£3.1M)
- 11 Shrewsbury and Severn Valley Flood Alleviation (£2.8M)
- 12 Glossop Brook (£2.6M)
- 13 Lower Witham/Horncastle Flood Relief (£2.5M)
- 14 Ea Beck (£2.3M)
- 15 Gainsborough FD Strengthening (£2.3M)
- 16 Thornes Wakefield (£2.1M)

■ TIDAL DEFENCES

- 17 Broadland Flood Alleviation Scheme (£14.0M)
- 18 Humber Bank Toe Works (£11.9M)
- 19 Kings Lynn/Denver Tidal River Defences (£5.0M)
- 20 Tidal Defences London: Provision for Refurbishment (£4.4M)
- 21 Roach: Wallasea Island to Great Wakering (£4.0M)
- 22 Goole Dock to Dutch River (£3.6M)
- 23 Broadland Compartment 11 Halvergote (£3.5M)
- 24 Colne Barrier (£3.4M)
- 25 Glasson Defences at Lancaster (£3.2M)
- 26 Thameside Revetements Phase 2: Shell (£3.1M)
- 27 Brough to North Ferryby (£2.6M)
- 28 Thames Tidal Defences (£2.4M)
- 29 Bideford Urban 4C (£2.4M)
- 30 Tidal River Crane: Flood Alleviation (£2.1M)
- 31 Crabley Clough to Brough (£2.1M)
- 32 Broad Oak to Strand including Outfalls (£2.1M)

▲ SEA DEFENCES

- 33 Mablethorpe/Skegness P130 Nourishment Phases 1-4 (£49.3M)
- 34 Pevensey Bay: Eastbourne/Cooden SD Improvements (£34.4M)
- 35 Dymchurch Sea Defences Phases 2 and 3 (£16.4M)
- 36 Happisburgh Breakwaters (£8.7M)
- 37 Severn Estuary Sea Defence Improvements (£8.7M)
- 38 Preston Sea Wall (£5.8M)
- 39 Cockersands (£4.7M)
- 40 Binn Wall Improvement (£3.4M)
- 41 Felpham Sea Defence Frontage (£2.5M)
- 42 Selsey/Bracklesham Enhancement of Defences (£2.5M)
- 43 Haverigg Sea/Tidal Defence Scheme (£2.5M)

The NRA will:

- continue to monitor beach movement and sediment transfer along coasts;
- determine the best methods of analysing monitored data to help future schemes;
- identify and procure material for recharging beaches;
- carry out effective beach management;
- co-operate with coast protection authorities.

Many capital schemes are designed in-house. The NRA will ensure that equally high standards are provided to all schemes and value is obtained throughout the process of procuring works. The NRA will:

- use or promote the use of best practice for design of all works;
- review conditions of contract to ensure the best value is obtained for the NRA.

Climate Change

Research is continuing into the effects of natural forces including the impact of climate change on NRA defences. Within the limits of reliability of predictions the NRA will:

- provide for sea level rise and increased storminess in the long term planning and design where this is cost justified;
- ensure that its assets are developed in the best possible way to meet future demand.

Environmental Assessment

Environmental Assessment (EA) and Audit will be carried out in line with European community directives, government policies and internal practices. It is seen as integral to the work of the NRA who will:

- integrate EA into project appraisal;
- follow good practice for the production of EA in all internal work;
- influence developers to do likewise where the NRA is a consultee;
- issue guidance and training to all staff involved in carrying out or evaluating EA.

Financing

The percentage rates of MAFF and WO grant for the various categories of work reflect the need and ability of the local authorities to fund the work. To fulfil its corporate aims and objectives, the NRA will:

- develop a comprehensive programme of long term needs and use this to secure the appropriate funding.

Public Awareness and Education

As well as long term capital investment, significant longer-term benefits will be seen as a result of the NRA's proactive approach to influencing public awareness and education, particularly for children. The NRA will:

- develop a national public education programme on flood risk and avoidance.

RESOURCES AND TIMETABLE FOR ACHIEVEMENT

A Flexible Resource

The achievement of this strategy is dependent on a highly flexible, yet specialised resource. The NRA has:

- well-trained flood defence staff committed to the environment, working with an increasingly multi-functional workforce to maximise flexibility to achieve flood defence objectives;
- a network of flood forecasting, warning and control rooms able to combine fast response for local needs with best use of specialist knowledge;
- constructed flood defences worth an estimated £5,000 million;
- automated instrumentation placed at key locations, access to the weather radar network and sophisticated forecasting models to enable a rapid response to floods.

The NRA will make all staff aware of the Flood Defence Strategy, as an integral part of ensuring that NRA Resources are directed towards its achievement.

Efficient Use - Better Value for Money

The cost of deploying this resource is over £250 million per year; of this some £105 million is spent on maintaining defences and £110 million on replacing or improving defences.

For the foreseeable future, expenditure will rise in line with inflation; additional work being funded by improving the efficiency of existing operations. The emphasis now and in future is firmly on making best use of current resources to deliver the right level of service, keeping NRA costs as low as possible.

Innovation is at the heart of efficient resource use. Examples of improvements are:

- more effective flood forecasting systems emphasising the use of rainfall radar and rainfall forecasting;
- automatic clearance of trash screens, supported by alarm systems;
- soft defences incorporating increased knowledge of coastal processes and sediment flow.

The changing availability of resources will affect the extent to which the highest priority works can be targeted. Flood Defence is working towards a needs based identification to enable a more rational approach to be taken as to whether improvement or continued maintenance is required.

The Timetable for Achievement

Improvements to the environment and flood defences are not achieved overnight. The planning and implementation of major programmes stretches over many years. There may be a further delay before the real effects of any work is seen.

The broad timing of the major initiatives to maintain and improve flood defence is given in the chart opposite. Their implementation is supported by business plans which detail the components of each initiative, their relative priority, outputs, timing and resourcing. Short to medium-term milestones in the achievement of the overall strategy are set out in the annual NRA Corporate Plan and reported on in the NRA's Annual Report and Accounts. Achievement of these initiatives is in many cases dependent on action by others to the same timescale, as documented in catchment management plans at local level.



RESEARCH AND DEVELOPMENT

Research and Development

Research and development (R&D) makes an essential contribution to all NRA work. It provides new knowledge and techniques to fulfil our duties better.

Liaison with MAFF in this area will continue to ensure that projects are developed in a co-ordinated fashion.

Strategic R&D in support of the NRA's flood defence work addresses a number of key issues.

Investment Planning

The objective assessment of flood defence needs provides a strong focus for the effective planning of future investment within the function as a whole.

Examples of research include:

- developing better asset management procedures and methods for prioritising maintenance investment;
- assessing alternative river maintenance strategies;
- determining probabilistic design procedures for sea and tidal defences.

Design Standards and Specifications

The main effort is going into formalising the best of present practice. This will involve a critical review of existing practice - much undocumented - followed by identification of areas where procedures could be made more efficient or effective.

The development of new engineering solutions, particularly environmentally-sensitive options, will be required in the near future.

To further this and to seek to maintain standards of service, R&D projects being

carried out include:

- investigating channel characteristics based on controlling processes including two stage channels and erosion processes;
- design of trash screens, grass and aquatic weed management and dredging;
- improving the understanding of the factors affecting saltmarsh stability and erosion;
- contributing significantly to a practical manual on beach management and recharge.

Emergency Response

The NRA has a stated aim to provide for emergencies and R&D will be required to develop a more effective flood forecasting and warning system as well as codes of best practice.

Examples of research include:

- evaluating standards of response to flood related emergencies;
- developing distributed models of rainfall on a catchment basis;
- improving methods of forecasting snowmelt and thunderstorms;
- determining new ways of rapidly sealing breaches in NRA flood defences.

Regulation and Enforcement

The NRA seeks to influence planning decisions about all developments in the floodplain. The need for a review of legislation will also be considered, and R&D is important in determining the best approaches to planning activity and development control.

Specific projects include:

- developing a strategic approach to furthering the NRA flood defence interests in Town and Country Planning;
- an analysis of catchment control problems;
- a study of public attitudes to flooding.

Impact of NRA Flood Defence Strategy

The one certain prediction that can be made is that the water environment will be subject to a great many changes in the future. Some are within the NRA's sphere of influence, many others are not.

Looking ahead, the strategy will ensure that flood defence interests continue to be taken into account in managing the catchment. Increased opportunities will exist to construct and maintain flood defences in an environmentally sensitive manner.

An Uncertain Future

The NRA must ensure that it reacts responsibly to climate change and associated sea level rises, the philosophy of which is set out by the Intergovernmental Panel for Climate Change (IPCC). Their impact on hard and soft defences, and on the emergency response required of the NRA, will continue to be studied. Allowance is already made for predicted changes and, in conjunction with MAFF and WO, further detailed guidance will be issued on dealing with these challenges as predictions become more reliable.

There has been a significant change in emphasis over recent years from drainage of land to flood defence. Requirements for agricultural production have changed and new farming practices need different standards of drainage. In some areas this may well lead to a reduction in standards which will be to the benefit of wildlife. This strategy will enable the NRA to determine a more appropriate standard of service.

The NRA will continue strong liaison with local authorities in the light of changes taking place through the Boundary Commission Review.

The European Influence

Much of the impetus for environmental legislation has come from the EC, for example, directives on environmental assessment have been passed into UK Law.

Close liaison with European countries will continue to be maintained and developed through involvement with both planning practice and coastal processes, especially where shorelines share a common sea.

The Public

Public attitudes will continue to exert a large influence, and increasing demands are made on public services to deliver stated standards of service. However, promotion of flood defence projects is initiated at local level, maintaining a good sense of proportion between the desirable and the affordable.

The NRA will actively seek to widen the debate on the protection of floodplain and washlands from development, taking all needs into account, through consultation on catchment management plans. This debate requires robust techniques for assessing the economic and social benefits of environmental improvement. It will inevitably be influenced by the state of the economy, as fluctuations adjust public priorities.

The Environment Agency

The future of the environment in England and Wales will be influenced by the success of the proposed new Environment Agency. Areas of particular importance include:

- integrating the Flood Defence function, which is essentially a provider of works, into the broadly regulatory and monitoring role of the Environment Agency. Effort will continue to be committed to make all functions work together;
- ensuring that public funds are spent where there is most need and that expenditure is supported locally. The economic and legislative framework within which Flood Defence operates is designed to do this. The permissive powers of the NRA mean that levels of protection are not defined by statute but are determined and carried out if justified.

MEASURING OUR SUCCESS

The success of the work of the NRA and, in due course, of the Environment Agency, will most clearly be shown by real improvements in environmental quality. Our progress in maintaining and improving flood defence will be monitored using the following key indicators:

- length of main river classified according to use made of the flood plain (i.e.Land Use Band);
- Land Use Bands protected to appropriate standard;
- floodplain protected by maintenance and improvement work;
- completion of S105 surveys as agreed with planning authorities;
- length of flood defence improved;
- percentage of properties warned prior to flooding occurring;
- amount of development on unprotected floodplain.

These and other measures will be monitored and published regularly, as an important part of our remit to report to Government and the public on the state of the environment.

EFFECTIVE DEFENCE ENCOMPASSES A
RANGE OF ACTIVITIES
–INFLUENCING DEVELOPMENT
–CONSTRUCTING DEFENCES
– FLOOD FORECASTING AND WARNING.

GLOSSARY OF ACRONYMS USED IN THIS DOCUMENT

CEC	Commission for the European Communities	LFDC	Local Flood Defence Committee
CMP	Catchment Management Plans	MAFF	Ministry of Agriculture, Fisheries and Foods
DOE	Department of the Environment	NRA	National Rivers Authority
EC	European Community	R&D	Research and Development
EA	Environmental Assessment	RFDC	Regional Flood Defence Committee
FD	Flood Defence	SOS	Standards of Service
GDO	General Development Order	SSSI	Site of Special Scientific Interest
HE	House Equivalent	WO	Welsh Office
IPCC	Inter Governmental Panel for Climate Change	WRA 1991	Water Resources Act 1991
LDA 1991	Land Drainage Act 1991		

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