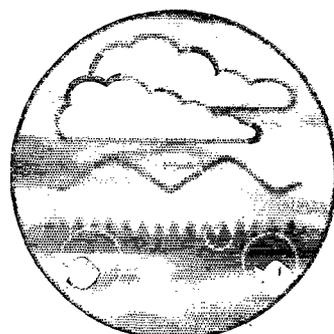
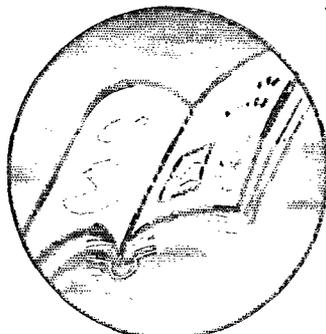
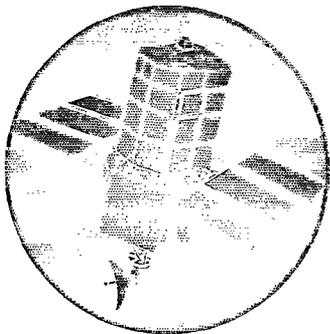


**Strategic Land Use Planning in Europe and USA:
Review of the Best Practice for the
Environment Agency**



Research and Development

Technical Report
W62



ENVIRONMENT AGENCY



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Strategic Land Use Planning Europe and USA: Review of Best Practice for the Environment Agency

Volume 1 - Overview and Recommendations

R&D Technical Report W62

John Chatterton & Colin Green

Research Contractor:
Middlesex University

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Statement of use

This project is intended to provide guidance to the Environment Agency in influencing external bodies and improving its national and regional land use management techniques and strategies. It was most specifically within the remit of flood defence, in conjunction with conservation and enhancement of the water environment. Many of the recommendations, however, will reflect the multifunctional nature of strategic land use planning. Specific items of best practice should be applied over a wide range of the Environment Agency's interest through a continuing action programme.

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GLOSSARY

ACC	Association of County Councils
ADC	Association of District Councils
AMA	Association of Municipal Authorities
BMP	Best Management Practice
BSI	British Standards Institution
CMP	Catchment Management Planning (now LEAP)
CORINE	Co-ordination of information on the environment
DETR	Department of Environment, Transport and Regions (previously DOE)
DOE	Department of the Environment (now DETR)
EC	European Community
EEC	European Economic Community
EIA	Environmental Impact Assessment
EPOCH	European Programme on Climate Hazards
EU	European Union
GIS	Geographical Information Systems
HEP	Hydro-electric Power
ISO	Institutional Organisation for Standardisation
LEAP	Local Environment Agency Plan (previously CMP)
MAFF	Ministry of Agriculture Fisheries and Food
MCA	Multi-criteria Analysis
NPLG	National Planning Liaison Group
OFWAT	Office of Water Services
RTPI	Royal Town Planning Institute
SERPLAN	South East Regional Planning Conference
STW	Sewage Treatment Works
PPG	Planning Policy Guidance Notes

EXECUTIVE SUMMARY

This R&D Technical Report draws together European experience on the integrated planning of land use and flood defence for river floodplains taking into account the conservation and enhancement of the riverside environment. Institutional arrangements for land use planning at a strategic level for flood plain management are examined, concentrating on issues that impact on or are impacted by flood defence policies. The state of available tools and procedures is reviewed with respect to flood plain and catchment management and source control. Where relevant, water quality issues are considered to reflect the overall integration of water and river management. Judgmental comments on the effectiveness of Best Management Practice (BMP) are reviewed based on examples from country case studies.

The research builds on an NRA R&D project (Tunstall, Parker and Kroll, 1994), which sought to define a strategic approach to land use planning and flood risk. The strategic recommendations contained in this report build on detailed work in the NRA project. Together both reports provide a full picture of the need for the Environment Agency to integrate land and water planning and to support this with appropriate research, liaison work and information dissemination to that effect.

Volume 1 of this R&D Technical Report contains the overview and recommendations from the study whilst Volume 2 contains more details of the country studies in France, Germany, Netherlands, Portugal and USA. A Project Record is also available which contains full details of the study together with progress reports and output from the Wallingford workshop.

Country studies were selected through Middlesex University's links with the European Union 'EUROFLOOD' project:

- In **the Netherlands** the National Environmental Plan demonstrates the advantages of combining the planning of the water environment with land use planning in achieving sustainable development. Case Studies were taken from the Rhine floodplain.
- In **France**, the Master Plan for Water Planning and Management (SDAGE) is a recent initiative which seeks to provide guidelines for a sustainable balance for the water environment within a framework of regional planning policy. Case studies in Bordeaux, Seine-Saint-Denis (Paris) and Vitrolles illustrate innovative source control methods.
- In **Portugal**, the emphasis is on centralised control with well co-ordinated flood defence policies. Case studies in metropolitan Lisbon and Setubal emphasise the importance of inter-agency co-ordination and public participation in decision-making.
- In **Germany**, the Vils River project in Bavaria and the integrated River Rhine project demonstrate the opportunities that exist to restore the storage capacity of the river corridors whilst simultaneously rehabilitating the ecosystems of those river corridors.
- In **England** the Cotswold Water Park, an area under great pressure both from

mineral extraction and leisure development, demonstrates a 'bottom up' approach to defining environmental carrying capacity. An "after-use" led strategy comprising three zones has been evolved as a basis for informing political debate.

- In addition to the European scene, storm water management strategies in the context of multi-purpose planning and development are reviewed in **The United States of America**.

In parallel with this research, and fundamental to its success, a Workshop was held to develop a consensus of Best Management Practice, and to help NRA (and now the Environment Agency) to identify areas where its own approaches could reasonably be improved. The workshop drew on the expertise of a wide range of participants, including representatives from the country case studies.

The R&D study has brought together a wealth of pertinent information from the country studies. Additionally, the Workshop generated a good consensus of opinion. The conclusions and key recommendations of the study are summarised in Section X. Its full value however can only be exploited when future Environment Agency working groups are able to focus on the many issues raised through this project. Overall the studies' message is to strengthen the present system of strategic land use planning, improve links with bodies such as the water utilities and make the best use of current legislation and the Best Working Practices identified.

Suggested Best Management Practice and key recommendations

Institutional Arrangements (see recommendations R19 to R26, pages 99/100)

- Support the concept of Statutory Regional Plans as one expression of regional government.
- Extend the scope of statutory plans to reflect the interests of the water environment.
- Develop and co-ordinate national Environment Agency policy to complement and reflect the content of Regional and Structure Plans.
- Maximise the effective use of existing legislation before seeking new powers.

Mechanisms, Procedures and Tools (see recommendations R50 to R55, page 100)

- Develop relevant indicators, and provide staff training on sustainability in land and water management.
- Seek specialist external consultation in public relations to advise on communicating with the public and nationally significant interest groups.
- Stress the importance of "vernacular" (intuitive) knowledge for its value in promoting "common sense" sustainability.
- Develop techniques for integrated land and water management through further research and development.

- Encourage the strengthening of the National Curriculum and further education with respect to environmental issues.

Land Use Plans - Statutory Plans and Catchment Management Plans
(see recommendations R27 to R30, pages 102/3)

- Develop and extend good communications with the public, local authorities and interest groups particularly from the development industry.
- Improve land use data base in order to take advantage of the above communications.
- Encourage local authorities to widen the scope of development plans to increase the policy content on the water environment.
- Develop strategic environmental appraisal and assessment tools for use in land use planning.
- Emphasise that land use/Local Environment Agency Plans (LEAPs) for sustainable development provides the opportunity to "cure" past mistakes and to prevent future problems.

Source Control (see Recommendations R31 to R39, pages 104/5)

- Develop a national integrated strategy for source control within a framework for surface water management.
- Clarify and resolve legal ambiguities to facilitate comprehensive surface water management and source control.
- Incorporate a surface water management framework within LEAPs, Development Plans and Strategic Plans.
- Integrate high (quantity) and low (quality) flow strategies, within surface water management plans in the context of the Urban Waste Water Planning Directive (EC Directive 91/271/EEC).
- Take into account future development pressures in long-term catchment change projections.
- Consider the effective use of economic incentives particularly "Guided Growth" policies.
- Develop a sustainable environmental strategy for source control.

Environmental Sustainability (see recommendations R1 to R18, pages 92/94 and R40 to

R45, pages 106/7)

- Ensure that Local Environment Agency Plans comply with environmental sustainability principles and are compatible with the statutory planning process.
- Co-ordinate Environment Agency policies across the full range of core functions and articulate them through the full range of avenues offered by the statutory planning machinery.
- Undertake Environmental Appraisals of all programmes, plans and policies.
- Adopt Environmental Assessment as the method for project development.
- Review surface water management and source control policies to ensure their environmental sustainability.
- Include "generic issues" with LEAPs (eg source control strategy, identification of environmental capacity, buffer zone needs).

It is noted that the definitive list of major recommendations for the Environment Agency is presented in Sections IX and X and Appendix I. Many other items of Best Management Practice are referred to throughout the report.

Implementation of Recommendations

These recommendations will be linked in the following way in order to allow the environment Agency to target its implementation plan:

- Recommendations for promoting Best Management Practice within the Environment Agency
- Recommendations to spread knowledge both inside and outside the Environment Agency
- Recommendations in connection with the Water Utilities and OFWAT
- Recommendations relating to possible re-structuring within the Environment Agency to improve cross-functional policy co-ordination
- Recommendations for further research into aspects of policy, legislation and practice
- Recommendation for improving links with the policy making institutions of the European Union
- Recommendations concerning input to the Environmental Agency
- Recommendations for special initiatives to be carried out by the Environment Agency.

These recommendations are incorporated into the Implementation Plan which has been produced for this report and submitted to NRA (now Environment Agency) management (1995): (see also Appendix 3)

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- Professor Dr-Ing Reinhard F Schmidtke: Bavarian State Water Management Authority (Bayerische Landesamt für Wasserwirtschaft). Germany
- Gilles Hubert: Centre for Research in National Resources and the Environment CERGRENE (Centre d'Enseignement et de Recherche pour la Gestion des Ressources Naturelles et de l'Environnement) Noisy-le-Grand, France
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- Professor Jan Wessels and his team at the Centre for Comparative Studies on River Basin Administration at the Delft Technical University, The Netherlands.
- Jill Millerchip MA of Thames Region, NRA for organising the Best Practice workshop in Wallingford in November 1993.

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KEY WORDS

Local Environment Agency Plans (Catchment Management Plans)

Environmental Sustainability

Source Control

Flood Plain Management

Institutional Framework

Land Use

EC Directives

Europe, France, The Netherlands, Germany, Portugal

USA

1. INTRODUCTION

1.1 Objectives

The overall objective of this R&D report as stated in the contract proposal is to "study experiences with integrated floodplain land use and flood defence, taking into account the conservation and enhancement of the riverside environment." Institutional arrangements for land use planning at a strategic level for floodplain management are outlined, concentrating on issues that impact or are impacted by flood defence policies. The state of available tools is reviewed, examining in greater depth those most pertinent to flood plain and catchment management and source control. Water quality and ground water issues (where relevant) will also be considered, to reflect the overall integration of water and river management. Judgmental comments on the effectiveness of best management practices are reviewed, based on examples taken from case studies.

Specific objectives are to:

- Study the level of unity in river basin administration with respect to flood defence, river environment conservation and enhancement, and land use planning.
- Study the response of water agencies to the impact of land use on the implementation of its functions.
- Study the relevance and possible contributions of developing EC law to the above practices.
- Identify best management practice from systems studied and make recommendations of use and applicability to the NRA¹/Environment Agency.

1.2 Conceptual Framework

The Project is to reflect forward planning rather than planning control with an emphasis on developing a Best Practice for **Strategic** (long term) planning and **Opportunistic** (best at the moment) planning.

Flood Plain management can be at the intersection of four main areas of management with corresponding administrative procedures and institutions. These four areas are briefly described as:

- Water resources planning, dealing with the management of the fluvial system, the construction of structural measures, the establishment of flood protection systems and the award of permits and licences for all water users;
- Land use planning, aiming at the implementation of national, regional and local planning

¹ References to the NRA will be left as such if they pertain to things that have happened before the formation of the Environment Agency, otherwise "NRA" will be updated to "Environment Agency".

tools and other measures for the administration of the territory;

- Environmental management, concerning aspects such as water quality or conservation of flora and fauna, with jurisdiction often loosely defined and split among several agencies and monitored by local, regional or national pressure groups;
- Civil protection and emergency planning as a specific area of intervention with its own organisation at national, regional and local levels.

In all these areas, with their respective administrations, flood plain and catchment management is here at the "core" of the concerns and duties and it is desirable that a very close relationship is established between these four areas of planning listed above. The ideal is the development of coincidental administrative boundaries with co-ordinated planning and catchment management. However, within existing administrative structures this is rarely practical. The Scottish and New Zealand authorities do, however, go some way towards creating this ideal planning system.

The land use planning system is influenced by both the physical characteristics of the riverine environment and the socio-economic activities within the catchment, river corridor and floodplain. The runoff characteristics of the catchment, the morphology of the watercourse and the vulnerability (social, economic and ecological) of the river corridor have an impact on or are impacted by land use planning. The potential pressures and conflicts that exist between the "players" at work in the strategic planning process within the control environment (economic, ecological, legal, administrative, etc.) provide the framework for Best (or Worst) Practice:

The Players

Environment Agency
Planning Authority
Developers
Residents/Occupiers
Anglers/Sports/Boaters
Farmers
General Public
Public Utilities

The Controls

Maintenance
Legislation/Zoning
Planning constraints/opportunities
Pressure Groups
Politicians
Charges/Subsidies/Incentives

No integrated or systematic approach to river and catchment planning, with concomitant Best Management Practice, will succeed without the full dissemination and discussion of factual material between all players affected by or affecting water management issues. During the country reviews and study tours there was no evidence that knowledge polarises opinion. Open management from the inception of a plan through to fruition is fundamental to success. Withholding information, misleading or deliberately misinforming is no part of the planning process. The following conflict/co-operation typology, adapted from American literature was found to be useful to understand the role of protagonist and antagonist in the planning and management process. Only by understanding the roles and motives of the players can resolutions to planning problems be resolved.

-Arbitrator..... (Statutory Authority)
- Allocator or
-Broker..... (Construction Authority)

-Advocate..... (Offensive Role)
- Activist or
-Guardian..... (Defensive Role)

Allocators tend to be agencies or government bodies; activists tend to be members of the public or pressure groups. Restrictive 'Cabals' within this framework result in conflict; open management and information exchange will enable co-operation and compromise.

Key issues creating potential pressures are:

- for the catchment
 - Source Control (quantity/quality)
 - Wet weather flow from STW's
 - Ground water contamination

- for the river channel
 - River training
 - Maintenance
 - Mineral extraction

- for the river corridor
 - Structural measures
 - Non-structural measures
 - Zoning/guided growth
 - Landfill
 - Wetland/riverine ecology

Strategic planning issues are reviewed within a selection of these key issues. For instance, taking source control as an example:

- Urban
 - Storm Water detention/retention
 - Use of permeable surfaces
 - Zoning
 - Economic incentives/charges

- Rural
 - Land use practices eg forestation
 - Agricultural planning
 - Control of erosion/sedimentation

The pervasive force in all current planning policies is the requirement for sustained and sustainable development and the retention and indeed expansion of 'natural capital'.

1.3 Potential Mechanisms Influencing and Controlling Best Management Practice

The simple matrix below was used as framework to contrast and compare Best (and Worst) Management Practice within each country study:

	Land Use Planning	Legislation	Economic Instruments	Special Programmes
River Management				
Floodplain Management				
Catchment Management				

Economic instruments relate to utility charging policies or incentive schemes such as 'set-aside' and forestry. Legal instruments reflect progressive implementation of statutory directives, regulations or orders at a local, regional, national or even International level (through European Community legislation). In some cases coaxing by pressure groups can be as powerful as legal powers where such powers do not exist. Again, public initiatives by individuals or authorities can be as effective as statutory planning measures:

Examples of potential mechanisms are:

- The Environment Agency sets prices for discharge/time conditions in negotiation with the utility/agency responsible for discharges to watercourses (or treatment works)
- Utility/agency passes charges to the land user/customer via connection charges or paved area formula
- Procedure is regulated by courts and/or consumer watchdogs for appeals and maintenance of fair charging policies
- Planning authority regulates development through land use zoning or creation of buffer zones
- The Environment Agency sets consent standards for quality and quantity which utilities and related water agencies respond to by setting Levels of Service standards
- The Environment Agency provides land users/utilities with incentives through soft loans, grants and tax advantages for controlling the impacts of runoff on flood defence strategies

- Managed strategies for managed retreat, extensification and set-aside, re-establishing or reverting to natural values

Clearly there will be mixed strategies and mixed levels of decision making in a completely integrated Master Plan. The application and interaction of each mechanism will promote or degrade the conservation of resources, for example, wetlands, water quality, and ensure or prohibit sustainable development. The key objective of any Best Practice policy is to meet the needs of sustainable development for the riverine environment in the context of developing UK and EC law and land use planning. Development of Best Practice in this Project is viewed in the context of creating economic efficiency, creating public safety, sustaining development and enhancing the environment.

Details of the Best/Worst Practice matrices by country are presented in full in the Project Record (Wallingford Workshop). Section X of this Report presents a synthesised overview of Best Practice recommendations as derived from these matrices and the country study reviews and case studies.

1.4 The Legal Framework

The legal basis or framework must be for administering, upholding and appealing against each control mechanism, with civil action procedures for negative consequences. The effectiveness of governmental or institutional structure has important repercussions on the effectiveness of declared Best Practice. The type of administrative hierarchy is crucial:

Vertical implies levels of government from state to municipality

Horizontal implies inter-governmental liaison geographically, that is along the river corridor or within the catchment

Functional implies agencies with a single functional objective, for example, water agency or highway agency.

1.5 The Country Studies

Land use planning information and its relationship to floodplain and catchment management was provided through study tours (The Netherlands and United States of America) or from information supplied by the European Partners (France, Portugal and Germany). These countries provided a good spread of geographical conditions, cultures and technical practices. Full country reports and literature reviewed during the course of this research are available in the project record.

1.5.1 The Netherlands (Figures 1 & 2)

The Netherlands is wholly dependent on the successful management of water; on dikes to prevent flooding and on drainage to maintain agriculture. The democratic systems set up to manage individual polders hence predates the municipal governments. A zero-risk philosophy predominates; the dikes must be managed effectively so that failure does not occur. The Netherlands is a strongly centralised state where water institutions, managed through the state controlled Rijkswaterstaat, have a powerful political influence.

Flood defence and disaster management take precedence over all else and groundwater quality is a vital consideration. Source control through surface detention/retention is given scant attention with land for agricultural use at a premium. National water management plans are periodically drawn up and are carefully co-ordinated to consider all public interests. The Dutch system /demonstrates the value of community involvement with environmental concerns becoming paramount.

The case study cited evaluates the innovative land and water management policies of the **Gelderse Poort in the River Rhine floodplain** and particularly considers the development and success of the Stork Plan and the creation of an ecological network along the Rhine.

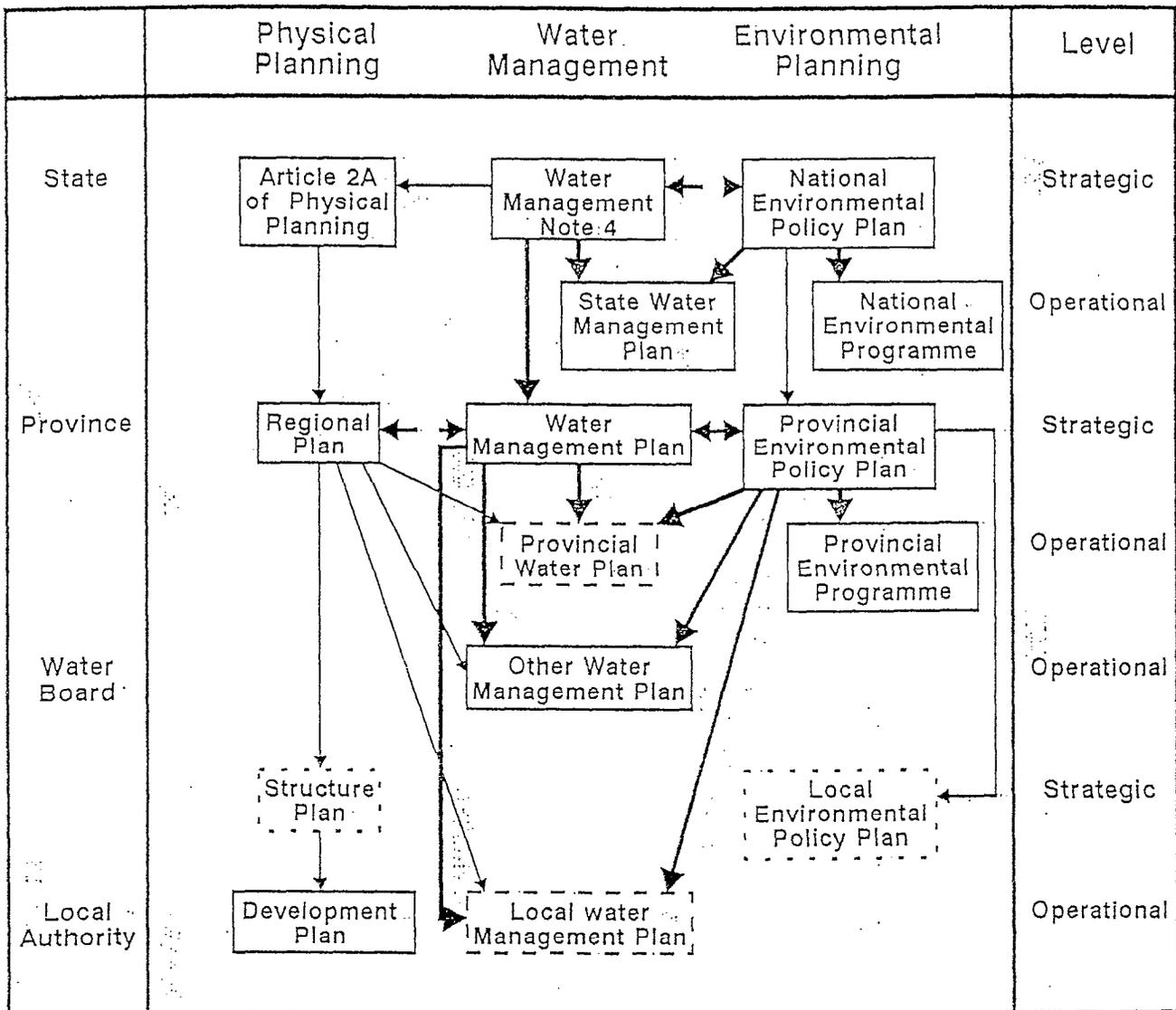
1.5.2 France (Figures 3a and 3b)

Historically France is a highly centralised state, but one where politicians maintain a local power base. Some power is being devolved to its 36,000 communes, many of which are so small they lack resources to implement these powers. New water and catchment planning laws and regulations could prove very powerful in the planning process but it is too early to monitor their effect. There is a strong move towards privatisation.

Recent changes have resulted in a degree of de-centralisation within what is essentially a centralised system of government. The level of consensus on planning issues is seen as a strength. However, the weaknesses are both the time taken to reach this consensus and the lack of confidence in the ability of the system to implement the plans. Advanced techniques of source control are being employed and tested.

The case studies cited include:

- **Seine-Saint-Denis north east of Paris:** A study of source control in an urban area at an inter-communal level;
- **Bordeaux:** A study of source control in an urban area using single and collective technical measures illustrating how a commune is implementing new water legislation; and
- **Vitrolles in south east France:** A study of the local application of a comprehensive storm drainage system integrated with urban landscaping.



SOURCE: SAMENHANG EN SAMENSPEL IN HET WATERBEHEER DELFTSE UNIVERSIAIRE PERS, 1988

Figure 1: Relationship between Physical Planning, Water and Environmental Planning in the Netherlands

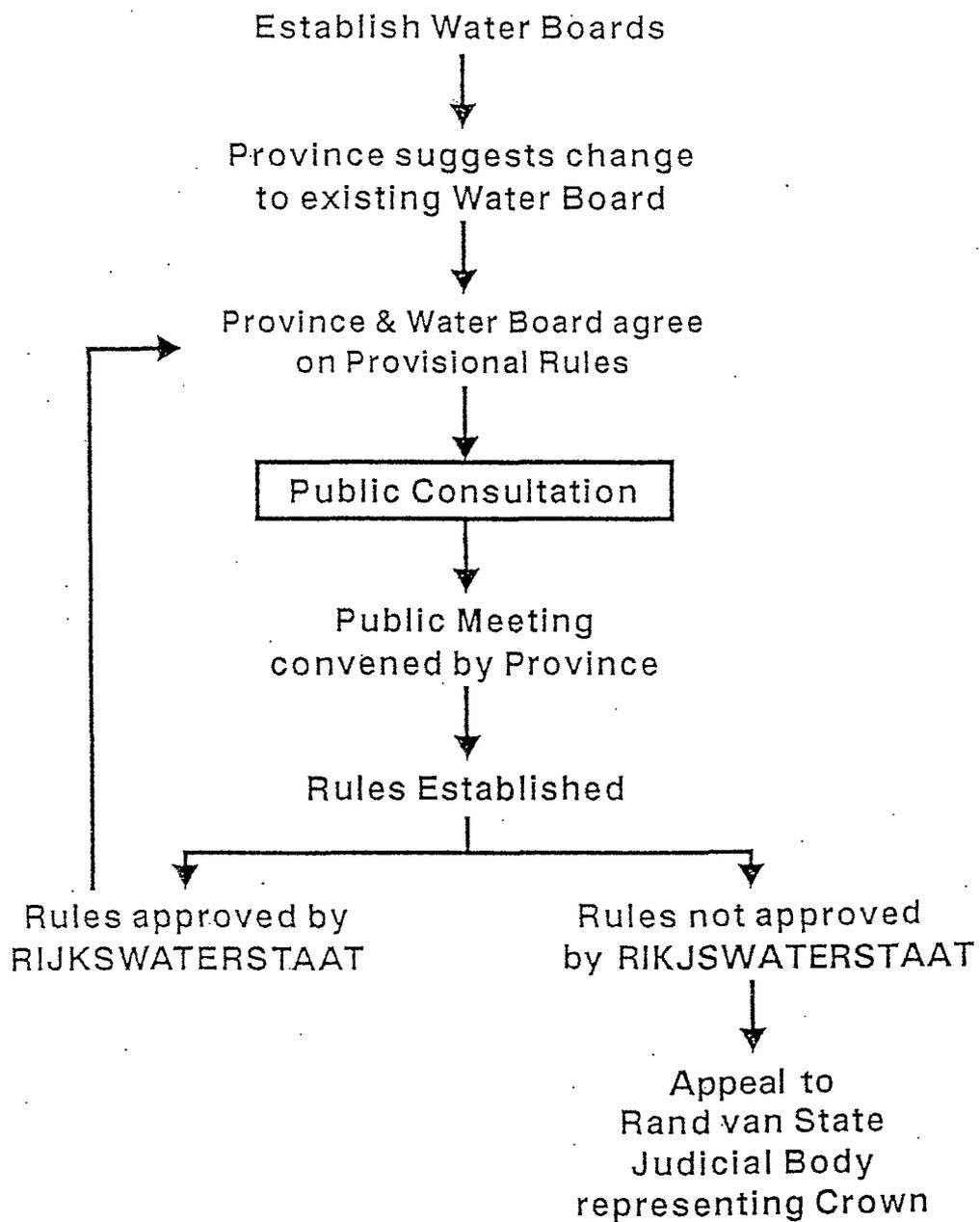


Figure 2: Vertical control of Water Management in the Netherlands

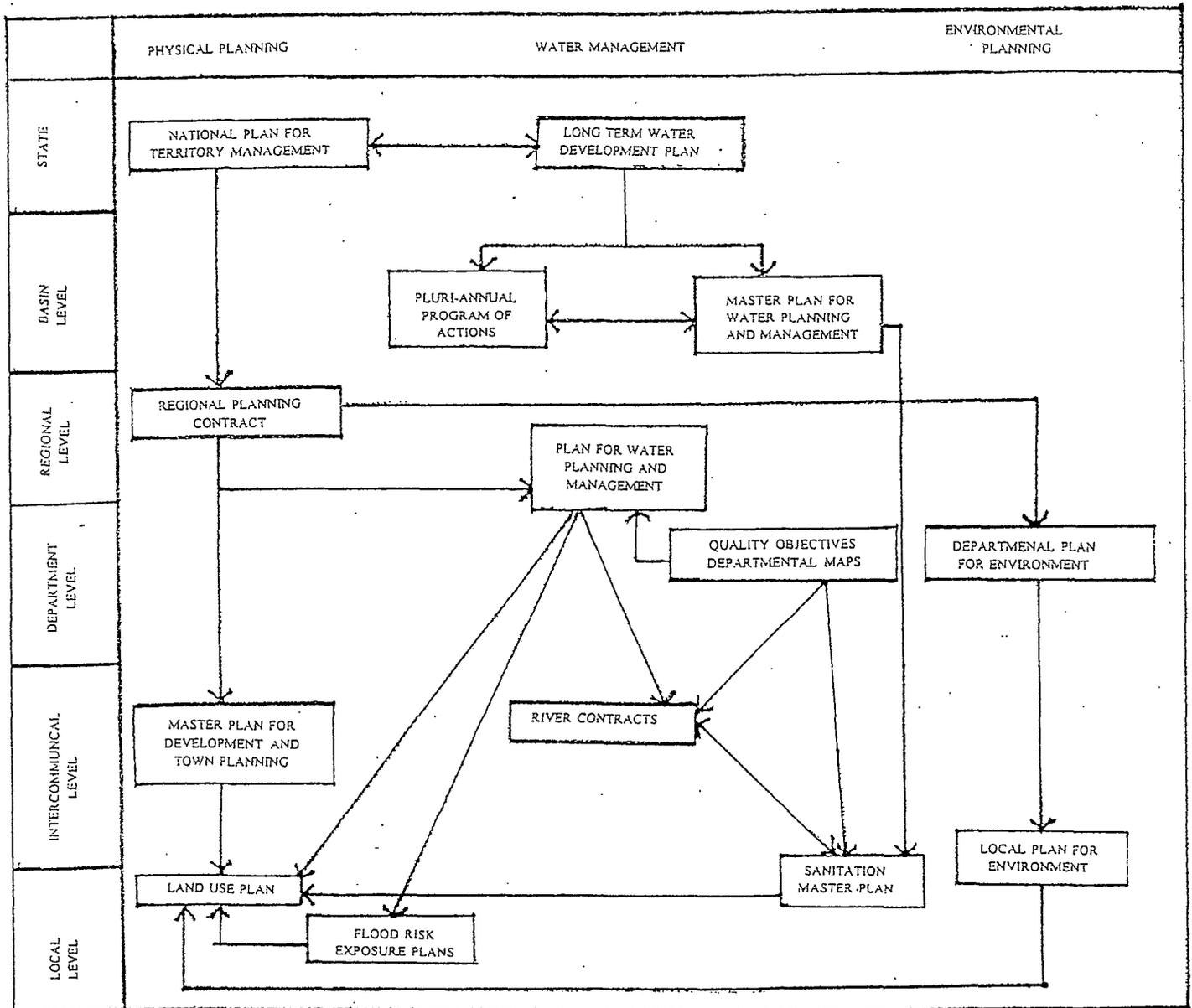


Figure 3b: Relationship between Physical Planning, Water and Environmental Planning in France

1.5.3 Portugal (Figure 4)

Portugal is a post-revolutionary state which has experienced economic growth and consequent urbanisation over the past 20 years without appropriate planning control systems. A significant amount of development is still undertaken without formal permission, with significant development in the flood plains. There is a major risk to life from flash floods. Until recently there has been little environmental concern, though National Ecological Reserves and CORINE biotopes (established in the framework of EC legislation) have recently been promoted. Currently new water laws are being implemented with a move towards a process of privatisation.

The system provides strong control and guidance coupled with good co-ordination. Recent changes have resulted in greater centralisation. Government departments exercise a high degree of control over plan preparation and a flood protection regime is being established. There is little attention given to source control.

Case Studies cited include:

- **Flood assessment and management of the flood risk in Metropolitan Lisbon:** This is a comprehensive multi-disciplinary approach involving meteorology, hydrology, hydraulic modelling, the study of sediment transport and vegetation cover in a land use framework. The emphasis has been directed to catchment land use plans and floodplain management using Geographical Information Systems technology.
- **River Restoration Project in Evora:** This project aims to restore and improve two tributaries and highly degraded and polluted watercourses in an urban area with high flow variation between dry and wet seasons.

1.5.4 Germany

Germany is a federal state in which the Lander have significant powers. Water, particularly rivers as communication routes, is a central concern; water institutions have consequently significant powers and authority. Germany is a constitutional democracy with strong constitutional and legal systems.

There is a complex four-level planning system, Lander, regions, districts and communities operating within a Federal water act. However there is concern about the strong lobby from minerals and agricultural interests which are more powerful than the planning framework. Decision making appears rather technocratic but there is a well-developed approach to flood plain management, source control, environmental impact assessment and river corridor management.

The effects of pollution, particularly pesticides in the water, is a matter of concern as is the accumulation of silts during flooding.

Case studies cited during the Workshop session include:

- **The Vils River Project, Bavaria:** This is part of a research programme directed by the Federal Ministry for Research and Technology. It illustrates the influence of land use

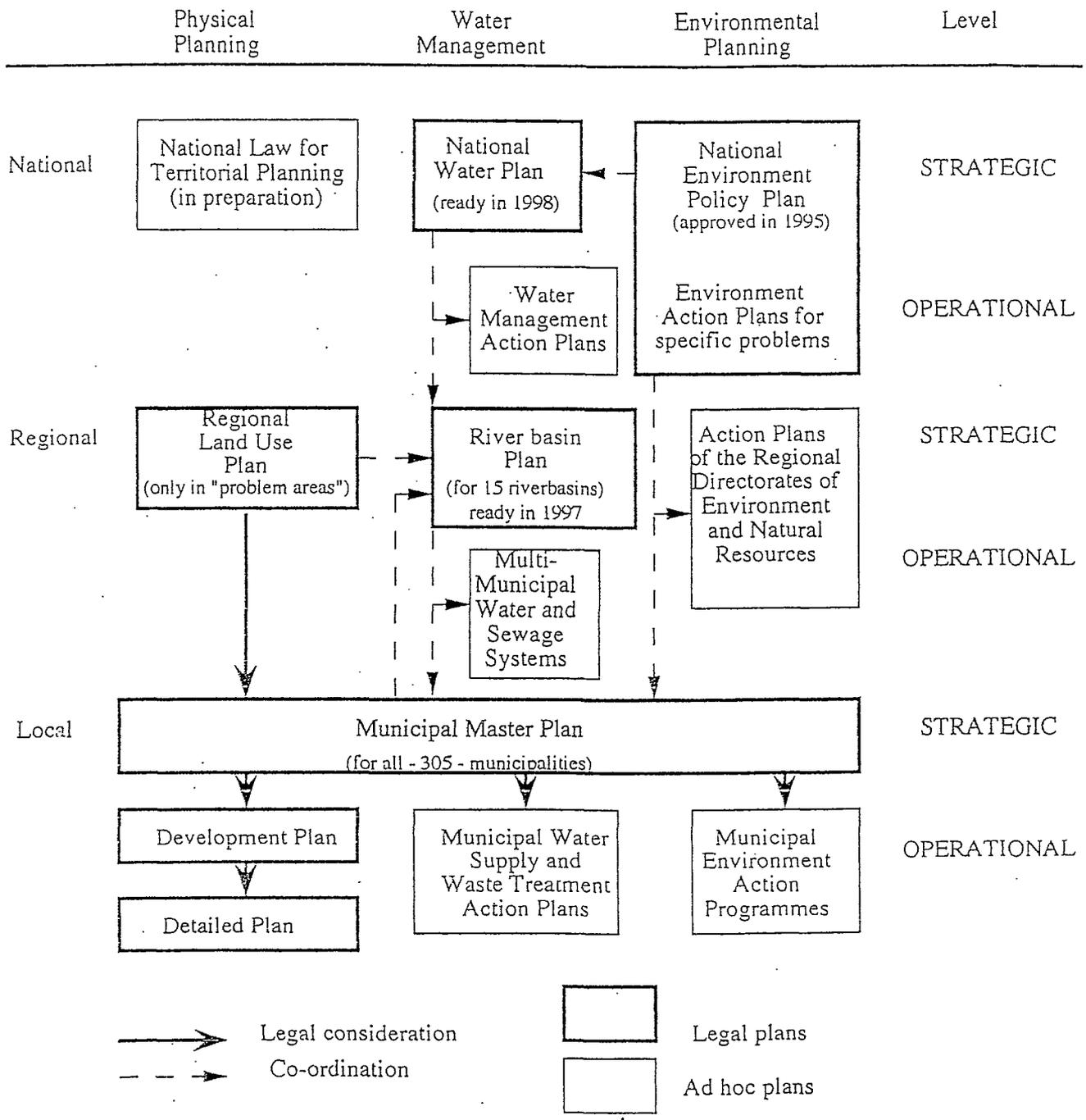


Figure 4: Relationship between Physical Planning, Water and Environmental Management in Portugal

planning on river management and the reduction of adverse environmental effects. It also illustrates the techniques required for catchment management plans.

- **The Integrated River Rhine Programme:** This multi-million Mark scheme provides for the restoration of detention/retention zones for flood alleviation and the rehabilitation of ecosystems in river corridors. Emphasis is placed on the multi-criteria decision support method developed to cope with the complex co-operation and co-ordination problems in the context of conflict potential.

1.5.5 The United States of America

In the USA a weak federal system prevails with major powers vested in the individual states which in some cases have been devolved and entrenched constitutionally to the local level. A highly fragmented local government structure below state level has evolved with multiple government structures. Consequently there is much emphasis on incentives to encourage action at the lower level of government and further emphasis on stakeholders in decisions and on conflict resolution and consensus building. The philosophy of 'manifest destiny'² and the legal power of the Bill of Rights give individuals a powerful mandate. Rights over natural resources are granted in perpetuity to individual land owners. There is a strong tradition of compensating flood victims through grants and soft loans somewhat modified by the Federal Flood Insurance Programme.

Water resource management in its widest sense has moved from single purpose objectives to a multi-functional approach. Comprehensive river basin management is still anathema to the American psyche, with the Tennessee Valley Project the only real planning triumph. Large scale Federal planning projects were regarded until recently as a form of creeping socialism. There are some very positive economic incentive schemes to guide growth away from critical areas and the National Pollutant Discharge Elimination System (NPDES) recently introduced is an innovative approach to regionalising source control. However, there is still widespread scope for corruption, not least in the operation of the Superfund programme to control and manage large scale pollution.

No specific case studies are cited though storm water management strategies in the context of multi-purpose planning and development are reviewed in some detail.

1.6 The Wallingford Workshop 15-16 November, 1993

A Workshop held at Castle Priory Conference Centre, Wallingford in November 1993 formed a crucial part of the project, drawing upon the expertise of a wide range of participants with a view to identifying aspects of best practice in land use planning that could be applied to the British situation. Representatives from France, Germany, Portugal, The Netherlands and

A jingoistic tenet dating back to 1845 holding that territorial expansion of the United States is not only inevitable but divinely ordained. The phrase was first used by John Louis O'Sullivan in an editorial supporting the annexation of Texas in the 'United States Magazine and Democratic Review' July - August 1845.

England presented case studies from these countries. Following workshop and plenary sessions a summary of "Best and Worst" Practice was identified, both in narrative and summarised in matrix form by topic area for each country.

1.6.1 Aim of the Workshop

The identified project objectives of the study were taken as the starting point:

- a) To review the UK land use planning scene and to explore the changing trends in European and US practice, the influence of changing legislation, and to identify and assess best practice in land use planning on the basis of the studies of the European partners.
- b) To make recommendations that will assist the Environment Agency improve its procedures and practices in relation to its prime partners in order to strengthen its influence upon the decision-making process.
- c) To provide an additional perspective for the National Rivers Authority's preparation for The Environment Agency.

Working Groups discussed and identified Best Practices in the selected countries. Further working groups, considered how these best practices could be applied to the UK in terms of the following specific topics:

- Institutional Arrangements,
- Mechanisms, Procedures and Tools,
- Land Use - Statutory Plans and CMPs (now LEAPs)
- Source Control, and
- Environmental Sustainability

The most important findings of each group are outlined below:

1.6.2 Group 1 - Institutional Arrangements

The conclusions fell into two categories:

- (a) Identification of examples of best and worst practice.
- (b) Changes to institutional arrangements that would enable the Environment Agency to operate more effectively.

Examples of Best and Worst Practice

- France** The system enabled a consensus on planning issues to be achieved. However, the weakness of the system is the time taken to reach the consensus.
- Portugal** The system provided strong central control and guidance coupled with good co-ordination. Possibly the UK ought to be heading in that direction.
- The Netherlands** The system demonstrated the value of community involvement.
- Germany** Exhibited a complex four-level planning system. It is remarkable that it works so well. There is, however, concern about strong lobbying from commercial and agricultural interests. The effects of pollution are a matter of concern particularly pesticides in the water.
- USA** There is perceived to be too much non-statutory guidance and excessive inducements to channel development away from critical areas. There was widespread scope for corruption driven by economic incentives.
- UK** There was a general but not universal view that regional planning should be statutory to rectify a weakness that better co-ordination was needed at a national level. Consensus planning at regional level was generally seen as a weakness although the SERPLAN³ representative saw this as a strength.

Changes to the UK system that might help the Environment Agency

The key points were:

- Strategic planning at the regional level should be mandatory.
- Poor policy co-ordination at a national level.
- Utilising the scope of Structure and Local Plans to reflect better the water dimension.
- There should be more scope for integrating Local Environment Agency Plans into the development plan system.

The discussion centred on whether a radical amalgamation of environmental agencies would benefit the Environment Agency. However, more sober counsel prevailed and the group

Perhaps - SERPLAN is not a typical example since it has the advantage of an independent secretariat and technical planning unit, which does give it a degree of objectivity which 'loose' organisations like other regional planning conferences do not always have.

concentrated on changes that would enable the Environment Agency to operate more effectively.

Since the privatisation of the water industry the quality of consultation was perceived to have declined. This was seen as an area to be addressed. The advent of The Environment Agency was seen as an opportunity to retrieve water supply and sewerage. There would then be one agency dealing with all aspects of the water industry. The Scottish model of local government was seen as one that might be emulated.

It was perceived that there was scope for the Environment Agency to be more proactive in influencing the existing planning system. Local Environment Agency Plans were seen as an opportunity to do this.

Furthermore there was scope to improve the links between organisations - particularly environmental agencies. The RTPi has pressed and will continue to press for the extension of the system of mandatory consultations for them to be two-way between the water industry and local planning authorities.

1.6.3 Group 2 - Mechanisms, Procedures and Tools

Mechanisms were identified as deliverables between the technical side of the water industry and public policy. The NRA has historically been more comfortable with its own permissive powers than with pursuing policy objectives through persuasions. The Cotswold Water Park methodology was seen to have contained advantages in highlighting policy issues. Multi criteria analysis was seen as helpful in the early stages of project planning but not helpful in presenting issues to the public.

1.6.4 Group 3 - Land Use - Strategy Plans and CMPs (now LEAPS)

In the UK the vacuum that exists between central and local levels means that there is no statutory regional plan. This leaves scope for the Environment Agency to develop its own regional overview. The Netherlands provides a model whereby they have seen the need to adopt a strategic view as a means of incorporating the local view and the equivalent interests of MAFF and Nature Conservation. Local Environment Agency Plans can bring these interests together as water was seen as a binding force for agriculture, conservation and forestry. However the vagaries of boundaries point to a need for flexibility. Thames Region is effectively one catchment and provides an overview of 14 counties. In contrast the County of Kent provides the overview of a range of relatively small catchments.

1.6.5 Group 4 - Source Control

In 1945 9.5% of UK land was urbanised. This has grown to 15% by 1992. In the UK technical advice on source control is only available in a few local planning authorities and the remainder tend to be hostile to the principle of source control. In France there is an element of partnership between the communes and the developer to ensure that source control is implemented. Technical help is provided to the developer.

The impact of individual developments is often not taken fully into account. The water utilities

should be encouraged to address problems and charge developers accordingly. Co-ordination between all the agencies must be integrated and a strategy of economic incentives must be devised.

1.6.6 Group 5 - Environmental Capacity

The challenge to the Environment Agency is seen as the sustainable and cost effective balance between the amount of water abstracted from rivers and underground sources and the amount retained to protect the environment and other Agency interests. The Agency's current approach to sustainability is to take advantage of the plan led nature of the planning system and to work through local authorities. Defining environmental capacity was seen as a partly scientific and partly political process. The Agency currently concentrates on ensuring that development does not take place within the floodplain and that the runoff from new development does not exacerbate existing problems. The group felt that better links with MAFF were desirable in order to secure more influence over agriculture and forestry in the interests of sustainability. The Agency should also be prepared to have a greater influence on Environmental Impact Assessments.

1.6.7 Summary Comments

These conclusions formed the foundation on which the Best Practice summaries presented in this R&D Technical Report were built.

Full transcripts and notes of the proceedings from the two day workshop can be found in the Delegate Summary of the Workshop (presented in the R&D Record).

Clearly, the limited amount of time at the Workshop produced results which may have done less than justice to the Country Studies, and laid the emphasis on some aspects at the expense of others.

It is strongly felt that

- a) The Workshop revealed the value of the information made available to the Environment Agency
- b) Working groups could ensure full discovery of that information, and also draw on information available from other sources (eg the Ontario hierarchical framework for surface water management, the emerging experience of the New Zealand Regional Councils, and the Australian approach to Total Catchment Management).

1.7 The Link with Previous NRA Research (Project 299 Planning and Flood Risk; A Strategic Approach for the NRA)

The research reported here builds on previous research by the NRA into the links between water and land use planning, specifically Project 299 (entitled, Planning and Flood Risk; A Strategic

Approach for the NRA as reported by Tunstall, Parker and Kroll (1994). That project sought to define a strategic approach for the NRA on the topic of planning and flood risk, and it contained a list of some 41 recommendations.

The link between these two projects is important, and in many ways Project 299 forms an extended case study for England and Wales which is similar to the case studies in other countries reported in this project.

Therefore the two research reports should be used together for their analysis of the need to integrate land and water planning. Thus, for example, many of the recommendations emanating from Project 299 take the form of suggestions for better liaison between water planning in the NRA and land use planning in local authority planning departments. Many of these recommendations have received attention from the NRA/Environment Agency since Project 299 reported (see the beginning of Section VII herein). However it is recognised that there is also still some way to go to see full implementation of the many ideas suggested there, particularly in the area of the documentation of policies and closer operational links with planning departments across England and Wales.

However the two research reports are different in their level of analysis and degree of prescription. Project 299's report contains many detailed recommendations for changing day to day procedures within the planning liaison systems that exists with the current institutional arrangements in England and Wales. The analysis and recommendations that follow herein are at a higher level, and are less detailed in their prescriptions, concerned as they are with the nature of these institutional arrangements, the need for source control to tackle land and water integration with a preventative policy stance, and the need for a sustainable policy framework and sustainable policies.

The reader of this report, therefore, should not look for detailed recommendations about day to day arrangements, but should look to Project 299 for these (while recognising that progress has been made since they were written). Instead the reader of this report should look for ideas as to how systems might be changed, policy emphases shifted, and the policy philosophy extended in more sustainable directions.

The two reports do, however, cross over in many fields. Thus our recommendations herein on the need for a national strategy build on recommendations in Project 299, as does our emphasis on the need for good enforcement systems, and full integration of land use development plans with CMPs (now LEAPs) and national guidance in this field. We are also building on the material in Project 299 in our statements herein on staff resources, staff development and training, and on the need for good flood plain mapping and research on techniques of public involvement in land and water integration.

In this way the strategic recommendations contained in this report build on detailed work in Project 299, and both reports add up to a full picture of the need for the Environment Agency to integrate land and water planning and undertake the necessary research, liaison work and information dissemination to that effect.

2. WATER MANAGEMENT IN THE NETHERLANDS

2.1 Dutch Best Practice in Land Use Planning

From a review of the institutional framework, land use regulations, administration and policy framework and the case studies outline, a summary of best practices is included. These are split into three separate areas: source control; catchment and river corridor planning; and floodplain development. Within each topic area elements of land use planning, legislation and economic instruments relevant to establishing best practices are highlighted.

2.2 Summary

- Water management is formulated and enforced through the governmental institutional framework (national, provincial, and municipal authorities) in conjunction with two critical super-state agencies; the Rijkswaterstaat and the water boards.
- The Rijkswaterstaat provides the direction for Dutch water management by formulating policy and means for enforcement through legislation at the national level. Twelve regional directorates execute policy and several specialist divisions (e.g. RIZA) advise in the policy-making process.
- Policy is initiated by national government which is composed of two levels of parliament: the first chamber which is elected by the people, and the second chamber which is elected by the provincial councils.
- The provincial councils in turn are responsible for the execution of nationally approved laws, and direct and interpret water law with regard to the water boards' activities. Provincial government therefore plays a supervisory role in water management while regulatory and financial aspects are under central government control.
- Water boards are decentralized functional forms of government and are geographically defined by natural and artificial drainage systems. Some are multi-functional, but not all, although the national government's push for functional consolidation has been the rationale for their reduction in recent years.
- Dutch water management is very progressive, seeking to redress the ecological balance of water, land, and natural values which have been knocked out of balance by the increasing pollution of water and land degradation over the past century of industrialization and population growth.
- The country's historic administrative and legislative tradition provides complicated but effective water management policy tools. The flexibility and tradition of using extra-governmental agencies to co-ordinate the execution of water management is most useful in the formulation of policies, whilst policy-planning and goal targeting has been effective in focusing on competing claims to natural resources.

- The increased flexibility towards land acquisition for restoration of natural water systems is important in moving towards a sound regional hydraulic network system of individual catchments. By maintaining the water table and the water quality and quantity of riverine influences, water management bodies can begin to re-establish a minimum ecological balance.
- Further liaison and trans-boundary agreements are needed to deal with shared catchment areas managed by vertically and horizontally fragmented institutional and political entities.

2.2.1 Source Control

- With regard to policy on source control it is recognised that catchments are dense and fully utilised with little room for flow storage or balancing.
- A transport study to improve the main branch of the Rhine for navigation suggested the construction of a reservoir to store and guarantee flow.
- Lack of space to develop such facilities made this option impractical.
- Source control is not currently high on the water management agenda. Some 400 million Guilder are being invested to improve storm drainage, but against logic it is suggested that detention effects have little effect on quantity control.

2.2.2 Catchment/River Corridor

- Effective land use planning has been achieved by allowing water management to reside in the public domain, although dictated by conscious political leadership.
- Vertical management of water and land use allows integrated planning and the operation of all best management practices at all government and functional levels. Formulation and execution of water management policies have thus moved towards greater integration of governmental, departmental and functional related agencies.
- This has led to an acknowledgement that the key to successful project acceptance is through strong independent project management committees with separate project groups. This results in alternative ideas being presented in similar ways, all of which have been tested on the same criteria.
- Integrated land use planning has created the opportunity for open forum and free dissemination of information at every stage of the decision making process. This has strengthened co-operation between water managers and other bodies, and separated the design from the decision making process.
- A worthy planning process has thus been developed by shunning vested interest, integrating technology and administrative innovation (for example the creation of Floodplain Boards) promoting non-conventional alternatives, and learning from past inadequacies in management.

- This process has been helped by the development of a system of impact assessment to relate all water impacts to land and environmental impacts, through Environmental Impact Assessment Agencies (EIA's) in newly created Special Protection Areas in accordance with European Commission Directives.
- The combined Ministry of Agriculture, Nature Management and Fisheries plays an important role in the land development process and is actively involved in landscape planning, re-naturalisation and nature development projects.
- Conservation objectives have also been included in municipal land use development plans by designating specific areas as 'farmland with natural values'. This has been helped by calling for an inventory of natural areas with grading and priorities between core and buffer zones (in accordance with Natura 2000).
- Optimal conditions are created for complete and well balanced biotic communities and sustained use by man in the illustrated trial projects; for example, the creation of fish corridors at weirs and the Gelderse Poort floodplain to reintroduce the Black Stork as an indicator of an undisturbed alluvial ecosystem.
- Legislative and administrative best practices are based on developing an integrated approach to water management embracing:
 - shore and bank design for multi-purpose conservation, restoration and development of the main ecological structures;
 - restoration of specific environmental types;
 - adapting and integrating legal, financial and administrative mechanisms;
 - establishing a broad social basis through education and economic incentives; and
 - understanding consumer use of various water functions and the conflicts between competing users.
- Best Practice has been successfully achieved by designating and distributing the tasks amongst government ministries, promoting close co-operation and consultation between these responsible ministries and allowing overlap between water boards and integration with the provincial administrative framework⁴.
- The provincial governments are responsible for the strategic planning of regional and local surface water, and formulating and defining the tasks of the water boards.
- Rationalisation of the water boards to bring quantity, quality and waterway management under a single control has helped promote integration.

All administrations have geographical and functional boundaries and there are some problems crossing these boundaries which require a collaborative response. An institutional culture is required that is not fixated with restrictive boundaries.

- The Water Management Act (1989) requires a National Policy Document every 4-8 years, so legislation is continually reviewed and updated. The National Policy Document (1991) set out target objectives for water management through a multi-track approach strategy forming the nucleus of an integrated water management policy with 4 tracks.
- Restructuring of water management legislation has included development control within water law and decided that the procedure for establishing or changing jurisdiction of a water board must combine public and state involvement. (see Section I, Figure 2).
- Included in water management legislation is the designation of far-reaching supervisory and statutory powers to enforce instruments of water legislation under a combination of administrative, criminal and private law.
- Economic Instruments that can be used for water management adopt the view that the 'polluter pays', taking the form of a tax scale for organic and heavy metal waste.

2.2.3 Floodplain Development

- Land use planning in the floodplain takes on a similar role to that in the catchment although relates primarily to controlling storm surges.
- Protecting the country against tidal storm surges according to national safety standards has always been the primary aim of water management. This has been done by developing a fully integrated disaster plan should dikes fail, with well tested warning response procedures, continually improving flood forecasting for tidal surges and fluvial flooding, and linking warning systems to media networks separate from the public system. (See Chatterton, 1993, Review of Flood Forecasting and Warning Response Systems for the Netherlands as part of the Euroflood component of EPOCH - European Programme on Climatic Hazards).
- Integration of development control with environmental impact assessment has resulted in a move away from the physical mechanisms (ie flood control) to a multi-objective evaluation of biological and ecological goals.
- Recognising that the biological aspects of floodplains support regulatory functions assisting with water purification, regulation of groundwater levels and sustaining the genetic pool of diversity has become an important issue.
- The best practice policy for hydraulic design and water restoration includes;
 - maintenance of natural banks;
 - banning herbicides and insecticides;
 - increasing biological methods of maintenance;
 - developing environmentally friendly shore protection;
 - developing an inter-governmental action plan;

- developing management partnerships between responsible ministries, provinces, owners, and managers;
- moving towards less intensive land use in floodplains;
- pursuing salt water marsh conservation;
- introducing and repairing fish corridors;
- providing corridors for animals;
- restoration of fish mating, sheltering and growing places;
- creating zones where fishing, hunting and shipping are excluded; and
- emphasising the value of flood waters as a sustainable source of groundwater.
- Best practice policy for guided use within the floodplain includes:
 - safety;
 - maintaining the river's function of discharging water;
 - maintaining the storage function of rivers;
 - accelerating the removal of pollutants to sea;
 - supporting the strengths of the soil;
 - improving drainage;
 - being aware of dehydration sensitive areas; and
 - recognising that re-naturalisation of floodplains seeks to develop basic components of the river system (alluvial forests, open water, marshes and grass vegetation).
- Legislation and jurisdiction relating specifically to the floodplains includes:
 - forming by-laws ('Keur') for water board operational management in compliance with provincial general rules,
 - issuance of a technical register ('Legger') at provincial discretion for upholding maintenance standards,
 - provision in the water board by-laws for regular on-site maintenance checks for all watercourses.

Forming the state contribution regulation for the construction and maintenance of dikes has provided an important way forward and strictly defines floodplains into summer and winter beds to effect changes including permits for land use change.

- Gravel winning and land reclamation is forbidden in winter beds.
- Delineation of a much wider zone along river corridors, maintaining higher water tables, wider bank zones and restricting farming activities has had important implications for nature conservation.
- Economic instruments for use within floodplains have introduced effective mechanisms to protect flood plain development:
 - reducing price support for arable production;
 - encouraging set aside with appropriate compensation; and
 - withdrawal of field drainage programmes.

Financing the cost of water management will be done through target groups which varies for individual projects. Compensation for property damage is decided by local judiciary.

3. RIVER MANAGEMENT IN FRANCE

3.1 Guidelines for Best Management Practices

3.1.1 Flood Control

- **Flood Control Procedures Set up by the State**

- **Plans for Flood Prone Areas (PSS)**

The PSS is an old procedure dating from the Law of 30th October 1935. It has no direct link with the town planning matters in flood prone zones. It is not considered by the Ministry of the Environment (Major Risks Delegation) as a risk management procedure. The PSS is a cumbersome procedure and does not fit in well with the spirit of de-centralization desired by the State. The PSS considers two main types of zones but does not give any precise information on quantitative criteria to delimitate the zones (in terms of water level and velocity).

- **Risk perimeter (PR)**

PR is directly related to town planning in flood prone areas. This procedure is easier to set up at a local level than the PSS. It is initiated by the Departmental Prefect and is dealt with by the State's Departmental bodies (DDE mainly or the Navigation Services). It is only applied to new town planning and is unable to impose constraints on the existing housing. The risk perimeter is independent of communal borders and this is a determining factor for its success.

- **Risk Exposure Plan (PER)**

This is the most recent tool (Law of 13th July 1982) and it is also the most sophisticated, but the system is cumbersome to set up (two years on average between the specification of a PER and its approval). It is managed at a departmental level. It is of interest for two reasons:

- a) it is applied to both present and future town planning projects;
- b) it establishes a relation between compliance with the specifications laid down in the PER and the reimbursement for damage by insurers in the case of a natural catastrophe.

- **Procedure Selection**

In principle, these procedures are applied to State rivers as well as to non-State rivers. The PSS is essentially applied to large watercourses but infrequently used (1 PSS per year on average) with PER more generally applied since 1982. The 1991 Water Law precludes the requirement for a PSS. However, the reticence of local authorities often leads to the abandonment of the PER with a preference for PR. Because of its cumbersome nature, the PER is now reserved to sectors where the risks are the greatest. Because of the time required to develop a PER, the State is sometimes obliged to take emergency, temporary measures so

as not to compromise the interest of the future PER. The Departmental Prefect will draw up a Public Utility Project (PIG) as a temporary expedient to stop all local activities likely to aggravate the risk.

- Respect of the Specifications and Procedure Control

Since de-centralisation, the constraints imposed by the State for controlling the use of flood prone areas have been very badly received by local elected representatives and development often proceeds regardless with a lack of control and an absence of monitoring by the State. Insurance companies again pay little regard to the PER's.

• Flood Control Procedures set up by Local Collectives

There is an obligation for PER's (Risk Exposure Plans), where accomplished, to be recorded in local town planning documents (i.e. POS Land Use Plan and ZAC Concerted Planning Zones). However, the lack of compatibility between legislative and regulatory measures relating to land use and those relating to flood risks is emphasised. The POS can classify zones where construction is not allowed on the floodplain or suggest construction constraints, but these measures are rarely taken.

• Current Developments

- Risk information

The law of 22nd July 1987 relating to the organization of civilian security, since its application in October 1990, establishes the right to information for those persons likely to be exposed to risk. It contributes to the reinforcement of the responsibility of local decision makers (mayors) and the public's level of consciousness towards risks.

- Financing the Procedure

- a) PSS, PR and PER procedures are grossly under financed. Priorities are determined by the size of the risk, actual events and local pressure.
- b) The State would like local collectives to make a financial contribution for the studies to be carried out.

- Comments on a New Type of Procedure

In 1992/93, a working group composed of representatives from the Ministry of Equipment (Town Planning and Development Directorate) and of the Ministry of the Environment (Major Risks Delegation) was set up to review new requirements for the right to information, financial contributions and the division of responsibilities between the State and local collectives. The elements of this new procedure are presented below:

- a) The State continues to be responsible for collection of information on historic floods. The results of these preliminary studies must constitute a tool for dialogue between the State

and local collectives.

- b) For watercourses with low flood risk, the State informs the commune of simplified risk maps or maps of events. It is then the collective's task to carrying out the necessary complementary studies (hydraulic studies, vulnerability studies, etc.) and to determine that its development projects do not aggravate the risk.
- c) In the case of the most vulnerable watercourses, the State carries out complementary studies and pursues these studies further so as to establish a PR or a PER, the PER being reserved for cases where the risks are the greatest for existing structures.

- **Development of Information and Training**

The legal arsenal available is judged as being satisfactory overall. The problems that are met (non-observance of regulations, lack of means to carry out a verification and monitoring) are linked to the low level of consciousness of the risk. Information and education on management of the risk are therefore a priority.

- **Inventory of Risk Management Studies (September 1993 - source DRM)**

- a) Preliminary studies: 230 (presently underway)
- b) Risk Exposure Plans: 707 PER drawn up, 376 made public, 282 approved
- c) Risk perimeter: 701 under study, 447 approved

3.1.2 Source Control

• **Procedure Set up by the State:**

- Among the procedures set up the State to exert control of runoff at a local level there are Public Utility Projects (PIG) which are required of communes and groups of communes as easements. The PIG offers the Prefect the possibility of instructing a commune or a group of communes to modify a Master Plan or a Land Use Plan, or even to develop another.

- The field of the projects likely to be labelled of general interest is necessarily vast. It can cover:

- a) the construction of a development project;
- b) the protection of natural heritage;
- c) the enhancement of natural resources;
- d) the prevention of risks.

- The Seine-Saint-Denis case study is a good example of the application of PIG.

- **Procedures set up by Local Collectives**
- **The Role of Town Planning Documents**

The attitude of commune representatives to PIG's varies according to their perception of the runoff problem. The present trend, which holds local collectives responsible in the case of damage or malfunction of the sewer networks, leads mayors to seek solutions to ensure a better management of storm water runoff.

Town planning documents will usually integrate storm water drainage provision within:

- a) provisional town planning (Master Plan and Land Use Plan);
- b) operational town planning, Concerted Planning Zones (ZAC's), housing estates or developments, building permits.

- **The Master Plan for Equipment and Town Planning (SDAU)** is a planning document which lays down the guide lines for urban development for a 20 to 25 years time horizon. It provides a reference framework for the major development decisions. It must ensure the integration of large inter-communal collectors, sewage treatment plants, and inter-communal detention basins. However, at a local level only general planning issues, such as transport infrastructure projects and urban development in the overall context of preservation of the natural environment are known to local elected representatives. Local interest in controlling runoff is therefore limited. In the years to come, with the development of the SAGE procedure (Schéma d'Aménagement et de Gestion des Eaux: Master Plan for Development and Water Management) its role in the field could be increased.

- **Land Use Plans (POS)** at a communal level set out the general rules of the land use. A POS dossier includes the following:

- a) the presentation report;
- b) the regulations;
- c) graphic documents; and
- d) appendices.

The presentation report defines the chosen development objectives and town planning measures. It must provide analysis of the impacts of future town planning on the environment. It must take into account the problems posed by communal development on neighbouring communes. For these two reasons, it must in principle refer to storm water drainage. In certain cases a description of the storm water drainage is added to the presentation report.

POS regulations define for each zone the right to occupy and use land. It includes around fifteen articles, some of which are obligatory (concerning the type of land occupation and use which is authorised or prohibited, the installation of town planning operations in relation to thoroughfares and property boundaries) and some of which are optional. Articles 4 and 13 are relevant to storm water drainage:

- a) **Article 4** concerns the utility infrastructure (electricity, gas, water, sewage) through which specifications on the sanitation method to be favoured and easements can be established.
- b) **Article 13** concerns the open spaces of the POS, the plantations and the wooded areas. It is also used to establish specifications so as to limit the impermeability of land, for example, obliging the developers to create green spaces proportional to the surfaces drained (that is, the surfaces rendered impermeable by proposed development).

Graphic Documents display two types of information:

- a) information directly concerning the POS, the zoning selected, the reserved sites, listed wooded areas, etc.
- b) information outside of the POS: the easements of public utility such as the sites reserved for the construction of public facilities, whose interest goes beyond the local level, (roads, railways, electricity lines) with flood prone zones being the subject of a special procedure (PER, PR, PSS) or of a PIG.

The choice of zoning is a determinant factor for the setting up of an efficient control policy for storm water runoff. The graphic document displays two main categories of zones, so called urban zones (U zones) and so called natural zones (N-zones):

- a) The U zones (already developed or immediately developable) are those for which the capacity of sanitation facilities (among others) already in place or planned allows rapid construction. The mayor cannot refuse to grant a building permit in a U zone because of lack of sanitation facilities.
- b) The N zones are divided up into different categories; future development zones (NA), partially equipped and already partly built zones (NB), zones of natural interest (NC), protected zones (ND). In NA and NB zones the developers generally pay for additional facilities including, as appropriate, alternative techniques (eg retention basins, dry basins).

The appendices of the dossier (also called Sanitation Appendices) contain plans and technical notes concerning:

- a) the existing (and proposed) water and sewer networks
- b) waste disposal measures.

The sanitation document is an integral part of town planning documentation but is often badly written, too brief to contribute useful information and sometimes it is even absent. When it

is conscientiously put together, it is used to put forward an overall sanitation plan and to describe the general characteristics of the chosen options (for example the sites reserved for the construction of storm water storage and treatment facilities). It is also used to propose new technical solutions for storm water drainage.

- **The Concerted Planning Zone (ZAC)** is a procedure which allows a local collective to build dwellings, shops, services and activities. It can be drawn up in the U zones and NA zones of the POS. It can be the object of a specific plan, the Zone Development Plan (PAZ) which includes a presentation report, a zoning, regulations and technical appendices. It replaces the POS whilst remaining in conformity with it. Environmental Impact Analysis is part of the ZAC procedure and alternative storm water balancing facilities are considered through technical co-operation between the collectives and developer.

- **Building Permits (PC's)**

The granting of a building permit by the local collective is dependent on:

- a) limiting storm water runoff (provision of a retention basin per plot or a dry basin/re-infiltration for storm water on site); and
- b) for limiting damage linked to storm water flooding (provision of a one-way valve on the evacuation system of domestic waste water, so as to avoid flooding of cellars when the collective network system is heavily loaded).

- **Optional Procedures**

There are two complementary procedures which act as a reference framework for local activities in the field of sanitation. They are:

- a) the Sanitation Master Plans;
- b) the Sanitation Regulations.

The Sanitation Master Plan (generally defined at an inter-communal level) aims at drawing an outline of the medium term activities for sanitation (5 years on average). It is used especially to programme expenditure.

Sanitation Regulations (defined at a communal or inter-communal level) are used to lay down the conditions to which connections and discharge in the sewer works (communal or inter-communal) are subjected.

These two procedures are optional. They are recommended by the State's central bodies (Ministry of Equipment, Ministry of the Interior), but the decision to use them is taken by local collectives themselves. They are the vector of expression of the local political will in the field of sanitation. As they require a good knowledge of the overall operation of the sewer system, these procedures are generally used by big towns and/or groups of communes (inter-communal syndicates, districts, urban communities) which have a large sewer system. They have both a political and technical objective.

In some cases, these procedures also have a role of raising consciousness through publicity brochures to both the public and developers.

- **Remarks on Strategy**

- The development of town planning documents such as POS and PAZ is left to the initiative of the mayor who presides over a working group. In many cases the bodies in charge of sanitation are absent from the working group. However, this practice is gradually changing, town planners and hydrologists finding themselves together in the same working group.

- Dossiers for building permits are in principle monitored by officers in charge of town planning but are more and more frequently transmitted for opinion to sanitation bodies. Unfortunately they have no means of verifying if their opinion is considered.

- It is fundamental that organised partnerships between local collectives, sanitation managers and technicians, developers and the public are formed and relationships nurtured. These partnerships are vital to ensure mutual understanding between the planners stages and developers. The developers or those who provide their services are not necessarily in the habit of building the specific facilities required by regulatory constraints. This is why some local collectives are seeking to set up standardised technical information procedures. As an example, the Water Directorate of the Urban Community of Lyons is seeking at the present time to deal directly with prime contractors to standardise improvement procedures for some specialised facilities (eg flow limiters, hydro-carbon separators, etc). The execution and the diffusion of technical guides used to transmit practical information is nowadays necessary.

- The Water Law of 3rd January 1992 has reinforced the obligations of local collectives in the field of sanitation. These new obligations meet the measures of the European directive of 21st May 1991. Relations between town planning and water management are henceforth explicitly recognised at the level of Master Plans and Land Use Plans.

- The law requires communes to define the limits of sanitation zones which must then be recorded in POS's. The system is based on the two-fold definition of limits between the collective sanitation zones and autonomous sanitation zones:

- a) in the collective sanitation zones, the commune shall have to ensure the discharge of waste water, the storage, the treatment and the release (or even the reuse) of collected waters; and

- b) in autonomous sanitation zones, the commune shall have to ensure the control of sanitation facilities (to protect public health) and if it wishes to do so, maintain them.

The system is completed by the definition of the limits of two other zones where some special measures shall have to be taken:

- a) zones where measures to limit the impermeability of land, to ensure the control of flow

and the flow of storm water shall have to be taken; and

- b) zones where it shall be necessary to plan installations to ensure the collection, the possible storage and the treatment of storm water.

3.2 Summary

- The French system is very well organised in that numerous mechanisms exist to control the problem of flooding.
- It is stressed that in the case of flood control policy, it is important to choose the procedure according to the local stakes and risks and to enforce temporary measures where procedures are used that require long delays.
- Procedures that are set up by the local collectives enhance the compatibility between legislative and regulatory measures relating to land use and those relating to flood risks.
- The relationships between flood control and water management and between flood control procedures and flood relief measures are recognised.
- There is also emphasis on the development of public information and training and sharing the community financing.
- Runoff control policy is limited in that there is only one procedure, the PIG, which operates at a local level.
- The regulatory approach is usual for large towns and it is recommended that the land acquisition approach is used for small towns to control runoff.
- It is preferable to have management of sanitation at an inter-communal level.

4. LAND USE PLANNING AND FLOOD PLAIN MANAGEMENT IN PORTUGAL

4.1 Guidelines for Best Practice in Floodplain Management

- Floodplain management programmes must be situated in the broader context of integrated catchment land use planning.
- Planning for flood mitigation requires a mix of technical, social, economic and environmental considerations. There is a need to take into account multi-dimensional problems, multi-disciplinary solutions, a wide range of tools and a complex and multi-directional (vertical and horizontal) institutional framework.
- A wise combination of structural and non-structural approaches for floodplain management should reflect the local context and technical and social conditions.
- Environmental concerns should be combined with floodplain management at different stages:
 - comprehensive land use planning and resource management in the catchment,
 - protection of natural and cultural values of floodplains and rivers, and
 - consideration of environmental impacts of structural and non-structural measures.
- Flood frequency analysis and hydraulic modelling are essential tools for the definition of areas subject to inundation and for the evaluation of flood risk.
- Local level context and responses are key factors for a proactive management process.
- The interface with the public plays an important role in floodplain management: Understanding of public perception and attitudes with respect to flood hazard are an essential means understanding how the public copes with those events, and influence the planning for relief, emergency and recovery measures.
- GIS is a useful and powerful tool not only for floodplain management, but also for facilitating the dialogue with decision makers, interest groups and the public in general.

4.2 Conclusions and Recommendations

- The studies have shown that for effective management of floods in the Metropolitan area of Lisbon it is important to have good collaboration with the central and local governments. This will enable plans to be effected with maximum efficiency.
- There is an ongoing need for more studies on hydrology and other physical aspects of flooding and there is a need for the groups that are working together to combine their research.

- The public should be encouraged to become involved by being invited to attend meetings. The provision of leaflets and invitations to public meetings should be encouraged through the media.
- Conservation and restoration of ecosystems as a general principle is also very important and should not be restricted only to areas of high ecological value.
- Introducing the concept of the National Ecological Reserve is a progressive aspect of land use planning because it relies on ecological consideration and sensitivity protection. It may also provide a significant contribution for the achievement of environmental sustainability.
- There is a distinct need for the updating of information regarding Environmental Impact Assessments and their significant and direct impacts. There is also a need to establish relationships between the trans-boundary river environment and its impact on coastal state water quality.
- Consideration should also be given to European Community legislation with Portuguese authorities encouraged to evaluate which habitats are in need of protection. Ecological standards are required that will seriously restrict local authorities in any deleterious land use decisions. The main problem is that monitoring of such standards is expected to be a major task.
- There should be more liaison with other countries regarding studies that are carried out and it is recommended that a Commission of Experts is set up between the countries in the EC. This will allow ideas to be exchanged and the possibilities of programmes implemented that have been successful in other countries.
- There also needs to be closer liaison with EC regarding practices that are carried out with guidelines as to how to implement new practices. It is also recommended that the EC offer incentives to land owners who might lose money as a result of changes in agricultural practices because of the need to reduce erosion.
- There should also be closer monitoring of pollution levels and programmes to encourage vegetation cover, including afforestation, on land that is "at risk". Landowners should be given guidance on these issues.

5. GERMAN CONTRIBUTION

5.1 Summary of Best Practice

5.1.1 Main Requirements of Water Resources Management

- Improving decentralized retention of precipitation water in the catchment by avoiding, or compensating for, the effects of sealing through settlements and traffic routes and of soil packing through intensive agricultural activities results in a deceleration of runoff; a reduction in peak flows and in an increase in groundwater recharge and low flows.
- For reasons of health protection and in order to protect the aquatic environment, harmful substances are to be kept away from all waters as far as possible.
- Over-fertilization of water bodies through the input of nitrogen and phosphorus from agriculture (topsoil runoff, interflow, groundwater path), industry, trade and households has to be avoided.
- Soil erosion is to be reduced to a minimum, as sediments and the adsorbed contaminants cause quantitative and qualitative adverse effects.

5.1.2 Special Requirements for Floodplain Management

- Rivers and their floodplains are to be considered as ecological units. This calls for an integrated river corridor management.
- Further structural flood alleviation measures should be restricted to settlements and technical infrastructure (avoiding downstream increases of flooding damage).
- Floodplain development is to be managed in a way that balances land use with the natural risk of flooding, so minimizing future flood damage, and gives equality to nature enhancement objectives.
- Grassland in more frequent inundated areas should be protected by special programmes, ploughing up of these lands prohibited, the establishment of alluvial forests and conservation of land bordering water bodies promoted.
- Extensification programmes should be used to convert agricultural land into grassland.

5.1.3 Methodological Aspects in Strategic Land Use Planning

- Best practice in strategic land use planning is to seek to minimize the conflicting interests between national development, environmental quality, regional development and social well-

being in a way that meets the overall objective of sustainability. Water resources policies have to be established in this context.

- There is a hierarchy of 3 levels for finding out which type of strategy can be called "best practice" for each land use category and its intensity: avoiding of adverse effects, compensating or tolerating them. Practical solutions very often result in a strategy mix.
- Strategic land use planning has a complex interface to the quantitative as well as to the qualitative components of water resources management. A rational analysis has to take as a starting-point the whole pattern of objectives involved in such a planning investigation. Using this basis it is possible to identify all the pros and cons of different land use activities and to quantify and evaluate them. Such a broad platform of information is needed to derive best practice strategies.
- The instruments and tools for implementing and executing best practice strategies, again, have to be selected in a rational way. Legislative activities may result in ordinances and regulations, grant programmes, technical instructions, programmes for economic incentives, education and improving public awareness or voluntary self-control/self-commitment. In addition, institutional and administrative cooperation has to be re-examined in its vertical and horizontal links with the possible result of indicating more efficiency by re-organization. In Germany there is a shift to a greater concentration of tasks at the level of lower authorities.
- Best development and management decisions on the operational level can only be obtained by taking into account the site-specific conditions. Therefore, strategic instruments have to be restricted on requirements, which are to be met everywhere (e.g. uniform emission standards). This is a very important aspect of the requirement to avoid over-regulation, and which means implementing second best solutions. In addition, strategic instruments have to provide the possibility for more far-reaching requirements in the individual case. For this purpose adequate planning procedures and tools are needed.

5.1.4 Best Practice in Source Control

- EC Programmes are used to encourage extensification of agricultural land by reducing grass cutting. Farmers receive compensation as part of these programmes.
- Systematic field drainage has now been stopped and farmers no longer receive grants.
- Where environmental compensation works are not feasible or possible then a tax payment can be taken from the developer to fund works to enhance the environment at another location.
- Special administrative courts can consider conflicts if water agencies, planners and developers do not agree. Negative and cumulative effects are considered important.
- Urban Waste Water Directives are executed in Germany. Uniform emission standards apply throughout Germany, but can be legally uprated by steps to comply with specific source control requirements.

6. WATER MANAGEMENT PRACTICES IN THE USA

6.1 Summary of USA Best Practice in Land Use Planning

- Decision making is fragmented three ways: **vertical, horizontal and functional**.
- **Vertical** fragmentation involves discontinuity amongst hierarchical levels of authority from Federal to state to local levels;
 - **Horizontal** involves conflict amongst the agencies sharing management jurisdiction over a watershed, floodplain, aquifer etc.;
 - **Functional** fragmentation arises because of the segmented administration between authorities responsible for the functional activities.
- **Horizontal** fragmentation is particularly problematic as, in the absence of a management scheme to regulate the conduct of all users, the common resource becomes more hazardous to all who share it.
- **Accountability** for flood related externalities is difficult to attribute because of the variety of sources, the rarity of damaging floods and the remoteness between cause and effect.
- A systematic approach is necessary to maintain the production of goods and services in the face of competing goals of natural resource management and the conservation of the river environment. This would allow water and land use planners to make informed land use decisions to balance the pressures of property development with flood protection, protection of wildlife, maintaining water quality, preserving wetlands and providing public open space.
- The best practices in water management is considered for separate aspects of catchment and river management are: **catchment and river corridor, floodplain development and source control**. Within each, the effect of land use planning, legislation and economic instruments on achieving best management practice are analysed.

6.1.1 Catchment and River Corridor

- Land use planning in the river catchment concentrates on using resources such as forestry to retain water and delay runoff.
- **Upland terraces** are constructed and riparian buffer zones are preserved to reduce runoff velocities and reduce surface erosion.
- **Gulley plugs and check dams** are constructed, and stream beds and banks are stabilised to reduce stream channel erosion.
- **Conservation tillage methods** such as no-till and minimum till field preparation, as well as contour ploughing and cropping, though originally designed to guard against soil loss, can also be used to protect nearby surface water sources.
- **Geographical Information Systems (GIS) and Decision Support Systems (DSS)** are

innovative techniques used to develop inventories of resources.

Legislation within the catchment is centred on the regulation of land use to protect public interest. This includes prohibiting industries that deal in highly toxic or inflammable substances, or development of an especially hazardous nature requiring flood proofing. US environmental law requires every property owner including businesses to implement **contaminant and containment procedures**.

- Establishing minimum standards for waste disposal and water supply through Sanitary and Well Codes, such as prohibiting septic tank systems in areas of high ground water and flood hazards, is extremely important.
- Preservation of streams and their associated lands has been assisted by setting up technical assistance programs such as that introduced by United States Department of Agriculture (USDA) Soil Conservation Service. This is termed "**streambelt environmental corridors**" and is an official streambelt map adopted by local legislation. This delineation covers all wetlands covered by the Wetlands and Watercourses Act. The concept of an environmental corridor conserving natural ecosystems and their biological resources for various recreational usages is thus introduced.
- **Economic instruments** that can be used within the catchment include the provision of economic incentives to encourage conservation practices, emphasising the economic advantages of a river project designed as a 'honeypot' where people stop, relax and spend money instead of driving by, and by authorising renewable resource planning with states.
- The **Forest and Rangeland Renewable Resources Planning Act of 1974**, enables the USDA Forest service to identify stream corridors to be designated as prime timber growing sites. Careful management practices minimise runoff, erosion and preserve natural storage characteristics.

6.1.2 Floodplain Development

- Land use planning within the floodplain considers a wide range of best practices. Most important is placing highest priority on early flood warnings and local preparedness as well as municipal enforcement of floodplain zoning regulations. This has been helped by establishing and enforcing **state flood plain encroachment permit programmes** with Federal assistance and public participation. Transferal of flood hazard areas onto planning authority development zoning maps has made it possible to combine flood hazard management with other land use management activities.
- An important move is the provision of **flood storage for discharge attenuation** which has had the added benefits of open parkland, enhancement of local property values, improved regional water quality through pollutant deposition, wildlife habitats, and recreation. It also helped to buffer potentially catastrophic events.
- **Flood Hazard Exposure Management** are also introduced to permit the sound and safe use of land subject to only shallow flooding by still, sediment free water. This had a provision for discharge/velocity control, environmental elements and deposition areas (planned sedimentation basins with access to facilities to prevent deposition in downstream channels or multi-purpose detention ponds).

- Floodway use for **ground water management** has been introduced to allow recharge and ground water outflows under drought conditions, help control pore pressure, and to develop a chain of detention facilities so that head is lost more slowly than the pore pressure relief rate. Similar strategies exist for ice jam control, wave attenuation and energy absorption where waterways are exposed to coastal flooding.
- Experience shows that the model planning process for **optimal flood plain development** should:
 - consider the different uses and users of the river in order to minimise conflicts of use;
 - be able to function within the existing institutional frameworks but should at the same time be flexible and adaptable to change;
 - have provision for both short and long term plans with the emphasis on long term planning; and
 - allow adequate opportunity for public consultation before decisions are taken.
- **Strong community involvement** has been found to be the key element in designating a floodway to generate multiple uses and benefits. Best management objectives try to harmonise the limitation of hazards to life and property, limit channel maintenance requirements, limit upstream liability for backwater flooding, limit structural requirements and use of established public rights with right of way acquisitions. Creation of Private Citizen Groups such as the **Flood Land Action Committees (FLAC)** in the Chicago Metropolitan District are successful examples of community involvement. FLAC requires residential developers of more than 5 acres or commercial developers of more than 2 and a half acres to provide 100% retention for a 100-year storm before construction is begun, and a ban of all further building or filling of floodplains with protection of water recharge areas. These groups address the problem of transcending local autonomy in the interest of implementing a regional or basin-wide approach to flood plain management. Their effect as catalysts on fair management is important.
- **Maintenance projects** have had to become more 'natural' and less 'engineered'. The key to sound maintenance is selectivity and a multi-disciplinary team is essential for environmentally sound results. Carefully considered management reduces the adverse environmental effects with little loss of flood control. Clearing and snagging is used as an economical technique for reducing the frequency and duration of high frequency flooding in environmentally sensitive locations. Riparian vegetation and the organic debris it produces influence stream morphology, water quality and aquatic and terrestrial ecosystems. Guidelines suggested include selective removal and disposal based on size, location, condition and habitat value, labour intensive construction techniques, access controls, and work scheduling to avoid fish spawning or other environmentally sensitive periods.
- Use of **land treatment** as a regulatory method has also been important for land maintenance. This includes strip cropping, establishing of perennial grasses and legumes and tree planting to improve hydraulic conditions. This is done by providing land cover, decreasing the length of field slopes and decreasing the rates of overland flow.

- An important development has been the recognition that any development can have serious repercussions on **wetlands**. Federal agencies have been directed to avoid unnecessary encroachment on floodplains and wetlands and to promote their restoration and protection through Executive Orders. Executive Order 11988 issued in 1977 by President Carter imposed a more rigorous standard in the case of "critical facilities" eg hospitals or public utilities (0.2% chance of flooding in any given year). If no maps exist these standards should be managed on the basis of best available knowledge. This has led to using **Decision Support Systems for water and environmental management** to determine the impact of decisions on the environment. They generate iterative 'what-if' scenarios to model the mitigating effects of flood plain development. Hydrologic and hydraulic studies are therefore done on a community basis and enable comparisons with the hazard boundaries upstream and downstream.
- Floodplain legislation is based on the **National Flood Insurance Programme (NFIP)** which aims to shift the costs of occupying floodplains to the occupants themselves. Federal flood insurance has been adopted at low cost in communities which adopt floodplain ordinances to reduce future flood losses (eg flood proofing to one foot above the 100-year flood level).
- **Developing Flood Insurance Rate Maps (FIRM)** on a community basis has become a priority. Changes in watershed land use, channel improvements, population movement, construction of flood control structures and any factors that impact on the flood hazard are included on the FIRM's. Post-flood damage assessments are underway to evaluate the effectiveness of the programme, to determine the performance of flood proofing, structural design and modifications imposed by the NFIP regulations. GIS technology is helping with the maintenance of the programme. Such innovations will allow production of flood-prone street address directories to allow streamlined insurance rating procedures and increased marketing of flood insurance.
- **The Disaster Relief Act, 1974**, requires recipients of disaster relief to evaluate natural hazards in the area in question and thereafter take appropriate action to mitigate such hazards. This includes the development of local disaster plans to ensure safe land use and construction requirements before post flood disaster loans can be made.
- Of all Federal programmes, **EPA's water quality planning programme** has the greatest potential impact on land use. Communities are encouraged to adopt land use controls as a means of achieving and maintaining clean water.
- Economic instruments used within the floodplain concentrate on **acquiring undeveloped flood plain lands** with Federal assistance under the Land and Water Conservation Fund, the Fish and Wildlife Restoration Acts, State self-help programmes and the Federal programme. Agencies should seek to increase the overall return on the investments through multiple benefits, recreation, fish and wildlife restoration food and wood production. Permanent evacuation and acquisition of land and property is possible with projects linked to urban rehabilitation, park development and waterfront revival. The "Reasonable Compensation" issues receive less than generous compensation in court as this land is not just a commodity to buy, sell or exploit, but an integral part of the watershed's drainage and biological life support system.
- "**Willingness-to-pay**" surveys have been introduced to evaluate public support for the retention of riparian greenbelts as natural buffer strips to enhance the water quality,

recreation, and fisheries and reduce sedimentation and turbidity in rivers and lakes. The intrinsic values of a natural resource have been found to be larger in economic terms than the recreation and agricultural use made of those resources. Encouraging a non-use through incentives is part of the Conservation Reserve Program.

- **Guiding growth away from hazard areas** has been encouraged by discouraging the development of service infrastructure, discouraging development into sensitive areas, providing grants for waste treatment facilities or highway construction conditional on the basis that they do not encourage new damageable development, and integrating state growth policy with flood plain management policy.

6.1.3 Source Control

- Land use planning for source control has concentrated on **master planning**, which is intended to determine a cost-effective system to meet quantity and quality control requirements for current and planned communities. Integrating local and regional long and short term objectives of storm water management assists in assessing per-capita pollution cost, thus creating the cornerstone for a standard in pollution as a tradeable negative asset. Emphasising basin-wide planning to prevent mis-application of detention storage has been important. The amount of storage can be significantly reduced by selective locations of facilities in the watershed. The effectiveness of detention ponds in reducing peak flows depends on their size and location in the watershed. A system of detention ponds on first order channels may reduce the flood peaks on smaller channels, but may be ineffective in reducing flood peaks on larger channels.
- To maximise the efficiency of off-site and **multi-site Storm Water Management Systems (SWM)** regulators should have the following powers:
 - Government participation in SWM systems relating to their design, location, control, financing, and planning to ease the problems associated with future development;
 - Planning responsibility for multi-site systems; and
 - Waiver of on-site SWM requirements in lieu of regional plans with levied contributions from those developers who benefit from multi-site planning.
- Developing Storm Water Master Plans controlled by a **Citizens Review (Storm Water Committee)**, has allowed inspection of potential problems bi-annually and provides residents co-operation during construction and re-instatement. Such a committee helps with easements and in return provides funds, trees, etc. for post-scheme landscaping. Developing local attitudes is essential to the success of SWM with public willingness to enforce basin-wide planning, to commit resources for maintenance, and to develop optimal multi-purpose facilities.
- **Retrofit solutions** for storm water management are more complex and expensive than pre-planned solutions, and are used only in the following circumstances:
 - when regulatory targets need significantly lower loadings,
 - when restoration of a sensitive receiving watercourse is necessary,

- when a serious local problem exists that is not addressed by non-structural means, or
- when regulations require that existing water quality standards for dry weather flow are met in storm events.
- Comprehensive storm water planning should include control of the magnitude and frequency of flooding, the nature and severity of water pollution events and the significance of erosion and sedimentation problems. Fragmentation and inter-agency conflict prevents optimum SWM. Most local agencies are more concerned with zoning and regulatory activities by developers than correcting current problems. Monitoring and controlling design must be by one agency to avoid mis-understandings and conflict and must be comprehensive to include both structural and non-structural management practices.
- **Detention ponds** are often thought as an effective means of ground water recharge, although they demand frequent removal of accumulated soil fines, water transported silt and clay particles. Recharge can also have an aggravating effect on foundations, pavements and sewage disposal systems, especially septic tanks. These conflicting objectives must be balanced. Ponds settle out herbicides, pesticides, hydro-carbons and chromates and therefore can be environmentally and socially contentious. Four conditions should be met before elaborating their water quality objective:
 - no resultant public health risks,
 - no public safety risks,
 - no significant, adverse aesthetic consequences, and
 - appropriate, sensitive and cost effective maintenance.
- A best practice approach for detention storage involves:
 - regular and effective debris removal,
 - regular and effective removal of accumulated sediments,
 - regular and effective shore weed maintenance,
 - the 'shut down' of algal bloom,
 - counterbalancing the effects of evaporation and seepage losses,
 - maintaining pond through flows,
 - avoiding large areas of shallow water,
 - maintaining adjacent open space attractively and
 - implementing catchment-wide best management practices for improving storm water quality.
- **Minimising stress** can be achieved through good management practice backed up by:

- Adequate legislation to control erosion and non-point source pollution (through local commitment);
- Maintaining oxygen levels above 4-5mg/l, assisted by the incorporation of fountains and hydraulic jumps; and
- Constructing cascade ponds where the upper ones trap sediment and pollutant loads and protect the downstream ponds, and in doing so help to cut down channel erosion and scour.

Planning considerations vital for good practice include:

- Optimising detention pond size; larger ponds have less susceptibility to perturbations in turbidity, temperature and dissolved oxygen;
- Achieving good drainage which is essential to allow recreational use as soon after draw down as is possible;
- Providing additional safety facilities for allowing the rapid draw down of detained water;
- Avoidance of sedimentation following the construction period to minimise the conflict between water quality and maintenance objectives; and
- Sensitive grading and landscaping which is a more cost effective method than fencing (see exemplary efforts in Disneyland (Anaheim) and Disney World (Florida)).

Legislation for source control has involved developing a comprehensive storm water pollution management strategy achieved under the auspices of the 1990 **National Pollutant Discharge Elimination System (NPDES)**. Each city and county will be issued with a NPDES permit specifying a management plan for reducing storm water pollution discharges from the municipal storm drainage system. According to regulations the plan may impose controls on a municipal basis, a watershed basis (for larger cities and counties) or for individual outfalls.

- The Plan involves reduction of storm water pollution by **'MEP' (Maximum Extent Practicable)** balanced against technological, regulatory and fiscal constraints. It is suggested that using the MEP approach, the municipalities would best operate a "bottom up" or "building block" approach starting with low-cost, non-structural controls and adding various management options until the most cost-effective management alternative(s) are achieved.

Hierarchy of Management Options

Increasing Programme Requirement	Tier	9	Retrofit BMP's to developed sites
	3	8	Retrofit BMP's to municipal open space
		7	Retrofit BMP's to existing drainage facilities
	Tier	6	BMP's for future drainage improvements

	2	5	BMP's for redevelopment sites
and		4	Monitoring & inspecting industrial areas
Costs	Tier	3	Nonstructural control programme
	1	2	Structural BMP's for new development
		1	Credits for existing controls

- **Economic instruments** effective for source control management are based on costing Regional Catchment Planning prior to the development of storm water facilities so reducing long term capital expenditure and frequent flooding problems. Allocating costs for storm water management are based on each party's pro-rate share of the design flood but with private contributors capitalising their investment in return for favourable tax advantages. Thus, sharing and allocation of costs can be derived from a financial structure that best suits private industry and government agencies.
- **Fees for storm drainage** based on property area and land use characteristics have been introduced. Thus user fees are based on services rendered, rather than traditional tax revenues. Charges are related to a given area's storm water runoff in excess of the contribution occurring in its natural, undeveloped state. Each parcel is assessed on a fee based on its runoff characteristics. The fee structure is based on an equivalent residential unit (ERU), which is the average impervious area for all dwelling units. Monthly charges of \$2-3 provide an equitable funding system to generate ongoing revenue to finance planning, design, upgrade facilities, O & M, monitoring and enforcement and the administrative management cost of comprehensive storm water management.

6.2 Summary

- The developments in recent years clearly show that the fundamental conflict underlying the management of resources is no longer strictly one of economic well being. The development of natural resources has a cost on both the social welfare and the natural environment. Today that cost is being quantified through punitive damages in the courts, as well as through an evolving system of pollution credits.
- The idea of **storm water management as a utility** is an extension of this trend toward quantifying the impact that human activity and structures have on the environment. This shift must not be understated, since for the first time the waste and subsidiary effects of human development are taken as negative costs. This is a revolutionary concept for the economics of capitalism, and is likely to have a positive effect in recalibrating ideas about development.
- Floodplain development is primarily concerned with **early flood warning schemes**. Federal assistance and public participation has helped to establish and enforce state floodplain encroachment permit programmes.
- By creating **zoning maps** of the floodplain, flood management has been integrated with other activities, and flood insurance proposals have transferred the cost of flood damage to occupiers of this area.
- **Development of the floodplain** has been limited, but any encroachment has been forced to become more 'natural'. This has resulted in storage areas and groundwater recharge schemes which have added benefits of open parkland, improved water quality, wildlife habitats and recreation. Floodplain development has therefore made use of the existing institutional framework to become more flexible. This has enabled decision makers to consider the floodplain users and its uses in more detail.
- New modelling techniques and **Best Management Practices (BMP's)** allow for greater efficiency in co-ordinating and achieving the most effective multi-objective goals of a fragmented decision-making and planning body. In a decentralize system, such tools are critical to building a unified approach to watershed management.
- Despite the fragmentation in water management of the watershed, there is hope that Federal, state, and regional agencies and agreements can build a consensus in effectively managing the watershed and optimising their collective resources.
- The importance of water management experts in helping alleviate conflicts of interests and goals in flood and pollution control, is central to helping resolve the problems in watershed management. They help define the problem in terms of conflicting water management goals, cost-efficiency, and long and short term costs and benefits. This quantification of water management decisions helps bring together disparate interests in a common field.
- Furthermore, the elevation of waste management as a respectable and growing business will increase public safety, as the industry emerges from the shadows of a neglected past.
- If the externalities are far reaching, as they almost certainly are when considering catchment management planning, it may not be practical to merge all the planning, administration and legislation instruments within one structure (as has been achieved in New Zealand). However,

some **conflict resolution** can be achieved through the full procedure of public participation and planning decisions formulated and enacted by incorporating all elements of strategy in the policy documents of both the governmental and functional players. Functional conflict resolution is followed by agency co-operation and consensus.

- A key emphasis in water management planning is **education**, sensitising the public to land and water management issues. It is a resource like any other mineral asset. Current methods for calculating Gross National Product completely exclude any measurement for the depletion of natural resources. Everything in nature is simply assumed to be limitless and free. The effects of our planning decisions must be assessed on the future generations who have to live with them. Bequest benefits must be considered part of the decision and planning process.

7. THE UNITED KINGDOM

7.1 Introduction: Links with NRA Project 299

Tunstall, Parker and Krol (1993) undertook an extensive review of current practice in this country and identified a best practice approach to incorporating NRA⁵ flood defence interests in Town and Country Planning.

The recommendations from Project 299 take the following form: (and the items in the square parentheses represent the itemised numbers of the recommendations in the Project 299 final report (R&D Note 207). The paragraphs below each item indicate progress being made in each area.

- **Suggestions that the NRA takes a more pro-active stance in integrating land and water planning within the context of sustainable development [1, 2]**

There has been encouragement on a national basis for NRA regions to get pro-actively involved in the forward planning process. 'Guidance notes' have been circulated to planning authorities and NRA staff have been involved with a national group evaluating policy for the protection of flood plains and target standards. Other staff have been active within the NRA in promoting sustainable development policies.

- **Definitions, data, standards and environmental economics needs for integrating land and water planning [4, 5, 6, 8, 31, 40, 41]**

The memorandum of understanding between the NRA and the ACC, ADC and the AMA, who were invited to represent the English and Welsh planning authorities, is a significant step forward in the collection of data and the promotion of NRA flood defence and planning interests. A range of surveys is likely to be undertaken under the provisions of the section 105 (2) of the Water Resources Act 1991 associated with the recommendations contained in DOE circular 30/92. In addition, information databases are improving along with the CMP (now LEAP) process. Work on section 105 surveys will complement this, and Thames Region has developed a 'development plans database' to monitor the take-up of NRA policies in local plans. More attention, also is being given to local plan programmes.

- **The role of Catchment Management Plans (now LEAPs) [3, 7, 33]**

There has been considerable discussion within the NRA recently about the role of Catchment Management Planning, and an NRA seminar was held in July 1994 on this subject.

⁵ The term "NRA" will not be updated to "Environment Agency" in this section as Project 299 was entirely done during the NRA days, but some of its recommendations still apply to the Environment Agency.

- **The production of policy documents and their dissemination, and associated consultation, etc [9, 11, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24]**

There still remains a substantial amount of work to be done on this topic. Thames Region has produced 'Thames 21' which has been discussed by the National Planning Liaison Group (NPLG). There is also a new 'guide to developers', which has been produced by NRA Headquarters. National policy documents are being considered, and a national set of 'guidance notes' has already been referred to, although they do not cover all the items the subject of the recommendations from Project 299. However, in addition, Thames Region has arranged visits to local planning authorities and there is now a national version of a 'planning liaison guide' which regions can use as a model and include local variations. The promotion of NRA planning liaison documents and policies to local authority members has not yet been pursued, at least in the Thames Region, but could be encouraged. Some work has been done on the production of documents for disseminating information to the public, but more could probably be done in this respect. The same applies to liaison with developers and development organisations.

The National Planning Liaison Group has been operating for about two years and provides a better focus for activity in the field of communicating between development and flood defence organisations, and this is an improvement on what the NRA did previously. There is more that could be done in this respect, but contacts are improving. The same applies to links between planning authorities and NRA regions; there have been programmes to carry out regular liaison, but these are not uniform across all NRA regions.

It is recognised that the NRA needs to improve its communication of its own plans, flood defence schemes, river corridor policies and Catchment Management Plans in order to ensure that communication between the NRA and local planning authorities is a two way process.

- **Integration with development plans and monitoring policy effects and performance [25, 26, 27, 28, 29, 31]**

Thames Region now has an embryonic 'planning policy checklist' which identifies opportunities through planning law and European Union directives to promote NRA/Agency policies. This is a possible initiative for national promotion via the National Planning Liaison Group.

The NRA supports the adaptation of policies to fit in with the Local Planning Authorities' requirements and Thames Region has been prepared to support the Local Planning Authority at enquiry or examination in public.

Section 54a of the Planning Act states the primacy of local plans. Thames Region normally responds accordingly and fits in with local planning authority requirements. With regard to performance indicators, methods in the Thames Region have improved but performance indicators are not yet available nationally. This matter is still being considered. The monitoring of local planning authority decision notices and evidence is still being pursued, and evidence is being collected where developments are permitted against NRA advice.

- **Legal and Guidance Framework [32, 39]**

The NRA continues to review the situation, in order to develop better policies within the context of sustainable development. The development of a PPG for river corridor management and planning, to make the integration of land and water management more explicit, would appear to be a wise future objective.

- **The Impacts of Flood Plain Policy (Conservation; run-off) [10, 12, 13, 30, 34]**

The NRA continues to be concerned at the secondary effects of flood plain development, including run-off exacerbated downstream, and the environmental impact of any necessary compensation works. The NRA is promoting the close relationship between flood defence and conservation interests, and seeking to co-operate with all other agencies' proposals and schemes for the natural use of land in river corridors and coastal sites. Considerable progress is being made in this respect, although there is still some way to go.

- **Staffing and Resources [35, 36, 37, 38]**

A significant number of initiatives have come from Thames Region with regard to staff resources, since that region has the resources, skills and interests required. The region has also promoted the current research (Project 426) and the development of a number of other policies and policy documents. The region also employs seven qualified members of the Royal Town Planning Institute, and the NRA has organised national training courses on planning enquiries and other courses are designed for the future. Liaison between the NRA and the RTPI is improving, and the NPLG will recommend further seminars and joint events with the RTPI and other bodies in the future.

As can be seen from the above, considerable progress is being made in England and Wales. However, less has been known in the past about the situation in Scotland, and therefore the sections below review that situation, as well as making some additional points about the developing situation in England and Wales.

7.2 Scotland

According to Frederiksen (1992), the first advantage in the Scottish system is that the water and sewerage services are currently combined into the same administrative unit as that which is responsible for land use planning. In this respect Scotland mirrors French practice where it is arguable that the greater involvement in use of source control measures, as reported in the French practice report, is a direct consequence of the same administrative authority both being responsible for land use planning and the provision of surface water drainage. In consequence of such a combined responsibility, it is in the interest of that authority to minimise the total costs of building and operating surface water drainage system. In economic terms the costs of surface water drainage are essentially internalised to those of planning and development.

Conversely, as described below, the current administrative and financial structure, as is the legal framework, in England and Wales is such as to reduce the overall economic efficiency of the system for surface water drainage.

Frederiksen (1992), in reviewing water resource administrative systems for the World Bank also

tended towards the recommendation that the ownership of water and sewerage services, as is presently the case in Scotland, should be in the ownership of the end users rather than directly privately owned. The subsequent World Bank policy paper (1993) is less pessimistic than Frederiksen about the long term viability of privately owned sewage companies, but tends towards recommending the French system. That is, where local government contract out competitively the operation, or construction and operation, of sewerage systems to private companies.

Other than in those regards, the system in Scotland is typified by Brown and Howell (1992) as being in substantial need of review and reform.

7.3 England and Wales

An obvious point is the separation of the operational authorities from regulatory Authorities (Frederiksen, 1992). This is probably a self evident virtue from an English and Welsh perspective but such a separation is not typical of many other parts of the world.

An aspect where England and Wales reflect best world practice is in the adoption of sustainable development principles and their application to strategic planning and watershed planning. The preparation of such set of principles and a review of current policy was a requirement of the Rio Conference (DOE 1994). It is often unclear as yet what is meant by sustainable development and how this may be applied in practice. However notable indications of the way that this may develop are the report on the application of sustainable development principles to strategic planning prepared by the Countryside Commission in conjunction with both English Nature and English Heritage, (1993). Similarly, the DOE report (1992) 'Using Water Wisely', is another indication of the implications of sustainable development principles in application to river basin management. Finally, at what might be termed the policy level, the inclusion of a duty upon the NRA to enhance the environment within the Water Act is a positive virtue.

At the next level down, in terms of strategic implementation, the first possible component is the development of regional planning conferences and coastal soil conferences together with NRA liaison with such groups. There is an argument that the natural unit of land use planning is a watershed, somehow defined. However, such a form of reorganisation is perhaps unlikely within England and Wales and regional planning conferences and coastal zones cell conferences are a desirable intermediary step.

Strategic environmental assessment (Therivel et al, 1992) of programmes and policies is being, perhaps not under the same name, progressively adopted by the National Rivers Authority. One such example cited is the Colne Valley flood alleviation plan. The European Commission has published a draft directive on CEA (CEC,1991).

The adoption of sustainable development principles, the development of regional planning coordination and the increasing use of strategic environmental assessments are all part of a developing approach to consider the wider impacts and interactions of individual projects and to develop the best option. The development by the NRA of multi-functional catchment plans are clearly both consistent with a necessary part of such a wider planning and policy making framework. Like all such plans, their importance lies both in their use in communication and liaison with other bodies and in the process whereby they are developed.

Again, a necessary component of a long term policy framework is the assessment of the current asset position. Therefore the NRA initiatives to determine the state of flood alleviation assets

provide the necessary basis for a coherent forward plan.

The NRA model clauses for adoption by local planning authorities have themselves been generally welcomed by, amongst others, the Countryside Commission et al (1993). In some areas, river corridors have also been the subject of a specific local authority plans (e.g. the Greater Manchester River Corridor Plans).

The use of the availability of potable water and sewage capacity and such matters of flood risk as a planning constraint is equally a desirable development.

However, this is not to imply that the development in flood plains or watersheds is necessarily a bad thing. There have been a number of cases where development in flood plains has taken place when and because the alternative sites for development were worse in environmental and other terms. This is to emphasise again the desirability of applying strategic environmental assessments, rather than assessing developments in narrow terms or against a single rule.

Within the NRA's own responsibility, the increasing consideration of a wide range of options for projects is an example of good practice. The scheme option selected for adoption can be no better than the best of those considered. The increasing and continuing concern by the NRA with both environmentally sensitive solutions and the consideration of managed abandonment options, in the case of flood alleviation and land drainage schemes, coupled with the multi-functional assessment of a river, enhance the probability that the best option will be determined.

At project level, the NRA's involvement in River Restoration is an obvious example of good practice. The recreational value of river corridors is such that the use of environmentally sensitive options for flood alleviation has been found to be more efficient in economic terms than conventional solutions.

In addition to acting as an undertaker of projects the NRA also acts as facilitator and provider of information and advice to other participants in the planning and development process. Consistently, the need for the NRA to promote itself as the ultimate source and arbiter of information on floodplain delimitation by the use of S.105(2) surveys under the Water Resources Act 1991 has been argued. This information is required not only by planners and developers but also by such parties as insurance companies who are increasingly, or perhaps for the first time, showing a concern with their exposure to flood risk.

Again it has been proposed that the NRA needs to provide guidance and guidelines for developers. That is, the NRA should be proactive in planning terms rather than simply responsive to individual planning application. It must be recognised that by the time a planning application

has been submitted by a developer, that developer will already have committed perhaps considerable sums of money. It is both economically more efficient and politically more sensitive to seek to guide rather than to react against.

Finally, there are a number of responses which have been adopted by planning and other authorities essentially to overcome the weaknesses in the system which existed for some time in England and Wales. Thus for example it has been known when the local government planning department was minded always to approve of new development against water authority, or subsequently NRA, advice for the local government engineering department to use the building

regulations to control the form of that development. An instance being the application of a requirement to use soakaways rather than connection for surface water runoff to a combined sewerage system.

7.3.1 Weaknesses and Opportunities

A long standing weakness in England and Wales has been the lack of duty on property vendors and their agents to inform potential purchasers of any risks associated with that property. Consequently, the awareness of that purchaser of the extent to which a property was at flood risk has varied widely between different parts of the country. Overall, knowledge of potential flood risk has been low. A consequence is the failure of economic efficiency to occur in that developments have taken place which would not have been viable had the purchasers been aware of the risks that they were running on purchasing that property.

A second area of weakness is in source control itself. As part of the privatisation process the water and sewerage companies were enabled to charge an 'infrastructure' charge for connecting a new property to the system. The purpose of this charge is to cover the cost of reinforcements and expansion of the existing sewerage or water supply system. OFWAT has expressed concern that such charges, which can be substantial, are inappropriate given that the K factor in the price formula allows for increased demand. OFWAT has therefore queried why new development should attract an additional payment over and above the general charge on the consumers for increases in demand. OFWAT argues that potentially the consumers are being charged twice for the same increase in demand. In economic terms, however, infrastructure charges are a potentially economic instrument which could be used to reflect the actual relative costs of connection. That is to say, an infrastructure charge would vary from site to site.

Charges therefore should be higher where either the impact on the environment or the cost of providing the surface water collection transport and disposal system were greater.

Currently, neither the legal nor the financial system provides incentives for such optimization through the use of economic instruments to occur. As Howarth (1992) has argued the current legal definitions of such terms as sewer inhibit the adoption of source control measures such as infiltration. Similar problems Howarth argues arise in connections with responsibilities for maintenance. Given that infrastructure charges are set on an average system reinforcement cost basis, rather than the site specific externality costs of connection to the system or the environment, there is a natural tendency by the sewerage undertakers to seek to minimise their long term maintenance costs given that they do not incur the capital costs of local works. As Ojolo (1993) has shown it can be cheaper for a developer to provide an infiltration system such as a swale or filtration drain than to provide an underground balancing tank, or a balancing pond, given in each case the same restrictions of discharges to the nearest watercourse or sewer. Legal and institutional barriers inhibit the widespread adoption of such options. Floret-Mignet (1994) has also found a relatively low level of knowledge about these options.

Although the application of abstraction and discharge fees has been considered, water is one of the less promising uses of economic instruments, given the local monopoly of both abstractor and discharger.

8. SUMMARY OF EUROPEAN COMMUNITY LEGISLATION

8.1 Introduction

Several bodies exist within the European Community (EC) to initiate and augment environmental legislation subject to the consensus of the EC Council of Ministers. These institutions and consultative structures are effective in terms of local problems and also in the gathering of information for use throughout the EC.

Environmental policy has officially been within the realm of the EC since 1972. The EC Environmental Action Programme has gradually developed to include nature by adopting the Bird Directive in 1979, and confirming the World Conservation Strategy and specified protection and restoration of the natural environment. Objectives include:

- to preserve, protect and improve the quality of the environment;
- to make preventative action a priority and therefore rectify environmental damage at the source; and
- to integrate environmental protection into other community policy decisions.

8.2 Structure and Policy Making of the EC

The EC is made up of four primary institutions: the Council, the Commission, the Parliament, and the Court of Justice. The Council is made up of representatives from each of the Member States, and has the power of final determination in legislative decisions. The Commission is comprised of 17 members elected for 4 year terms and is also responsible for controlling and regulating EC policy related activities. The European Parliament is made up of representatives from the Member States and acts in an advisory role, while the Court holds final authority on all matters of Community law and consequently stimulates the implementation of EC law.

8.3 EC Measures to Protect the Environment

Two main types of measures exist within EC policy for the protection of the environment; those that specify protective actions, and those that shape the more sensitive areas of policy such as agriculture and regional development. A series of these measures is laid out below. These are the main directives that effect environmental management and floodplain protection.

8.3.1 1974: Directive 75/268/EEC Countryside Protection in Less Favoured Areas

The purpose of this Directive is to ensure that financial incentives are provided for the continuation of farming in less favoured areas. This aims to have a positive effect on the conservation of the countryside and provides the framework for areas to be designated as less favoured.

To be designated as less favoured areas, they must have sufficient accessibility, have utilities in place, and also fall into one of three categories:

- mountain areas,
- areas in danger of de-population, poor economic conditions and low or diminishing population dependent upon agriculture, or
- other small areas affected by specific handicaps.

The general aim is to ensure the continuation of farming practice in areas where it is in danger of disappearing. The importance of this is in the link between farming and the conservation of the countryside for aesthetic and environmental reasons, tourist potential, or the protection of the coast.

- **Effect on UK Practice**

The directive is a precedent in the UK for policy concerning the preservation of the countryside. A MAFF report to the Ministry of Agriculture stated that the majority of Community funds allocated to this measure had gone to the UK. One criticism has been that the Directive exacerbates the problems of overgrazing on land that is already marginal for agriculture use.

8.3.2 1976: Directive 76/464/EEC Dangerous Substance Discharges

This directive is aimed at eliminating or reducing the pollution of inland, coastal, and territorial waters by dangerous substances. It also provides the structure for six 'daughter directives' which set emission limits on these substances. The Annex to the directive contains lists of substances which the Member States must either eliminate (list I) or reduce (list II). List I substances were chosen on the basis of their toxicity, persistence, and bio-accumulation characteristics. List II substances are those which may have a detrimental effect on the aquatic environment. List II also includes substances which effect the taste or smell of marine products for human consumption.

The Member States must develop an authorisation system for the discharge of List I substances into inland surface waters, territorial waters, internal coastal waters, ground water, and sewers. This must include emission limits on concentration and quantity of the substances. For List II substances, pollution reduction programmes must be instituted, which must include deadlines for implementation, prior authorisation and compliance with emission standards for all discharges.

8.3.3 1979: Directive 79/409/EEC Birds and Their Habitats

This directive is aimed at the protection of wild birds and their habitats. It seeks to control the hunting of wild and migratory birds, protect their eggs and nests, and protect their habitats against intrusion and destruction. Member States are to consider ecological, scientific, and cultural concerns relating to wild birds and to establish measures for their safeguard. These measures are to include preservation, maintenance, reestablishment of habitats, the creation of protected zones, and the regulation of hunting.

The directive prohibits the deliberate killing or capture of wild birds, destruction or damage to nests, removal of nests or eggs, disturbance of the birds during breeding and rearing and keeping wild birds. Annex I lists birds which are considered susceptible to decline caused by excessive disturbance of habitat, and designates special conservation measures. Member States are required to adequately inform the Commission of the details of these measures to ensure conformity

among the Community. Annex II lists birds that may be hunted within national regulation provided proper conservation of the species is not jeopardised. Methods of killing which are inhumane such as snaring, explosives, nets, use of blind or mutilated live birds etc, are prohibited.

- **Effect on UK practice**

One of the most significant effects is criticism that has arisen over the establishment of Special Protection Areas (SPA) set aside for the preservation of bird habitats. The UK is well behind most other EC countries in the proportion of land designated as Special Protection Areas. The designation of these areas has been slowed down by the government's policy that the proposed site has to first be designated as a Site of Special Scientific Interest (SSSI) and then notification must be given to landowners, occupiers, and local authorities of the SPA proposal. The effect of these policies has been to prolong the process of establishing protected areas for bird habitat.

8.3.4 1980: Directive 80/68/EEC Groundwater

This directive defines "groundwater" and sets guidelines to prohibit or regulate direct and indirect discharges of dangerous substances into groundwater systems. The Annex to the directive contains two lists of families and groups of dangerous substances which are subject to regulation or prohibition. Member States are directed to prevent the substances on List I from being discharged into groundwater and to regulate the discharge of substances on List II. Direct discharges of List II substances into groundwater systems is authorised only after investigation into the possible effects.

- **Effect on UK practice**

The most profound effect of this directive is on indirect discharge of dangerous substances into groundwater systems through seepage from land deposition. There is significant evidence that numerous instances of groundwater contamination via indirect seepage from industrial sites and other sources can be found in the UK. The Department of the Environment has determined that industrial waste disposal operations will not fall under the jurisdiction of the directive unless they may cause dangerous substances to reach the water table in quantities sufficient to cause the deterioration of the quality of usable groundwater.

Claims by Friends of the Earth that several thousand waste tips posed a risk to groundwater, and two reports which showed that groundwater was threatened by agro-chemicals and chlorinated solvents as well as by landfill sites, persuaded the NRA to institute policies for the monitoring of groundwater. The groundwater protection policy published by the NRA in 1992 sets forth recommendations on the classification of groundwaters on the basis of their susceptibility to contamination and defining protection zones around sources of groundwater.

8.3.5 1982: Resolution 82/72/EEC Signing of the Treaty of Bern

This resolution aims to protect wild animals and plants and their habitats. It builds on the Birds Directive by including the protection of other animal species as well as plants.

8.3.6 1984: Regulation 1872/84/EEC Community Actions for the Environment (CAE)

This regulation sets up a fund for subsidising environmentally protective actions, specifically the protection of endangered animals.

8.3.7 1985: The Publication of the Green Paper on the perspectives for Common Agricultural Policy

This augments the role of agriculture to include the protection of the environment.

8.3.8 1985: Directive 85/337/EEC Environmental Impact Assessment

The purpose of this directive is to ensure that an environmental impact assessment is undertaken before the approval of any project likely to have significant effect on the environment. Annex I of the directive lists specific types of projects that mandatorily require an EIA before approval, and Annex II list types of projects that require an EIA if the Member States judge the project to have notable effects on the environment. The EIA is to determine the level of effect of the project in the following four areas:

- effects on human beings, flora and fauna,
- effects on soil, water, climate, and landscape,
- effects on the ecology between the first two groups, and
- effects to material assets and cultural heritage.

The decision about approval on any project must be made available to the public, although the reasons for the decision may be withheld. Some projects may be exempted from the required EIA provided the Member State disclose the reasons for the exemption and consider whether other methods of assessment may be suitable for the project.

The project types listed in Annex I include oil refineries, thermal and nuclear power stations and nuclear reactors, radioactive waste storage and disposal facilities, iron and steel works, asbestos extraction and processing facilities, integrated chemical installations, motorway, express roads, railway lines and airport construction projects, trading ports and inland waterways, hazardous waste treatment, incineration, or landfill installations. All projects in these categories are subject to mandatory EIA requirements. Classes of projects listed in Annex II include agricultural, extractive industries, energy related industries, metal processing, glass manufacture, chemical industries, food industries, textile, leather, wood, and paper production, rubber industry, infrastructure projects, and modifications to Annex I projects.

The directive also specifies information that developers must supply to the Member State before an EIA is carried out. This must include details of the site and a description of the project, any data which may be needed to determine the effects on the environment, a description of any procedures which may need to be undertaken to avoid or reduce the effects, and a non-technical summary of the pertinent information. The developer is required to consider direct, indirect, and possible cumulative effects of the project when compiling the necessary information. All information must be made available to the public and the public should be allowed to comment on the proposal before permission is granted.

- **Effect on UK practice**

Most of the main parts of directive were already existent in UK legislation prior to the issue of

the directive. Developers were already required to supply relevant information to the responsible authority and the public have the right to express opinion on projects. The planning authority already considers the information supplied by the developer in its decisions and informs the public. The primary changes brought about by the implementation of the directive are in the content of information that developers are required to supply and the extent of environmental effects that have to be considered.

One of the problems that has arisen from the directive is the lack of clarity on the status of 'pipeline' projects. There are no specific guidelines on how to deal with projects that had been submitted for approval prior to the implementation of the directive and have not yet been approved. Another cause for concern is the question of 'staged' development where developers obtain approval for specific phases of a larger project under the contention that each phase is a development unto itself, without regard to the environmental impact of the project as a whole.

There is also evidence that the EIA process does not have clear standards of practice and that assessors are inadequately trained. The DoE has stated that it will issue a guide which is yet forthcoming. Another area of contention is that it is difficult to challenge a decision not to require an EIA, unless it can be proven that such a decision is wholly unreasonable and environmentally unsound.

8.3.9 1985: Decision 85/338/EEC Information on State of Environment (CORINE)

This is a decision by the Commission to initiate a programme to consolidate all information on the environment available within the Member States. The programme that this has arisen from is called CORINE (Coordination of Information on the Environment). Its four main areas of particular concern are:

- a) the identification and description of biotopes that are of importance to the conservation of nature
- b) gathering and co-ordinating information on atmospheric emissions which contribute to acid rain; providing representation of the damage caused, and working toward a solution of the problem
- c) increasing efforts toward the preservation of the Mediterranean environment, and
- d) ensuring that data on the state of the environment is co-ordinated, consistent and readily available within the Community.

• Effect on UK practice.

The Department of the Environment will now consider European Environment Agency requirements when reviewing environmental statistics in the UK. The main effect has been to increase data collection efforts and the exchange of information between the Member States.

8.3.10 1985: Regulation 85/797/EEC

This regulation sets out a policy on agricultural structures which includes actions to protect and preserve the environment. Article 19 allows national aid to be given to farmers in environmentally sensitive areas who maintain or introduce agricultural production practices

conducive to the preservation of the environment. National or regional authorities can define a programme and specify environmentally sensitive areas. The proposed programme will then be reviewed by the Commission and a Committee of Member States to determine whether the programme fits within the criteria of the Article. If so, national funds are subsidised with the Agricultural Fund of the EC and extended as aid to farmers. Of the EC States the UK has the highest percentage of farmers (40%) who accept the management agreement specified under the Article.

8.3.11 1986: Directive 86/278/EEC Sewage Sludge

The purpose of this directive is twofold: first to ensure that humans, animals, and plants, and the environment are wholly protected against the possibility of detrimental effects from the unregulated use of sewage sludge on agricultural land, and secondly to promote the correct use of sewage sludge.

This directive establishes that national concentration limits for metals in soils be established and that the spreading of sewage sludge must be banned when the soil exceeds these levels. Two options are available to Member States for regulating the use of sewage sludge: they may either establish upper limits on the maximum quantity of sewage sludge which may be applied per unit area per year, or they may apply the limits on metal addition per unit area per year. Three Annexes define concentration limit values for heavy metals which encompass soil, sludge for use in agriculture, and amounts which may be added annually to agricultural land based on a ten year average.

The directive requires that sludge is treated before use but Member States may authorise the use of untreated sludge if it is injected or worked into the soil. A minimum period of not less than three weeks between the spreading of sludge and grazing or harvesting is to be set. The use of sewage sludge is also prohibited on soil in which vegetable and fruit crops (except fruit trees) are grown. Its use is also forbidden for ten months before the harvesting of fruit and vegetables which are normally in direct contact with the soil and eaten raw.

Analysis and sampling requisites are stipulated in two Annexes. Details of quantities of sludge produced, and used in agriculture, its composition, how treated and where used are to be kept by Member States. Information about treatment and analysis results must be released upon request. Member States are required to submit a consolidated report on implementation of the directive five years after notification and regular reports every four years thereafter.

- **Effect on UK practice**

The UK already complied with most aspects of this directive. However formal compliance will require additional regulations and legislation. Some changes in practice have occurred such as injection of sludge below the surface of grassland rather than spreading on the surface. One of the most significant effects will be to reduce the amount of sewage sludge that can be diverted to agricultural land now that it can no longer be dumped at sea (Directive 91/271). This additional constraint will increase pressure to find new methods for the disposal of sewage sludge.

8.3.12 1988: Regulation 88/1094/EEC Set aside, Extensification and Conversion of Production

The objective is to regulate the agricultural market by reducing the production of some products and by extending aid to farmers for set aside. The main aim of this regulation is to help poor regions overcome environmental problems and stimulate economic and social development. Member States can make proposals for programmes to be supported by the EC and the Commission who then determine whether the programme is to be supported, and how much aid is to be given. This is the first measure to specifically integrate the protection of the environment within regional development.

8.3.13 1990: Regulation 1210/90 European Environment Agency

This founds the European Environment Agency and the environmental monitoring and information collecting networks within the Community. The purpose of the Agency is to provide the Member States with comprehensive information on the environment at the European level to facilitate the protection and preservation of the environment; to ensure that the general public has access to information on the state of the environment; and to see that the necessary scientific and technical support is afforded.

The first set of duties for the Agency is to establish the information exchange network throughout the Community, to collate the information, process and analyse the data, and to carry on with the programmes begun by the CORINE project. The Agency is also to co-ordinate and disseminate consistent, comparable information to provide a basis for sound environmental policies within the Community and Member States. It is also responsible for promoting new methodology for monitoring and assessing the state of the environment and projecting its future state.

The regulation delineates eight specific areas that the Agency is to give priority to with regard to the compilation of information. These areas include air and water quality, soil quality, plant and animal ecology, land use and natural resource exploitation, chemicals, waste management, noise pollution, and coastal protection. The Agency is also required to consider socio-economic concerns and international affairs.

8.3.14 1991: Directive 2328/91 Environmentally Sensitive Farming

This directive sets out guidelines for financial aid schemes which are aimed at getting farmers to implement environmentally sensitive farming practices. The directive is a consolidation of a series of previous directives and regulations on farm development policy. The aid should be provided by means of annual premiums per hectare to farmers who adopt these practices and maintain them for at least five years. Proposals are to be sent to the Commission by the Member States for approval of the schemes for reimbursement funds from EAGGF.

- **Effect on UK practice.**

The Agricultural Act 1986 gave new powers to Ministers to allow them to designate environmentally sensitive areas with the consent of the Treasury and in consultation with the Secretary of State for the Environment, the Countryside Commission, and the Nature Conservancy Council. Farmers within these areas can enter into agreement with the Ministers to practice environmentally sensitive farming in exchange for payment.

8.3.15 1991: Directive 91/271/EEC Urban Waste Water Treatment

This directive is aimed at reducing the pollution of freshwater, estuaries and coastal waters by urban waste water. Urban waste water, as defined within the directive, includes domestic sewage, industrial waste water and rainwater runoff. This directive sets minimum standards for the reduction of pollution from these sources as well as for the collection, treatment and discharge of urban waste water. This directive provides a reinforcement to directive 76/170 on the quality of bathing water by initiating regulations regarding the disposal of sewage sludge and ordering the termination of sewage sludge dumping at sea by the end of the year 1998.

Under this directive towns and villages with a population equivalent greater than 2,000 must have a sewage collection system in place by the end of either the year 2000 or 2005 depending on their size. The guidelines for the treatment of urban waste water going into these systems is graduated according to the size of the population. Towns with a population greater than 15,000 are to process all discharges through secondary treatment systems by the end of the year 2000. The deadline for the emplacement of these systems for towns with a population between 2,000 and 10,000 is the end of the year 2005.

Certain 'sensitive' areas must be protected by tertiary treatment being provided for discharges. These areas are determined by the Member States on the basis of criteria set out in Annex II and encompass waters which need significant reductions to nitrates and/or phosphates, surface waters that have high nitrate levels and are intended for the abstraction of drinking water, and any additional waters that need the protection of higher treatment standards in order to meet the requirements of Community directives. Discharges into such water are required to go through tertiary treatment systems by the end of 1998.

The directive also contains a provision so areas of coastal water can have lower standards of waste water treatment. The directive requires that discharges must undergo a minimum of primary treatment (a physical and/or chemical process involving the settlement of suspended organic solids). In addition, comprehensive studies must indicate that the environment is not being adversely affected. No deadline is set for the installation of primary treatment systems although there is a provision for the Commission to submit 'appropriate proposals' to the Council if these conditions are not met.

- **Effect on UK practice**

This directive will have costly effects throughout the UK water industry, especially in coastal areas. It is estimated that the cost of upgrading sewage treatment systems that do not currently comply with the standards set out in the directive will exceed £1.5 billion (CES Ltd. study cited in Manual of Environmental Policy, Release 0: 4.6-6). This is not inclusive of the cost expected in fulfilling the requirements of the directive on bathing water quality. This will clearly divert resources away from improving the quality of inland waters, with consequent repercussions on the quality of river water entering the sea.

As zones that are designated to be less sensitive areas are not required to process discharges through secondary treatment, it is expected that the UK will take advantage of this, and the NRA will designate most coastal areas as less sensitive. Primary treatment facilities will still need to be put into place which will create other problems such as aesthetic consideration, smell, and treatment and disposal methods. These considerations and the problems associated with the termination of sewage sludge dumping at sea in 1998 and the increased volume of sewage sludge

will necessitate improved technology and innovation.

8.3.16 1992: Directive 92/43/EEC Habitats and Species Conservation

The purpose of this directive is to maintain the conservation efforts within the EC and to establish a level of conservation that will protect the bio-diversity of each of the Member States. This is to be achieved through the conservation of habitat and the protection of species.

This directive introduces the concept of 'a favourable conservation status' for habitats and species populations. It also defines natural habitats as 'terrestrial or aquatic areas distinguished by geographic, abiotic and biotic features whether entirely natural or semi-natural'. Those types that are designated as being of special interest to the Community and those that are in need of protection to maintain bio-diversity are then designated as protected habitats by the Community. Although the directive does not specify floodplains as protected habitats, there are numerous habitats designated as protected areas which occur within floodplains. Plant and animal species which are considered as being of special interest are preserved and protected by the designation of their habitats as protected areas.

The directive sets out measures for the institution of Natura 2000, a European ecological network of sites which are deemed to be of interest and importance to the Community. This includes sites containing habitats of plant and animal species deemed to be of importance to the community, and those classified as 'Special Protection Areas' under Directive 79/409 for the protection of birds. The directive outlines the steps involved in the establishment of Natura 2000 as well as level of involvement required by each of the Member States. It also provides the guidelines to be followed by the Member States in the selection of those habitat sites and species.

The first stage of the process is for Member States to submit a list of sites which may be of Community importance following guidelines specified in the Directive. The Commission will then draw up a list of sites based on criteria established in Annex III of the directive. The final list of sites are to be ratified by a committee of representatives from the Member States and then specific sites are to be designated as Special Areas of Conservation. Member States are obligated to protect all sites on the final list of sites of Community importance.

Special Areas of Conservation and Special Protection Areas are to be protected by the following measures:

- Member States are required to avoid loss of habitat and disturbance of selected species in any of the areas,
- Plans or projects to be carried out on any site are to be subject to an assessment of the effects which they may have on the site, and
- If the project will have negative effects on the site but the project must be carried out for reasons of public interest, economic or social interest, there being no alternative, then the Member State must make all efforts necessary to ensure that the Natura 2000 network remains cohesive.

Member States are required to establish measures for the protection of species considered to be of importance to the Community. These measures include the preservation of habitats, the prevention of disturbance to the species, and the prohibition of killing, capture, transport or sale of the species. Picking, collecting, cutting, and uprooting of plant species listed is also to be

prohibited.

A report to the Committee on the implementation of the Directive is to be submitted by the Member States every six years from the notification date. Research and information exchange in the area of species and habitat conservation is to be encouraged by the Committee and by Member States.

8.3.17 Convention on Environmental Impact Assessment in a Trans-boundary Context

This was put forward by the **UN Commission for Europe**, and is an attempt to apply principles of environmental impact assessment to policies, plans, and programmes. It takes a more structural approach to water management, as is reflected in the Convention's **Protection and Use of Trans-boundary Watercourses and International Lakes**. This agreement carries the following provisions:

- Conservation and restoration of ecosystems as a general principle;
- Co-operation not only in individual projects, designated sites, and sectoral policies, but also in the development of policies, programmes, and strategies covering entire or partial catchment areas;
- The procedures for Environmental Impact Assessment to establish the relationship between the (trans-boundary) river environment and its impact on coastal state water quality; and
- Joint bodies are suggested and the co-ordination of their activities with other joint bodies within a shared catchment area.

8.4 Summary

Since the mid-1980s, the co-ordination of water management has intensified at the regional level in European politics. Recognition of the inter-dependent nature of water management between upstream and downstream users, has moved the European Community to push the process of management into the international arena. This European effort has taken innovative approaches to the protection and conservation of transnational boundary natural resources in international and EC legislation.

The importance of mainland European rivers in the International context has led to the wider integration of EC environmental legislation into member country national legislation than has occurred to date in the UK.

9. SUSTAINABLE DEVELOPMENT

9.1: Introduction

The United Kingdom is committed through several treaty obligations to the adoption of sustainable development. As an outcome of the Rio Summit, the UK and other governments were also committed to preparing annual reviews of progress towards sustainable development (Department of the Environment 1993), as well as a series of other specific documents (H M Government 1994). These are, however, somewhat thin in content.

The principle of sustainable development is most commonly summarised by the Brundtland definition (World Commission on Environment and Development 1987): "*development which meets the needs of the present without compromising the ability of future generations to meet their own needs*". As a slogan, this is easy to adopt as it seems little more than commonsense: technical analyses of sustainable development abound (Pezzey 1989). What is more difficult is to define what this means either in terms of policies, programmes, plans and projects or to the assessment of them.

One way of elucidating what sustainable development means in practice is by setting up two artificial extremes in the debate and applying a dialectic to them. These two artificial extremes of philosophical approaches to sustainable development may be labelled the 'neoclassical economic' approach and the 'radical ecologist' approaches.

The neoclassical economic approach (Pearce, Barbier and Markandya 1990) diagnoses nonsustainable development as being inefficient in economic terms in the long run and as resulting from a failure of market prices to capture all of the opportunity costs of production and consumption. Its prescription is then to correct markets and prices to reflect true long run opportunity costs.

What may be termed 'radical ecologist' approaches (McBurney 1990; The Ecologist 1993; The Group of Green Economists 1992) diagnose nonsustainable development as being a socio-political problem where nonsustainable development is a symptom resulting from structure of social relations and the pattern of ownership of resources. Its prescription is therefore to adjust social relations and the ownership of resources towards those required for long run sustainability where this requires not simply the efficient use of resources but also the equitable redistribution of resources.

Most conceptualisations of sustainable development involve a mixture of these two philosophical approaches. Thus, the famous Brundtland Declaration (World Commission on Environment and Development 1987) refers not only to the rights of future generations but also to those in the less developed parts of the world. Similarly, the Dublin Declaration (ACC/ISGWR 1992) on Water, agreed as part of the preparations for the Rio Summit, sets out four principles:

- Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment.
- Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels.

- Women play a central part in the provision, management and safeguarding of water.
- Water has an economic value in all its competing uses and should be recognised as an economic good.

If the two approaches differ in their diagnosis, both approaches essentially agree that it is necessary to distinguish between three forms of capital or stock resource:

- *human capital* (including transport and other forms of infrastructure, plant, equipment and so forth)
- *renewable natural resources* (eg fish stocks, groundwater, river flows)
- *nonrenewable natural resources* (eg fossil fuels, climax woodlands)

Where they differ is in the extent to which sustainable development allows for the substitution of one form of capital for another; in particular, the extent to which increases in human capital can be substituted for decreases in nonrenewable natural resources.

They also generally agree that sustainable development requires two shifts in the patterns of consumption:

- towards the use of renewable resources and away from nonrenewable resources; and
- limiting the use of renewable resources to the sustainable yield from those resources.

If the use of renewable resources is to be limited to the sustainable yield of these resources, or the *carrying capacity* of each of those classes of resource, then it is necessary to determine what is that sustainable yield. Consequently, the NRA should seek to determine what are the sustainable yields of the renewable resources for which is responsible under varying climatic and other conditions. Similarly, it should seek to collaborate with other agencies in the establishment of the carrying capacity of other forms of renewable natural resource.

This carrying capacity is influenced by the impacts of other forms of human and natural activity. It is, therefore, necessary to determine what are the *critical loads* (Critical Loads Advisory Committee 1994) for both renewable and nonrenewable resources, exceedance of which will reduce either or both the stock of or yield from that resource. The NRA should continue to play a full part in the studies to determine critical loads.

Although the two philosophies disagree about diagnoses, both incorporate a general expectation that some forms of consumption of resources will decrease. In the neoclassical approach, this reduction is simply a byproduct of the pursuit of long run efficiency. In the radical ecologist model, reduction is essentially an end in itself: the radical ecologist philosophy tends to see the 'excess' consumption as immoral.

For example, a mango sold in the UK is estimated to require 600 times as much energy to grow and transport it as it yields in food energy. The neoclassical economist will see nothing inherently wrong provided that energy is priced at its long run opportunity cost. The radical ecologist is likely instead to talk in terms of the agriculture of developing countries being 'distorted' towards the production of cash crops instead of food, the negative redistribution of land

away from peasant farmers, and the developed world taking an excessive share of available nonrenewable resources because they are richer. Radical ecologists are more likely to talk therefore in terms of what is fair and neoclassical economists in terms of what is efficient.

The neoclassical economics: prescription

The neoclassical economist will argue that development is and will not be sustainable unless:

- the cost or price of a resource does include all of the real opportunity costs of the resource, including those consequences which are not priced at present (termed 'externalities'); or
- the price of a good is set equal to its long run marginal cost.

Thus, neoclassical economists would place a great reliance on the use of pricing or charging mechanisms to bring demand into line with supply, perhaps through the creation of a market. Therefore, the types of strategy which the neoclassical economist will prescribe may include:

- charging for abstraction of ground and surface waters;
- metering domestic and all other forms of water consumption;
- charging for nonpoint runoff loads (eg nitrates, pesticides) and volumes;
- infrastructure charges which reflect the true location specific marginal costs of system expansion;
- charging for discharges to surface and ground waters;
- charging landowners for surface water runoff; and
- the creation of new property rights for environmental assets which can be bought and sold, the highest bidder, by definition, being that individual or organisation who can make best use of that resource.

These principles are encapsulated in the slogans '*the polluter pays principle*' and '*the user pays principle*'. A general restriction made concerning economic instruments (Department of the Environment 1993; Tietenberg 1991) is that they are unlikely to be suitable for pollutants which are cumulative.

In their own terms, these approaches have some difficulties in implementation. Firstly, pricing a resource does not itself result in any reduction in demand. Thus, water metering in itself does not save a single drop of water⁶. What prices do is provide a signal about the desired change in behaviour by the consumer and provide an incentive for making that change. It is this induced change in behaviour which results in the reduction in demand where effecting this change in behaviour causes the consumer to incur some costs. In effect, the cost of water metering, for example, is simply a transaction cost and the economist will ask whether other means of effecting the reduction in demand might not result in a lower total cost for transaction and behavioural

⁶ What reduces demand is the installation of water efficiency appliances or changes in behaviour; if that is what is wanted, then metering is one way to seek to induce these changes.

modification. It may, for example, be the case that either the reduction in water leakage or retrofitting existing building with devices which use less water (American Water Works Association Water Conservation Committee 1993; California Urban Water Agencies 1993; Dewitt 1991; Maddeus 1987) would be more efficient.

Secondly, to the neoclassical economist, part of the virtue of a market is that changes in demand for a product or resource cause the producers to change the supply. However, for natural resources, supply is exogenously determined by such factors as climatic change. The scope for the market is, therefore, limited to allocating an exogenously determined supply between competing consumers. Although all markets require supervision and maintenance, even the earliest legal code, that of Hammurabi, containing requirements for regulating markets, it is likely to be true that an allocation system will require more supervision and maintenance than a true market.

Thirdly, in a true market, prices and the quantity consumed not only fall out of the interaction of suppliers and consumers but at levels which are jointly optimum. The market-like approaches proposed by neo-classical economists seek to invert this process: to create a set of prices such that the optimum quantities emerge. To do this can require more information than exists. For example, to set the appropriate charge for wastewater discharges to a river so as to result in the optimum level of discharge requires knowledge of both the costs of the damages resulting from different levels of pollution in that river and the marginal costs to the polluter of pollution abatement. The first is difficult and expensive to determine; for the second, the polluter has the best information and the polluter is strongly motivated to conceal the true costs. Therefore, the optimum level of pollution in efficiency terms is unknown and largely unknowable.

Consequently, the use of pollution charges is likely to be most effective if all considerations of economic efficiency are abandoned. Indeed, arguably the most effective use of charging is the Dutch system which was originally intended simply as a revenue raising measure (Bressers 1983). Instead, prices should be considered solely as providing signals about the desired direction of the change, and as providing incentives to make that change. This signal will itself provide an incentive to draw forth technological innovation which will reduce the costs of pollution abatement, as well as expanding a market for pollution abatement equipment which will drive down costs. Therefore, the process of charge setting is one of 'hunting' towards the optimum.

The system adopted in Germany for wastewater discharges (Imhoff 1992) may be argued to follow this approach. Charges are set to ratchet upwards over the years, this planned schedule of price rises both allowing for the capital intensive nature of much pollution abatement and time for technological innovation. If, however, it appears that the charges are insufficient to induce the required reduction in discharges then the ratchet can be tightened. Conversely, if it appears that the costs of pollution abatement are beginning to exceed the benefits, the ratchet can be slackened off.

It might be generally argued that neoclassical economics places an excessive reliance upon financial incentives and totally ignores all other possible incentives, such as moral pressure. In those charging systems which have been successful, notably France and Germany (Opschoor and Vos 1989), the monies collected from charges are used for soft loans and grants to polluters to invest in pollution abatement equipment. In addition to being fiscally neutral, it adds the incentive of moral persuasion. Such a 'recycling' approach is becoming commonplace in Eastern Europe where charges are being increasingly adopted.

Such hypothecation of a tax like charge is abhorred by finance ministries worldwide and the so-called 'Treasury Rules', although lacking any constitutional weight or significance, discourage such hypothecation. Conversely, if a charge is not hypothecated then it risks becoming simply a revenue raising measure. Market failure is likely to increase the effectiveness of a charge as a revenue raiser whilst reducing its economic efficiency. There is consequently a danger that the organisation collecting the charge develops a hidden interest in maintaining market failure.

Therefore, the NRA should continue to explore the use of economic instruments but with the proviso that the monies thereby raised are not lost to some general revenue pool.

In many cases, it has been found that the price elasticity of demand for water related resources is low: a large price increase is necessary in order to achieve a small decrease in demand (Gibbons 1986; Herrington 1987; Stevens, Miller and Willis 1992). In such statistical analyses it is not possible to separate out true elasticity from inefficiency: the failure of the consumer to act in his or her best interest. There is evidence that such inefficiencies as a result of market failure are present (Brechling, Helm and Smith 1991): thus, measures of the price elasticity of demand may be no more than measures of the extent of market failure. In this case, measures other than charges are likely to be necessary in order to shift behaviour. On their own, charges may otherwise yield substantial income but be inefficient. The use of moral suasion is but one such approach. It is worth noting that in the United States, 'retrofitting' has been introduced in order to reduce water demand in areas where water metering is already standard practice (California Urban Water Agencies 1993).

In general, whereas economists were once convinced that economic instruments such as charging structures were inherently more efficient than regulations, or 'command and control' measures, this conviction has waned when confronted with the real world (Common 1989). Thus, the general conclusion is now that mixtures of economic instruments and command and control strategies are likely to present the best option (Bernstein 1993; Palange and Zavala 1987). In particular, when confronted with what are essentially monopolistic abstractors and dischargers in relation to a particular catchment, the neoclassical economist will have further doubts about the likely efficiency of charging mechanisms. Charging structures may be effective as tax raising strategies but it will be difficult to achieve efficiency improvements where competitive price pressures do not force the abstractors or dischargers to seek to minimise their costs, and hence consumer prices.

Whereas demand management methods are likely to result in a reduction in total demand, one effect of the use of charges for abstraction and discharge is likely to be a redistribution of abstraction and discharges between catchments. The total volume abstracted, for example, may not be very different after the introduction of abstraction charges. However, the points and catchments where abstractions are made may change. It may, therefore, be simpler to design a charging strategy with that consequence explicitly in mind than to develop a more complex charging structure. Thus, a charging structure may be designed to direct abstraction away from catchments where abstraction is already above sustainable yields; to direct discharges away from catchments where pollution loads are above assimilative capacities; or peak runoff volumes are above the channel capacity. The NRA should, therefore, focus its interest in economic instruments to those contexts where current abstractions or discharges are above carrying capacities.

Neoclassical economists will also favour, in principle, infrastructure charges which reflect the true local marginal costs of system expansion rather than a flat charge across the company's area.

In consequence, that development will tend to locate in those areas where the costs of system expansion are least. However, they recognise the problems of marginal cost pricing in capital intensive industries, like the water and sewerage industry, are formidable (Hanke and Davis 1973; Mann, Saunders and Warford 1980; Turvey 1976). The NRA should discuss with OFWAT the extent to which the companies can be encouraged to adopt marginal cost pricing in relation to infrastructure charges.

Again, they will favour the levying of charges for changes in runoff, both in terms of quantity and quality, whether this change occurs because of changes in agricultural practices or through urban development. They will want such charges to reflect either the impact of the runoff on the environment, or, where a system of collection and treatment is in place, to reflect the marginal costs of so collecting and treating the change in runoff. Consequently, in some cases, it will be more financially desirable to the landowner to store and/or treat that runoff onsite. Whilst the administrative costs necessary to set marginal cost charges for runoff volumes and loads are not likely to be negligible, they have been used successfully in the United States (Gilbert 1988). Indeed, in the United States, complex and subtle charging structures have been developed (National Regulatory Research Institute 1991). Therefore, it is desirable that OFWAT require the companies to explore the feasibility of adopting such marginal cost pricing.

Artificial barriers, such as the legal issues described by Howarth (1992), to the use of least cost solutions would consequently require removal. The NRA should, therefore, lobby for the appropriate legislation to be introduced. Some systems of onsite infiltration have, for example, been shown to be cheaper than conventional tanking solutions (Ojolo 1994). More generally, it would be necessary to prevent the sewerage companies from using their local monopoly power to enforce solutions which maximise their profits rather than economic efficiency.

The neoclassical economist has some problems with rights to abstraction or discharge which were granted in perpetuity where these affect the scope for licences for abstraction or discharge being granted to others at a later date. In economic efficiency terms, where there is a limited resource, it should be used by that individual or organisation which can make best use of it and not simply the first person who made a claim upon it. If an existing licence holder is using that resource for a lesser purpose than someone who is seeking a licence, then that licence should be reallocated to the new use on economic efficiency grounds. Where the stockpiling of licensed rights is essentially costless to the holder of those rights, then economic efficiency is particularly likely to be damaged. The holding of such rights can be an effective barrier by which to prevent the entry of competitors to the market.

The neoclassical economist's preferred solution to this problem is to make these rights tradeable so that the right, say, to abstract a given quantity of water or discharge a given quantity of waste can be bought and sold in a created market. However, the evidence is that unless the costs of holding such tradeable permits is made sufficiently expensive then the advantages of preventing potential competitors entering the market and of hedging against future uncertainties outweigh to the existing license holders any benefits from selling on such permits (Opschoor and Vos 1989).

In general, tradeable permits are likely to work best when conditions approximate to a competitive market: many small producers, none of whose actions can have a significant effect upon the overall level of supply or price. Thus, the scope for the use of tradeable permits appears less in the water area than, say, for air pollution.

Ignoring for the moment the problem of an excess of licensed rights over available supply, the economist will, therefore, want charges for unused licensed rights as well as actual abstractions or discharges so as to encourage license holders to relinquish those rights.

The radical ecological model

In the radical ecological model, economics are part of the problem. The radical ecologists argue that whereas economics subsumes the ecosystem into the economic system, in reality, the converse is true: without the survival of ecosystem, there can be no economic system. Hence, attempts are being made to develop a wider economics based, for example, upon energy flows (Constanza 1980).

Secondly, they will recognise that against the neoclassical economist's ethical claim that value is the instrumental value of a resource as determined by each individual's preferences, there are other concepts of value. In particular, they will place greater emphasis on the 'deep ecologists' (Devall and Sessions 1985) ethical claim that species have an inherent right of existence by reason of existence (Naess 1993). Consequently, that the economic value of a resource measures only part of its value (Green 1992; Wilkinson 1994). Consequently, they would place even greater emphasis on the concepts of *critical*, and *constant* natural capital (Countryside Commission/English Heritage/English Nature 1993) than do the neoclassical economists.

'Critical natural capital' is defined as that irreducible minimum network of those sites or habitats such that no loss of any single site amongst those making up the network is acceptable. Each such site is typically irreplaceable under any realistic timeframe.

'Constant natural capital' is the stock of sites or habitats such that, provided that the totality remains unchanged, the loss or damage to any single site is acceptable if an adequate substitute is created. In the United States, wetlands are now managed on a constant natural capital basis.

The principle of critical natural capital is arguably embedded in the Habitat Directive (42/93) of the European Union. Therefore, the NRA should seek, in association with the statutory consultees, to identify, for each catchment, those areas or features which constitute the critical and constant natural capital.

For other forms of natural capital, *tradeable natural capital*, the sacrifice of such capital is acceptable provided that the gains result in an increase in economic efficiency.

Whereas neoclassical economists are driven to a reliance upon these terms because of problems of defining 'nonuse' value, the concepts of critical and constant capital are consistent with the deep ecologists' concept of the inherent value of species.

The radical ecologists' prescriptions are likely to include:

- a preference for the management of renewable resources as a common property resource through, for example, the creation of river basin committees made up of users, regulators, local government and other interested parties rather along the lines of the French 'Basin Agencies';
- the imposition of legal duties to ensure that resources are used efficiently on all parties (eg the consumer, the NRA and subsequently ENVAGE, OFWAT, the companies and other

decision makers);

- the imposition of a similar duty to conserve and enhance the environment, similar to that on the NRA, being made on the same parties;
- an emphasis on control at source rather than 'end of the pipe' solutions.

They will be likely to define the problem of over-abstraction of groundwater and surface waters as resulting from the Anglo-Saxon tradition of treating natural resources as essentially infinite and granting private rights in perpetuity to the use of such resources. Typically, in countries following such a tradition either more rights were granted than was the sustainable yield of the resource, or other changes threaten to reduce the sustainable yield below that demanded by private rights.

Thus, in some cases, essentially non-existent rights were created to resources which are not there. The right of the owner of such a created right to compensation for the extinguishing of this, in some cases non-existent, right makes reducing the demand to the sustainable yield potentially expensive. The proposed use of economic instruments, such as charges, would then be seen by radical ecologists as an attempt to recover from this over-allocation of resources: as a band-aid approach to basic problem.

The radical ecologists instead point to the success in other cultural and legal traditions of the management of water resources as a common property, notably in Holland and Spain, as well as in other countries (Berkes 1989; Bromley and Cernea 1989; Maass and Anderson 1978; McCay and Acheson 1990; National Research Council 1986; Seabright 1993; Synder 1990). They argue that the sustainable yield of the resource is highly dependent upon exogenous factors such as climate and so the decision is one of allocating a fixed but variable supply between competing demands. Furthermore, that the good itself combines elements of a private and public good, and that equity of allocation is important. In this instance, they argue that management as a common property resource has been found historically to be adaptative (Ostrom and Gardner 1993). Consequently, rather than use what they would term as a band-aid approach, they would seek a shift to management of water resources as a common property resource.

The radical ecologists would propose that a legal duty to ensure that resources are used efficiently so that demand management is considered, arguing that otherwise the tendency is for solutions always to be demand chasing. The neoclassical economists, it was noted above, would require that any proposed expansion in demand should be judged by assessing the true marginal value of the increase in demand, and that this should, ideally, be done by introducing marginal cost pricing.

Both groups would therefore welcome the NRA Board's (NRA 1994) statement that: "*Before any new sources are developed, it is essential that the water companies make sure they are doing all they can to reduce leakage and carry out demand management*". However, the radical ecologists would want a duty to set out in those terms not only for water supply but also for other aspects of the water cycle. However, they will argue that such an conceptual approach can, and should, also be applied to discharges, runoff and other aspects of the water cycle. In addition, that such a duty be imposed upon all parties involved, including both OFWAT and the companies.

They would argue for a managed approach because they will argue that a reliance upon a market approach only works when the decisions of one person in a market have no effect upon anyone

else. A perfectly competitive market is defined in economic terms as one where the decisions of any one producer or consumer have no effect upon the quantity or price of the good. Conversely, they will argue that this is not true in regard to many decisions in regard to a catchment. Thus, that if a pricing structure were established so that landowners created individual on-site storage, then this would only accidentally and improbably result in the hydrologic regime which was most efficient for the catchment as a whole.

They will also consequently argue for the need for a strategic approach rather than one where the pattern of development is determined largely by the accidents of land ownership. Equally, they will argue that devising and maintaining a charging structure is difficult and expensive for a good which is a public good, and where there are other interdependencies between the actions of individuals. Where only some externalities are recovered through charges then the market will also be distorted.

Thus, neoclassical economist's first thought will be that those protected by a flood alleviation scheme should bear the costs of the scheme. However, the individual landowner's share of the cost will vary according to the nature of other development protected: if the level of development increases in the protected area, so the mean charge rate should fall. Equally, in some cases, floodprone land has been released for development in order to protect other environmentally more important areas from development pressures (Parker and Thompson 1990). Charging for flood protection would redirect development pressures towards those other more sensitive areas.

In these conditions, planning is, it will be argued by the radical ecologists, more efficient than constantly reassessing the locally appropriate prices. Equally, whereas the locally appropriate prices will constantly change over time, a plan offers some stability to developers and landowners.

They will also note that 'catchments', or sub-catchments, are typically regarded as the natural form for local government administrative areas (World Bank 1993).

In the absence of such a pattern of local government in England and Wales, they will argue for 'catchment management' committees, made up of users, members of local government and others interested in the sustained management of the resource. The French system of catchment 'parliaments' (Barraque, Berland and Cambon 1994; Meubkat, Babillot, Chenard and Touze 1987) may be seen as similar to this approach.

The European Union has adopted the principle of *subsidiarity*, of the devolvement of power when possible and appropriate down from the Union and the nation states to the lowest possible level. In a highly centralised state, like the United Kingdom, this principle has yet to be put into general practice. However, it is consistent with, for example, the Dublin Declaration's principle of public participation.

They will want to see the use of *strategic environmental assessment* (Therivel, Wilson, Thompson, Heaney and Pritchard 1992) as part of this planning process, involving consideration of water related and other environmental constraints. More generally, they will argue that planning is a process and not a product.

The neoclassical economist wants to use charges or prices which reflect all costs, including environmental externalities, and regards the possible development of, for example, of onsite closed cycle water and wastewater treatment (Niemczynowicz 1991) as a development which

should occur if it is efficient. Legal, monopolistic or planning barriers where they obstruct efficient new approaches should be removed. The radical ecologists will, however, tend to favour such systems on principle, particularly where these make less demands on nonrenewable resources than do conventional systems. Consequently, they will favour active measures to encourage and expand their use.

For example, the NRA should lobby to ensure that the Building Regulations are updated so as require the use of water efficient and waste efficient fittings. Similarly, the NRA should also seek to ensure that British Standards and ISO standards similarly embody requirements leading to efficiencies in the usage of water by domestic and other appliances.

Again, the NRA should undertake an educational and information campaign to raise public awareness of the possibilities for improvements in the efficiency of the use of water. It might develop an award system for building developments which demonstrate advanced efficiency, similar to the existing energy efficiency award system. A labelling system might also be introduced for domestic appliances, similarly to that which exists for energy efficiency.

Overall, the radical ecologists will favour solutions which result in reductions in source rather than 'end of pipe' solutions. In this they will agree with Gardiner's (1994) prioritisation of surface water management strategies as:

- 1) "Maximise infiltration at point of rainfall
- 2) Optimise storage/infiltration in surface water system
- 3) Extend storage as practicable (eg on redevelopment)
- 4) Provide balancing lagoons
- 5) Increase storage in river systems (eg washlands/multistage channels)
- 6) Ease bottlenecks in river system (eg old mill systems)
- 7) Divert flows to alternative river channels
- 8) Contain flows (deepening/widening channels)"

They will also favour the adoption of the *precautionary* principle (O'Riordan and Weale 1990): taking precautionary action against potential threats before scientific certainty as to the extent of that threat is high. Neoclassical economists would not disagree with this principle in theory, but would wish to assess the costs of being wrong (if current information were to prove to overestimate the threat) against the benefits of being right (the losses which will result if the current estimate of the threat is correct) on a probabilistic basis.

9.2 Lessons From the Case Studies

Looking across the national case studies, and to a limited extent taking into account wider knowledge of procedures in the individual countries, some broad generalisations can be made.

These are summarised in **Table 1**. There are some differences as well as some commonalities. However, the particular approaches emphasised in the individual case studies reflect the particular problem in each area. Consequently, that all sustainability issues are not highlighted in each individual case study simply reflects the particular nature of the local problem. Thus, the different case studies tend to demonstrate those different aspects of sustainability which are most relevance to the local problem. This also means that the different case studies tend to bring out different points.

Thus:

9.2.1 The Netherlands

Geldersee Floodplain

This demonstrates the advantages of combining the planning of the water environment with land use planning in achieving the sustainable development of the Rhine riparian areas, which are to be developed for both recreation and nature conservation. It enables the restoration of alluvial forests, open water, marshlands and grass vegetation, and is coordinated with water quality management plans. Buffer zones are used to protect areas of critical natural capital from all human activity.

9.2.2 France

The Master Plan for Water Planning and Management (SDAGE) and the Plan for Water Planning and Management (SAGE) are both recent initiatives which seek to provide guidelines for a sustainable balance for the water environment within a framework of regional planning policy.

The problems arising from increasing urban runoff are being addressed through direct ground infiltration and flood peaks are to be reduced through the temporary storage of water on floodplains. Such source control measures are the subject of three of the case studies. Clearly, there are lessons for Britain where both public authorities and the sewerage companies are generally reluctant to adopt balancing ponds and other source control measures for long term maintenance.

Bordeaux

In the interests of operational efficiency, the public authorities accept the transfer of responsibility for drainage works for the evacuation of storm water from private property. Experiments have been carried out on the implementation and management of such works and to determine rules to govern the size of such works.

Department of Seine-Saint-Denis

The drainage strategy for this area, which is currently being comprehensively redeveloped, is based upon publicly provided retention basins. These basins are form part of storm drainage network which has a highly automated control system.

Vitrolles

In an area of rapid development, an inter communal planning syndicate has sought to resolve potential flooding problems through a network of dry retention basins, where these basins are also developed to provide amenity and recreational facilities.

Saintes

The town is subject to major flooding and a Risk Exposure Plan has been adopted to define those zones in which development may take place, and the restrictions which apply to any development.

9.2.3 Portugal

Metropolitan Lisbon

Rapid, uncontrolled urban development of the watershed and river corridors was followed by catastrophic flooding. The inter agency ad hoc task force set up in response has resulted in the establishment of floodplain mapping, legally enforced buffer zones surrounding the river corridor, and administrative structures based on catchments.

Setubal

The capacity to participate depends upon access to information. GIS and compute graphics are being developed to enable the public to access and manipulate data so as to enable public participation in decisions about the management of the river catchment.

9.2.4 Germany

The Vils River and Rhineland Polder studies demonstrate the opportunities that exist to restore the storage capacity of the river corridors whilst, simultaneously, rehabilitating the ecosystems of those river corridors.

9.2.5 Great Britain

The Cotswold Water Park, an area under great pressure both from mineral extraction and leisure development, demonstrated a 'bottom up' approach to defining environmental carrying capacity. An after-use led strategy comprising three zones has been evolved as a basis for informing political debate.

9.2.6 Summary

It is notable that all the countries are in the process of changing the administrative or legal systems relating to catchments; that management strategies are rapidly evolving. The case studies therefore illustrate what are seen as signposts of best practice in an emerging and evolving field.

Whilst seen from the present perspective as being 'best practice', the case studies themselves have been implemented over a period of several years. New best practices can be expected to emerge in the course of this evolution; best practice necessarily following the development of 'best concepts'. Thus, a review of best practice in five years time might show a different emphasis on particular aspects as new techniques are added to the existing portfolio, and current best practices become seen as self-evident truths.

Generalising across all the countries, there continues to be a heavy reliance on regulations, as opposed to the use of economic instruments although France, Germany and the Netherlands all have extensive and largely successful experience with the use of economic instruments in conjunction with the use of regulations.

All the countries are adopting or already using multi-objective integrated land and water planning.

With the exception of France, the involvement of the public is seen as a priority. France and the United States appear to have placed the greatest emphasis on demand management and source control, although this may be a consequence of the selection of the case studies.

Matching local administrative planning boundaries to coincide with catchment boundaries is usually undertaken by creating new and often semi-informal structures rather than by radical revision of historical boundaries.

The lessons from the case studies are predominantly closer to the prescriptions of the radical ecologist approach than to the neoclassical school. This reflects the lack of use of economic instruments found in the case studies selected and the use of planning, regulatory and management approaches instead. Both perspectives are reflected in the Cotswold case study as both groups agree with the need to identify natural capital. The neoclassical economist will also support use of Risk Exposure Plans, the Saintes case study, as a way of correcting for market failure: of supplying the information which the market needs to operate efficiently. So, however, will the radical ecologist support this approach because it is a management approach.

9.3 Conclusions and Recommendations

At the beginning, an artificial differentiation between a 'neoclassical economics' and 'radical ecologist' approaches was made. In practice, the NRA and its successor should pick and choose between the different strategies preferred under each approach. A number of these strategies are preferred by both approaches. Thus, it is recommended that:

- R1: The NRA should lobby for an explicit duty to conserve natural resources to be incorporated into the legislation establishing ENVAGE, and for a related duty covering water resources be set upon OFWAT and the companies.
- R2: For each catchment, the NRA in consultation with the relevant agencies (eg English Nature, the Countryside Commission, English Heritage) and others should identify the components of critical natural capital and constant natural capital.(see R47)
- R3: The NRA should continue to participate in existing studies on the critical loads to resources and ensure that studies are undertaken for all resources for which is responsible.(see R47)
- R4: The NRA should quantify the carrying capacity, or sustainable yield, of those resources for which has a responsibility and, where appropriate, encourage the definitions of these capacities for other resources by the relevant organisations.(see R47)
- R5: The NRA should initiate a discussion with OFWAT and planning authorities as to the scope for setting infrastructure charges on a marginal cost basis.
- R6: The NRA should establish catchment committees, including representatives of the planning authorities, user groups and other interested parties as part of the catchment planning process.
- R7: The NRA should apply strategic environmental assessment within its own functions.(see R40)
- R8: The NRA in considering any increase in demand in any part of the water cycle, including proposals for changes in wastewater discharges, should consider whether a demand management strategy would not be more efficient.

- R9 The NRA should encourage research and innovation in closed cycle onsite water and wastewater systems.
- R10 The NRA should levy charges upon un- or under-utilised licenses for abstraction and discharge in order to encourage the release of those existing rights.
- R11 The NRA should continue to investigate the use of economic instruments, such as marginal cost pricing, for abstraction, runoff and other discharges. In investigating these options, it should pay due attention to the likely costs of operating and controlling compliance with such a system. The first area of application is probably in catchments where existing rights to abstract or discharge exceed the sustainable yield or assimilative capacity of the catchment. It is likely, however, that economic instruments will be found to have the greatest scope in other areas of The Environmental Agency's functions.
- R12 Where any economic instruments are introduced, the NRA should seek to ensure that the income generated is dedicated to the reduction of the problem which the charge is intended to reduce. The purposes to which this income might be applied include soft loans, grants and demonstration projects.
- R13 The NRA should seek necessary changes in legislation so that artificial barriers to the wider use of efficient methods of onsite storage or disposal of runoff and wastewater are removed. Such legislation should be such so as to ensure that the sewerage companies are not placed in a position so as to exploit their local monopolies by inhibiting the innovation of efficient solutions.(see R45)
- R14 The NRA should seek to the updating of the Building Regulations so that water consumption and discharges are minimised through the use of efficient fixtures and fittings. By involvement in the relevant BSI and ISO committees, it should seek improvements in the water efficiency of domestic and other appliances.
- R15 The NRA should consider introducing a labelling system for water efficiency for domestic appliances.
- R16 The NRA should consider starting an award system for building developments which achieve an above normal efficiency of water usage or wastewater disposal.
- R17 The NRA should ask OFWAT to seek to promote the wider use of marginal cost pricing by the water and sewerage industries.

Overall, therefore,

- R18 The NRA should set itself the objective of winning the Stockholm Water Prize within the ten years as a leader and innovator in sustainable water management.

Of these recommendations, both the radical ecologists and neoclassical economists would agree with recommendations 2, 3, 4, 8 and 13; those relating to the identification of natural capital and to the removal of artificial barriers. There is likely to be some measure of agreement on most of the others, particularly 15, although, in some cases for different reasons. Thus, in the instance of water efficiency, the neoclassical economist will see this as a way of correcting for market failure caused by imperfect information, the radical ecologist will simply see anything which

encourages the conservation of resources as a good thing. Those which can be seen as principally originating from a neoclassical economic framework are recommendations: 5, 9, 10, 11, 15 and 17; those concerned with the use of economic instruments. Conversely, the radical ecologist perspective is more reflected in recommendations: 1, 6, 7, 12, 14, 16 and 18; those which are more directed towards planning and management.

That the recommendations may appear to owe more to the neoclassical economic approach than to the radical ecologist perspective, whereas the case studies illustrate the opposite balance, is partly a consequence of introducing a distinction for dialectic purposes. Or, simply that at the time that the policies for the case study areas were being developed, the neoclassical economic options were just not considered.

Table 1 Case Studies and Sustainable Development

	Country					
	United Kingdom	France	Germany	USA	Portugal	The Netherlands
explicit objective of resource conservation	••	•	••	•	••	•••
identification of natural capital	•••	•		••	••	••
use of economic instruments			•	•		•
catchment basis for planning	•	•	•	••	••	••
public participation and consultation	•		•••	••	•••	••
demand suppression or source control		•••		•••		•
multi-objective integrated water and land use planning	••	•••	•••	••	••	••
development of regulations		•••	•••	••	••	••

Key

- relatively low importance or weight in case study
- moderate importance or weight in case study
- important tool or process in case study

10. OVERVIEW OF BEST MANAGEMENT PRACTICE

The objectives of this R&D project are :

- To study in the selected countries the level of integration of river basin administration in relation to flood defence, river environment conservation and enhancement, and associated land use planning.
- To study the response of water agencies to the impact of land use on the implementation of their functions.
- To study the relevant and possible contributions of developing European Union law to the practices in the different member countries.
- To identify best practice from the countries and systems studied and to make recommendations regarding their use applicability to the NRA.
- In this respect the research is targeted at suggesting changes that would enable the NRA to operate more effectively (particularly with the emergence of ENVAGE).

This summary chapter therefore seeks to highlight the lessons learnt from the country overviews, and their case studies, and to translate these into recommendations for the NRA to consider.

10.1 Introduction

A key problem for environmental protection in England and Wales is that the National Rivers Authority is expected to manage and regulate water issues (catchment planning, flood defence, etc.) without any statutory control of land use planning or land use change. Yet many water management problems are in effect land use management problems, be they the prevention of non-point source pollution or the prevention of the growth of flood damage potential in land areas liable to flooding.

Given the need for the integration of land and water management and planning, one ideal is for integrated planning at the strategic level, bringing together all environmentally related issues under the remit of one decision making authority. This, however, implies that all decisions can be made within one organisation, at the strategic level. In fact many important decisions are made on a "day to day" basis at lower levels of government and in local agencies.

One possible solution is that these local agencies operate within catchment boundaries that allow direct linkage with the NRA. However, to demand that local authority boundaries coincide with catchment boundaries is a politically naive concept. History and national culture has largely determined local authority boundaries with multi-functional boundaries far exceeding the functional responsibilities of water resources management.

Therefore we need to find arrangements, procedures, tools and mechanisms that allow and encourage integrated water and land management broadly within the current institutional and

legal arrangements. This must be done in a way that is sustainable and maximises, for the NRA, the effectiveness of the complete system while minimising its cost.

This research has gained insights into the ways that this is being attempted in other countries of Europe and the USA. It thus points to lessons that could be useful to the NRA, although these cannot often be transferred wholesale, simply and unchanged into the British scene.

10.2 Institutional Arrangements

The institutional situation in the different countries studied is very different and is changing rapidly as countries search for institutional arrangements that will better integrate their land use and water polices. Outside the list of countries studied here is New Zealand, which leads the way in integrating all aspects of the planning process. All countries have recognised that inadequate institutional arrangements are one of the prime causes for the continuation of unsustainable environmental protection policies.

10.2.1 Country Research Overview

Thus we see in **France** the new 1992 legislation and a move to Agence de l'Eau as mechanisms for integrating water quantity and quality management and land use planning and environmental protection on a catchment-wide basis, as an innovative step to achieve "all-in" planning. The French consensus approach is developing in this way from loose consensus to statutory Master Planning.

The system, however, is too embryonic to monitor its successes (or failures). It provides, however a good model for study, evaluation and potential application in other European states.

In theory, communes and inter-communal committees have planning, finance and regulatory functions under their remit. Basin agencies have a statutory responsibility for the development of Catchment Master Plans, giving directions for all users of water with local planning committees coordinating procedures at a local planning level.

Good practice is the multi-level co-ordination between the national state apparatus, the Ministry of the Environment and local land use plans. Even within source control the commune designs the system for the developer so best methods can be directed and implemented. This partnership arrangement, as in the **United States**, is commendable, because it means that the local community "owns" the plan and is therefore more likely to enforce effective and long term implementation.

The **Dutch** "bottom up"/"top down" consensus approach with integrated land and water planning at local (Provincial) and National levels (see Figure 1) is guided through their four-year National Plans. These are formulated at state level (the Rijkswaterstaat functional agency) and coordinated at the local planning level, controlled through provincial government and implemented by water boards under provincial 'control'. Rigorous national planning is crucial where physical space is at a premium, but this is not all. The **Dutch** also lead the way in local community involvement in flood management issues, particularly through their unique application of flood plain boards with both a water and land use planning role (see the Gelderse Poort case study). In this way a balance is struck between central oversight and local participation.

The **Portuguese** system of government also has a strong central downward direction with tight co-ordination at national, regional and local levels with legislation empowering local authorities. This strong central direction is commended.

In contrast the **United States** system is dominated by a horizontal structure of state level management, with a national aversion against Federal control, through the imposition of inter-state catchment planning. Furthermore incentive schemes, where the system is driven more by financial and political aspects, can override the prospect of environmental benefits. The 'manifest destiny' culture and the 'common enemy rule' leaves widespread scope for individual actions against the best interests of the community or state.

These actions are often encouraged by economic incentives and certainly supported in law by the Constitutional 5th Amendment of the Bill of Rights. On the positive side the National Pollutant Discharge Elimination System (NPDES), introduced in 1990, is attempting to provide a national best management practice for quality (and quantity) water control, particularly in the urban environment. This uses tiered decision making based on a 'Maximum Extent Practicable' approach.

The weakness of the **German** system lies in the level of non-statutory guidance. Plans are developed at every level, with the 'Lander' (federal states) at the top level setting objectives, with regions, districts and communities often presenting conflicting policies at lower levels. The Water Act is set at Federal level and enforced by districts, apparently missing out regional input into the planning system. Agriculture and mineral interests in Germany have strong lobbies which distort land use decisions.

In summary, in **France** the new institutional arrangements will, it is hoped, enable a consensus on land use and water related planning issues to be achieved. However, the weakness of the system is the time taken to reach consensus. In **Portugal** the new institutional arrangements provide strong central control and guidance, coupled with good local co-ordination. It is strongly felt that the UK ought to be heading in this direction⁷. In **The Netherlands** the fully integrated vertical institutional hierarchy is complemented by the effective community involvement in all levels of government. In **Germany**, with a complex four-tiered planning system, it is remarkable that administration and legislation are effective at all. There is concern, moreover, about the vested interest of commercial and agricultural interests, particularly with respect to application of pesticides. In the **USA** there is perceived to be too much non-statutory guidance and the excessive use of inducements to direct development away from critical areas. There is also widespread scope for corruption driven by economic incentive.

10.2.2 Lessons and Recommendations for the NRA

In **England and Wales** there is a common view within the National Rivers Authority that regional planning should have at least some statutory basis, to rectify a common weakness that better co-ordination is needed at a regional/national level. Consensus planning at the regional

The structure of the National Rivers Authority created in 1989 and the future National Environmental Agency are significant steps towards centralisation of the rivers and environmental functions.

level is generally seen as weak.

The review of procedures in the five selected countries suggests the following changes may be beneficial to the NRA:

- R19 In England and Wales there is a need for better co-ordination at the national level, which in turn is then reflected at the regional level, perhaps with some use of catchment boundaries as sub-regional boundaries.
- R20 The Scottish Regional Councils are an excellent model of this planning integration. This was commended in a 1992 review of water resource administrative systems by the World Bank. The abolition of this system will negate this integrated structure.
- R21 An ideal would be to 'tie together' the different strands of the environmental planning process, but there is currently no mechanism to unite the institutions involved, except for the role of the Department of the Environment.
- R22 Ideally an environmental agency should embrace land use planning, water pollution, air pollution, waste disposal and mineral extraction, which would be an advance over the current situation. Such an arrangement would necessitate a multi-functional approach.
- R23 British regional plans should have a statutory basis and be broadened to include water, forestry and agriculture etc. with the NRA more pro-active in regional planning. Catchment management plans were seen as an opportunity to do this.(see R42 and R44)
- R24 There is scope to improve the links between organisations, particularly the environmental agencies.
- R25 Institutional systems at estuaries should be arranged so that catchment based arrangements for water management interface effectively with coastal zone management agency areas responsible for coastal resource management.
- R26 Strong enforcement of weak legislation is better than weak enforcement of strong legislation.

10.3 Land Use Issues and Catchment Management Plans

10.3.1 Country Research Overview

Our country comparison indicates that as far as land use planning and decisions are concerned, the water resource management agency must provide a clear focus for communication with municipalities and all lines of local and regional government in order to create a strong framework for land use planning including development plans and development control.

This is best exemplified by the relationship between the Rijkswaterstaat and the provincial governments in **the Netherlands**, contrary to the horizontal and vertical disintegration of planning co-ordination in the **USA**.

In addition, land use plans need to be clearly communicated to the community they affect. No integrated approach to catchment management, with concomitant Best Management Practice, will succeed without full dissemination and discussion of factual material between all players affected by or affecting land use and water management related issues.

However, our research shows that information itself is not enough: there is no evidence from the country studies that knowledge polarises opinion. Open management, from the inception of a plan through to implementation, is fundamental to success. Withholding information, misleading or deliberately misinforming is no part of the planning process. Only by understanding the roles and motives of all players can resolutions to planning problems be found. Restrictive 'cabals' result in conflict; open management and information exchange will enable co-operation and compromise.

The involvement of the community requires:

- a clear and accessible method of approach,
- supporting information systems, and
- action to retrieve information from the community.

This brings obligations on the water/river management agency (see also "Mechanisms and Tools", below). The agency must provide clear land use constraint maps, for example the RAN (national agricultural reserves) and REN (national ecological reserves) produced in **Portugal** or the FIRM maps used in the **USA** Flood insurance programme for designating flood risk areas. The public must also be aware of the techniques used for flood plain zoning, source control and the creation of buffer zones etc. The incorporation of processes such as Strategic Environmental Assessment should include procedures for monitoring, public audit and review.

10.3.2 Prevention and Cure in Different Countries

Cure or prevention approaches to land and water management issues can equally facilitate successful planning:

The 'Cure' Approach

Development proposals can be used as a catalyst for environmental restoration or enhancement. Source control projects in Bordeaux, **France**, and numerous examples in the **USA** exemplify this.

Promoting the designation of river corridors as environmentally sensitive landscape areas for nature conservation and rehabilitation can be beneficial, for example the Integrated Rhine Programme in Baden Wurtemberg, **Germany**, and further downstream in **The Netherlands**, the 'Stork Plan' as exemplified in Gelderse Poort.

Promoting greater public awareness of water environment issues as is paramount in **The Netherlands** via environmental television channels and public involvement in the production and implementation of Master Plans (**France**).

The 'Prevention' Approach

The promotion of a vertically tiered system of statutory planning from national through regional (provincial) to local (municipal) levels can be beneficial, focusing on the integration of land use, water management and conservation. In **The Netherlands** water is all pervading and used as an integrating medium affecting decisions on land use, encompassing both agriculture and nature conservation.

Community involvement at every planning phase of land use planning is important to success. There should be a symbiotic relationship between local authorities and water/river authorities to articulate land use requirements, with respect to both the short and long-term (for example, climatic change - see **Dutch** policy on the review of Delta Plan dike standards in the context of development of sustainable flood plain environments).

Promotion of effective and timely information management is important for an effective preventive approach to land use planning in catchment management.

10.3.3 Lessons and Recommendations for the NRA

- R27** The scope of Structure and Local Plans should be widened. It would be advantageous for these plans not only to reflect water interests more comprehensively as in **France**, but also agricultural and forestry issues as well. Regional strategies should similarly extend beyond land use planning issues to include social and economic policy issues.
- R28** There should be more scope for integrating Catchment Management Plans into the development plan system with NRA developing its own regional overview. There is scope for the NRA to be more pro-active in influencing the existing land use planning system. CMP's are seen as an opportunity to reinforce current initiatives of "NRA Guidance Notes" in development plans.
- R29** Catchment Management Plans can bring disparate interests together as water is seen as a binding force for agriculture, conservation and forestry.
- R30** There should be more national guidance on the integration of land use and water planning. In this respect a PPG on water management is seen as a high priority.

10.4 Source Control

In addition to the control of land use (see above), there needs to be control of runoff, and this is best exemplified by pro-active source control rather than retrospective river works.

10.4.1 Country Research Overview

In this respect our country comparison research shows that it is not enough simply to have small scale local source control works. Regional strategies (catchment-based) are essential to ensure the development of best management practice and avoid the adverse consequences of 'ad hoc' planning. Regional planning at the Municipal Level for source control is exemplified by the **USA**.

NPDES strategy and recent **French** initiatives (see the Seine-Saint-Denis and Bordeaux case studies).

In addition it is clear from our research that a long-term perspective of the flow regime is required to assess desirable flows and the effects of increases in surface and waste water runoff to determine areas where source control should be encouraged. The Public Utility Projects (PIG) in **France**, exemplified in the Seine-Saint-Denis case study, and the Storm Water Master Plans developing as part of NPDES in major **US** conurbations (e.g. Chicago) as coordinated by Citizen's Review (Storm Water Committees) are commendable.

Provision of economic incentives can promote source control in areas defined in development plans, coupled with regional planning to avoid proliferation of 'chicken pox' detention ponds and the encouragement of river corridor restoration and 'green' parkways, as typified in California, **USA**. Technical advice to developers on regional planning for source control should be coordinated by the planning agencies as in **France**. In France there is an element of partnership between the communes and the developer to ensure that source control is implemented.

The adverse effects of inadequate source control are directly a result of only short term co-ordination of land use issues and lack of integration between water and land use planning with the secondary effects of development ignored. There has been increased recognition in **France** and the **USA** of the dual purpose of source control for both attenuation of flood peaks and during low flows for pollution control (including ground water protection).

Source control is not easy, given the different interests involved. Conflict resolution needs to be sought between planners, developers and the public, perhaps using the following:

- Equitable charging based on sound utility management as in the **USA**, with cost sharing pro rata to the contribution to runoff;
- Adequate compensation mechanisms, and
- Provision for on-going maintenance coordinated through local municipalities.

In the **USA**, two-tier management and cost sharing of source control is promoted. Developers are encouraged to invest in one-off capital costs with eligibility for tax relief. Annual maintenance costs then become the municipal responsibility.

Subsidies can distort decision making and should be discouraged. Thus in **Germany** there is no longer financial support for field drainage systems. Again in Germany if environmental compensation works are not feasible or possible then a tax payment can be taken from the developer to fund works to enhance the environment at another location.

In the **UK** technical advice on source control is only available in a few local planning authorities and the remainder tend to be hostile to the principle of source control.

One difficulty is that legislation is not sufficiently comprehensive; there is surely a requirement for the EC Waste Water Directive to be used to control quantity as well as quality, with national

source protection strategies also developed to cover both quantity and quality objectives, as in the USA.

10.4.2 Lessons and Recommendations for the NRA

In order for the principle of source control to be taken forward, a number of issues has to be addressed.(also see R46)

- R31** Further research is considered essential in order to identify a national strategy and appropriate policies to take the NRA forward to and beyond the Environment Agency. This strategy should be based on sustainability principles which consider quality and quantity aspects together with the impact on groundwater protection policy and associated issues.
- R32** Point source and non-point source control require regulation measures based on precautionary principles. A source checklist is suggested in conjunction with emission standards. Outstanding legal ambiguities must be resolved.
- R33** Targets must be identified for strategies over longer timescales (15 to 50+ years) to determine any integrated river regime incorporating both high and low flow conditions. GIS and information databases are seen as an essential tool to facilitate this process.
- R34** Resources must be provided by the NRA and local authorities to give technical advice to developers to support and encourage the use of structural and non-structural source control techniques.
- R35** A strategy for economic incentives should be considered with compensation measures and tax advantages for capital projects. Costs, changes and responsibilities must clearly be defined.
- R36** Ecological damage assessment should be part of appraisals of environmental capacity.
- R37** The water utility companies must be encouraged to participate in the 'partnership' approach with the NRA and other interested bodies. The Plc's should be encouraged to address problems and charge developers accordingly.
- R38** The national strategy should have a co-ordinated regional focus, be long term in perspective, and develop instruments, economic incentives and implementation tools to encourage integration of land and water use planning that emphasise source control.
- R39** Source control strategies at regional and local levels should integrate with other land use considerations, including pollution control, recreation and amenity. Links must be made between CMP's development and strategic plans with clear methods of local implementation of policies. Appropriate source control strategies should form part of a National waste plan.

10.5 Environmental Sustainability

It should be self-evident that the objective of improving land and water planning is to create a more sustainable system for environmental protection and resource use. The challenge is seen as the sustainable and cost effective balance between the amount of water abstracted from rivers and underground sources and the amount retained to protect the environment.

10.5.1 Country Research Overview

Our research shows that environmental sustainability and sustainable development needs to provide the basis for a legal and political mandate to ensure effective planning and implementation. The **Dutch** National Environmental Plan and Rijkswaterstaat four-year National Plans, which are founded on the principles of the Brundtland Commission exemplify this legal and political mandate.

It is also clear that baseline information is required to define environmental capacity for river and water resource management. The work by Thames region for the Cotswold Water Park Joint Advisory Committee provides a template of good practice in this respect. This should include sustainability checklists and follow the EC directives/regulations - see CORINE; Natura 2000 etc).

A system should be in place that requires quality assurance of Environmental Impact Assessments against EC Directive 85/337/EEC. These are routine in, for example, **The Netherlands** and **Portugal** as part of national legislation; as is commitment to other EC environmental legislation and Natura 2000.

The concepts of environmental sustainability should be integrated into Catchment Management Plans, as in **Thames Region**. The debate on sustainability should involve full public participation with political weight given to the outcome (how this has been done is best exemplified in **The Netherlands**).

The **German** multi-criteria assessment may be beneficial as a checklist for evaluating environmental factors. However, its use for weighting these factors must be viewed with some caution. Moreover it is important to recognise that social values will change over time and plans will need to change to reflect these changes, as is being attempted in **Bavaria (River Vils)** and within the Integrated Rhine Project.

In the **UK** the NRA's current approach to sustainability is to take advantage of the plan led nature of the planning system and to work through local authorities.

10.5.2 Lessons and Recommendations for the NRA

Detailed recommendations and strategies for achieving environmental sustainability are detailed at the end of Section IX.

The NRA will become more effective in its decision making process, and its policies and plans will be more sustainable, if the following are accepted:

- R40 Environmental Impact Assessments should form part of the catchment management planning process;(see R7)
- R41 Alternative solutions to floodplain management should be targeted, e.g. morphological solutions, non-structural solutions and managed retreat/set back;
- R42 The NRA should strive to make sure that Catchment Management Plans are recognised by local authorities and other agencies in their decision making process and form part of statutory development plans to protect the water environment;(see R23)
- R43 Land acquisition powers should be available to the NRA for the provision of buffer zones (see Gelderse Poort case study, **The Netherlands**); and
- R44 More control over agriculture and forestry is provided to land and water management agencies.(see R23)
- R45 The NRA should lobby for an explicit duty to conserve natural resources to be incorporated into the legislation establishing ENVAGE and for a related duty covering water resources to be set upon OFWAT and the Water Companies.(see R13)

10.5.3 Further investigations

This R&D study brought together a wealth of pertinent information from the country studies. Additionally the workshop generated a good consensus of opinion. The conclusions and key recommendations of the study are summarised in Sections IX and X of this R&D note which distils this great volume of information. Its full value however can only be exploited when future NRA working groups are able to focus on the many issues raised through this project.

There is not yet an adequate information base on which to develop a fully sustainable water strategy for the NRA and other agencies. However the output from this research project will provide much of the raw material needed for such work.

Further research and development is recommended for:

- R46 The further development of the institutional framework to implement strategic surface water management and source control via CMP, sub-CMP and local Master Drainage Plans.(see R31 to R39)
- R47 An environmental tiered database to assist with the definition of critical and natural capital.(see R2 to R4)
- R48 Determining the commitment of local authorities and other agencies to Agenda 21 to which the UK government is a contributing signatory.

•R49 An integrated approach to environmental management through ENVAGE. (see R22)

10.6 Mechanisms: Procedures and Tools

Mechanisms are identified as deliverables between the technical side of the water industry and public policy.

Without adequate procedures and tools, there will be little progress. While recognising that political commitment and will are important for the development of better integration of land and water management, better techniques can also help.

10.6.1 Country Research Overview

In **The Netherlands** hydraulic instruments for guidance on river management and dike construction have introduced concepts for improving and enhancing the environment. Rapid changes of concepts/practices occur following a disaster (eg 1953 floods, or the Sandos chemical spill on the Rhine or the Saxony forest fires).

These disasters have led to more comprehensive disaster management and the development of plans and procedures to heighten public awareness. **The Netherlands** relies on the dissemination of good hydraulic/hydrological information via public media networks to publicise standards of service and flood warning procedures.

In **Portugal** detailed catchment and flood plain maps delineating multiple facets of land use characteristics and incorporated into sophisticated Geographical Information Systems are the foundation for catchment management planning. Dissemination of 'Task Force' appraisals of recent flood events, particularly in the Lisbon area are again the keystone to increasing public perception of the flood risk.

In **Germany** multi-criteria analysis (MCA) with evaluations of up to 100 variable options may be confusing to the public but provides an aid to early decision making. The skill in the procedure is to reduce the analysis to a minimum of, say, five options for public scrutiny. MCA is seen as helpful in the early stages of project planning but not helpful in presenting issues to the public.

In the **USA** there has been a long history of sophisticated procedures to aid decision making. Decision support tools and Geographical Information Systems assist, for example, with flood zoning and supporting the flood insurance programme. Here there is a strong emphasis on community involvement.

In **France** diffusion of information to the public, technical bodies, local politicians, teachers etc. is via 'pedagogical' suitcases or government produced packs of information, though it is difficult to ensure they reach the correct targeted groups. Negotiation skills training is becoming as important as technical training.

In the **UK** the NRA has been more comfortable with its own permissive powers than with pursuing policy objectives through persuasions.

However, our research showed that full knowledge is not essential before adopting new procedures. Experience, intuition and local (vernacular) knowledge can be as important as sophisticated models in catchment management. More critical is the adoption of a philosophy of open consultation and participation.

10.6.2 Lessons and Recommendations for the NRA

- R50** The NRA should broaden its expertise in the area of techniques for sustainable integrated land and water management, through a programme of staff development.
- R51** Particular emphasis should be given to developing user-friendly GIS systems, and experimenting with multi-criteria analysis.
- R52** Environmental economics, broadly defined, should continue to be supported by the NRA, particularly focusing on the definition of critical and natural capital.(see R1 to R3 and R47)
- R53** Flood plain mapping should continue to receive a high priority, and techniques should be developed for 'fast tracking' flood plain evaluations.
- R54** Greater use should be made of sensitivity analysis as a planning tool.
- R55** More research should be undertaken on the best means of involving the public in catchment planning at a regional and strategic level.

10.7 Concluding Remarks

Overall, the strategies adopted in each of the countries studied have developed out of the cultural context of the country and its historic pattern of institutional development.

However, it would appear that there are certain key principles or philosophies which all countries have in common:

- Flood plains should be mapped to create an adequate information base with which to integrate water and land use management,(see R53)
- It is important to inform the public about the risks they run and for public participation in decision making,(see R55)
- Programmes and projects must be environmentally and appraisal led,(see R7 and R40)
- There is a need for more information to support decision making and public participation - GIS and Decision Support Systems are seen as the way forward; and (see R47, R51 and R55)
- Catchment plans are required as part of the process of institutional integration.(see R19 to R26 and R29 to R30)

Our research has also identified more detailed aspect of best practice in the different countries.

There are general lessons concerned with planning, and also in particular concerning plan implementation (see Appendix 2):

- There is a need to create local ownership of plans and programmes from the water industry,
- It is important to use what legislation and other tools are available rather than to wait until new legislation can be developed,(see R26)
- Prioritisation of strategies is essential,
- A mix of strategies is likely to be the best option and this will be catchment-dependent,
- All institutional integration will leave boundary problems; the task is to minimise these, and
- It is necessary to work 'with the grain' of the existing institutions and legislation, rather than against it.(see R26)

Finally, there are practical lessons of implementation (both from success and failure - the lessons of failure can be as useful as those of success):

- Strong constraints require technical support/assistance to be given to developers,(see R34)
- Good enforcement of weak regulations is better than weak enforcement of strong regulations,(see R26)
- It is essential to prioritise areas for the development of flood plain maps rather than to commence upon blanket coverage,(see R53)
- The distinction between 'flood plain mapping' and 'constraints' must be remembered, and (see R53)
- Quality regulation under the EC Urban Waste Water Directive can also be used to control quantity.(see Section VIII, 3.15).

11 REFERENCES

(A full list of References cited during research into the Case Studies is found in the Project Record).

ACC/ISGWR 1992 The Dublin Statement and the Report of the Conference, Geneva: World Meteorological Organisation

American Water Works Association Water Conservation Committee 1993 The Water Conservation Manager's Guide to Residential Retrofit, Denver, Co.: American Water Works Association.

Barraque B, Berland J-M and Cambon S 1994 EUROWATER – Vertical report on France, Noisy-le-Grand: Laboratoire Techniques, Terroires et Societes.

Berkès F (ed) 1989 Common Property Resources, London: Belhaven

Bernstein J D 1993 Alternative Approaches to Pollution Control and Waste Management, Washington DC: World Bank

Brechling V, Helm D and Smith S 1991 "Domestic Energy Conservation: Environmental Objectives and Market Failure" in Helm D (ed) Economic Policy Towards the Environment, Oxford: Blackwell

Bressers H 1988 "A comparison of the effectiveness of incentives and directions; the case of Dutch water policy", Policy Studies Review 7(3), 500-518

Bromley D W and Cernea M W 1989 The Management of Common Property Resources, World Bank Discussion Papers 57, Washington DC: World Bank

California Urban Water Agencies 1993 Evaluating Urban Water Conservation Programs: A Procedures Manual, Denver, CO: American Water Works Association

Common M S 1989 "The Choice of Pollution Control Instruments: Why is so little notice taken of economists' recommendations?", Environment and Planning 21, 1297-1314

Constanza R. 1980 "Embodied energy and economic valuation", Science 210, 1219-1224

Critical Loads Advisory Group 1994 Critical Loads of Acidity in the United Kingdom, Pencil: Institute for Terrestrial Ecology

Department of the Environment 1993 UK Strategy for Sustainable Development, London: DOE

Department of the Environment 1993 Making Markets Work for the Environment, London: HMSO

Devall B and Sessions G 1985 Deep Ecology, Layton, Utah: Peregrine Smith

Dewitt J S 1991 "Assuring your conservation plan is a reliable supply alternative" in Bailey H E, Forrest S and Snow L (eds) Water Supply & Water Reuse: 1991 & Beyond, Bethesda, MA: American Water Resources Association

English Nature 1993 Conserving England's Marine Heritage: A Strategy, Peterborough: English Nature

- Gardiner J 1993 "Water and the Natural Environment" paper given at the Conference Planning and Water – An Elemental Challenge
- Gardiner J 1994 "Capacity Planning and the Water Environment: Experience in the Thames Catchment"
- Gibbons D C 1986 The Economic Value of Water, Washington DC: Resources for the Future
- Gilbert J B 1988 "A comprehensive approach to equity and fiscal stability in rate structure design" in Proceedings of a conference organised by L'Ecole des Ponts and Chaussees Cout et Prix de L'eau en ville, Paris: Presses de L'Ecole Nationale des Ponts et Chaussees
- Green c H 1992 "The economic benefits of water pollution abatement", paper given to the Scientific Section, Institution of Water and Environmental Management, Gloucester
- Hanke S H and Davis R K 1973 "Potential for Marginal Cost Pricing in Water Resource Management", Water Resources Research 9(4), 808-825
- Hardin G 1968 "The tragedy of the commons", Science 162, 1243-48
- Her Majesty's Government 1994 Biodiversity: the UK Action Plan, CMND 2428, London: HMSO
- Herrington P 1987 Pricing of Water Services, Paris: OECD
- Howarth W 1992 Integrated Catchment Planning and Infiltration Systems: Legal Aspects, paper given at CONFLO'92
- Imhoff K R 1992 "Treatment standards and wastewater discharge fee in Germany", Water Science and Technology 26 (7-8), 1897-1903
- Jacobs M 1993 Sense and Sustainability, London: Council for the Protection of Rural England
- Maass A and Anderson R L 1978 And the Desert Shall Rejoice: Confluence, Growth and Justice in Arid Environments, Cambridge, MA: MIT Press
- Maddeus W O 1987 Water Conservation, Denver, CO: American Water Works Association
- Mann P C, Saunders R J and Warford J J 1980 "A Note on Capital Indivisibility and the Definition of Marginal Cost", Water Resources Research 16(3), 602-604
- McBurney S 1990 Ecology into Economics won't go, Bideford: Green Books
- McCay B J and Acheson J M (ed) 1990 The Question of the Commons Tucson: University of Arizona Press
- Meubkat G, Babillot P, Chenard A and Touze N 1989 L'evaluation ex-post de la politique publique de lutte contre la pollution de l'eau, Villetaneuse: Centre de Recherche en economie industrielle, Universite Paris-Nord
- Naess A 1993 "The Deep Ecological Movement: Some Philosophical Aspects" in Armstrong S J and Botzler R G (eds) Environmental Ethics – Divergence and Convergence, New York: McGraw Hill

National Regulatory Research Institute 1991 Cost Allocation and Rate Design for Water Utilities, Denver, CO: American Water Works Association

National Research Council 1986 Proceedings of the Conference on Common Property Resource Management, Washington DC: National Academy Press

National Rivers Authority 1994 Water: Nature's Precious Resource, London: HMSO

National Rivers Authority Thames Region 1994 Thames 21 – A Planning Perspective and a Sustainable Strategy for the Thames Region, Reading: National Rivers Authority

Niemczynowicz J 1991 "Environment and urban areas – The necessity of changing views", paper given at the International Conference on New Technologies in Urban Drainage, Dubrovnik

O'Riordan T and Weale A 1990 Greening the Machinery of Government, Discussion Paper No 3, London: Friends of the Earth

Ojolo A 1994 Urban non-point source pollution control drainage measures, unpublished MPhil thesis, Bounds Green: Middlesex University

Opschoor J B and Vos H B 1989 Economic Instruments for Environmental Protection, Paris: OECD

Ostrom E and Gardner R 1993 "Coping with Asymmetries in the Commons: Self-Governing Irrigation Systems Can Work", Journal of Economic Perspectives 7(4), 93-112

Palange R C and Zavala A 1987 Water Pollution Control: Guidelines for Project Planning and Financing, World Bank Technical Paper No 73, Washington DC: The World Bank

Parker D J and Thompson P M 1990 Post-Project Appraisal of Urban Flood Protection Schemes, Enfield: Flood Hazard Research Centre

Pearch D W, Barbier E and Markandya A 1990 Sustainable Development, London: Earthscan

Pezzey J 1989 Economic Analysis of Sustainable Growth and Sustainable Development, Environment Department Working Paper No 15, Washington DC: World Bank

Rees J and Williams S 1993 Water for Life, London: Council for the Preservation of Rural England

Rees J, Williams S, Atkinson P, Hammond C J and Trotter S 1993 Economics of Water Resource Management, report to NRA Anglian Region

Seabright P 1993 "Managing Local Commons: Theoretical Issues in Incentive Design", Journal of Economic Perspectives 7(4), 113-134

Stevens T H, Miller J and Willis C 1992 "Effect of Price Structure on Residential Water Demand", Water Resources Bulletin 28(4), 681-685

Synder G 1990 Understanding the Commons: The Practice of the Wild, North Print Press

The Ecologist 1993 Whose Common Future?, London: Earthscan

The Group of Green Economists 1992 Ecological Economics, London: Zed Books

Therivel R, Wilson E, Thompson S, Heaney D and Pritchard D 1992 Strategic environmental assessment, London: Earthscan

Tietenberg T H 1991 "Economic instruments for environmental regulation" in Helm D (ed) Economic policy towards the environment, Blackwell, Oxford

Turvey R 1976 "Analysing the Marginal Cost of Water Supply", Land Economics 52(2), 158-168

Wilkinson D 1994 "Environmental valuation and policy – is there a link?", paper given at the ESRC Environmental Valuation Seminar, Leeds

World Commission on Environment and Development 1987 Our Common Future, Oxford: Oxford University Press

World Bank 1993 Water Resources Management, Washington DC: The World Bank

APPENDIX 1: LIST OF RECOMMENDATIONS

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APPENDIX 2 : SUGGESTED BEST PRACTICE AND KEY RECOMMENDATIONS WITH TOPIC AREAS

A2.1 Institutional Arrangements

- Support the concept of Statutory Regional Plans as one expression of regional government. (see R23, R42, R44)
- Extend the scope of statutory plans to reflect the interests of the water environment. (see R27)
- Develop and co-ordinate national NRA policy to complement and reflect the content of Regional and Structure Plans.(see R28)
- Maximise the effective use of existing legislation before seeking new powers.(see R26)

A2.2 Land Use and Catchment Management Plans

- Develop and extend good communications with the public, local authorities and interest groups particularly from the development industry.(see R47, R51, R55)
- Improve land use data base in order to take advantage of the above communications. (see R2 to R4, R47)
- Encourage local authorities to widen the scope of development plans to increase the policy content on the water environment.(see R23, R42)
- Develop strategic environmental appraisal and assessment tools for use in land use planning. (see R7, R40)
- Emphasise that land use/catchment management planning for sustainable development provides the opportunity to "cure" past mistakes and to prevent future problems.

A2.3 Source Control

- Develop a national integrated strategy for source control within a framework for surface water management.(see R31, R33, R38, R39, R46)
- Clarify and resolve legal ambiguities to facilitate comprehensive surface water management and source control.(see R13, R45)
- Incorporate a surface water management framework within Catchment Management Plans, Development Plans and Strategic Plans.(see R39)
- Integrate high (quantity) and low (quality) flow strategies, within surface water management

plans in the context of the urban Waste Water Planning Directive (EC Directive 91/271/EEC).(see Section VIII, 3.15)

- Take into account future development pressures in long-term catchment change projections. (see R33)
- Consider the effective use of economic incentives particularly "Guided Growth" policies. (see R28, R30)
- Develop a sustainable environmental strategy for source control.(see R31, R46)

A2.4 Environmental Sustainability

- Ensure that Catchment Management Plans comply with environmental sustainability principles and are compatible with the statutory planning process.(see R7, R40)
- Co-ordinate NRA policies across the full range of core functions and articulate them through the full range of avenues offered by the statutory planning machinery. (see R23, R42)
- Undertake Environmental Appraisals of all programmes, plans and policies.(see R7, R40)
- Adopt Environmental Assessment as the method for project development.
- Review surface water management and source control policies to ensure their environmental sustainability.(see R31, R46)
- Include "generic issues" with CMPs (eg source control strategy identification of environmental capacity, buffer zone needs).(see R28, R39)

A2.5 Tools and Procedures

- Provide staff training on sustainability in land and water management.(see R50)
- Seek specialist external consultation in public relations to advise on communicating with the public and nationally significant interest groups.(see R55)
- Stress the importance of "vernacular" (intuitive) knowledge for its value in promoting "common sense" sustainability.
- Develop techniques for integrated land and water management through further research and development.(see R46 to R49)
- Encourage the strengthening of the National Curriculum and further education with respect to environmental issues.

APPENDIX 3 : IMPLEMENTATION AREAS OF RECOMMENDATIONS

A3.1 Recommendations for Promoting Best Practice Within the NRA - (Operational Guidance)

The recommendations fall into two categories, both relating to making the Catchment Management process more effective:-

The first category is concerned with deepening the technical content of the Catchment Management Planning process by (1) including surface water management and source control strategies in the process, (2) using Catchment Management Plans to prioritise flood plain mapping and, (3) using Strategic Environmental Assessment to strengthen the process to be adopted for the development of specific projects.

The second category is concerned with maximising the opportunities offered to the NRA through the planning system. Emphasis should be on working alongside existing institutions and procedures. The NRA should work on improving the compatibility of Catchment Management Plans with the external development plan system. CMP's should take greater account of future development pressures and their implications for the water environment. An appropriate technique for the NRA is to undertake area-specific studies for locations where development pressures are likely to result in concentrated pressure points. The process should also concentrate on improving communications with the public, local authorities, interest groups and the development industry. The NRA also needs to recognise that the planning system provides opportunities for rectifying past mistakes and to forestall future problems. The sooner these opportunities are appreciated the more likely they are to be realised resulting in an improved level of debate particularly during the consultation stage of Catchment Management Plans.

A3.1.1 Benefits

Despite the improvements to the NRA's approach to its role as a consultee under the statutory Town & Country Planning System it is clear that there are further opportunities to improve its EFFECTIVENESS particularly in the preparation of Catchment Management Plans resulting for example from CMP's becoming more compatible with the development plan system.

A3.2 Recommendations to spread knowledge both inside and outside the NRA (Underpinning Knowledge)

The recommendations are concerned with staff training, seeking advice on involving the public and outside bodies through CMP's, seminars, Sect 105 surveys, liaison meetings with local planning authorities and others and the provision of comprehensive advice to the development industry.

A3.2.1 Benefits

The study demonstrated the scope for improving the awareness of core functional staff of sustainability issues resulting in extending the number of organisations with an interest in the environment and greater understanding between them and the NRA.

Training in this area would result in improved cross-functional co-operation. Secondly the study identified a deficiency in terms of the NRA's presentation of its planning activities resulting in a failure to maximise the opportunities offered by the development plan system.

A3.3 Recommendations in connection with the Water Utilities and OFWAT

The recommendations are concerned with developing the NRA's effectiveness in the economics of water management and improving techniques in conjunction with the Water Utilities and OFWAT in order the better to realise the objectives of the NRA's Water Resources Strategy.

A3.3.1 Benefits

The study has hinted at the use that the NRA could make of economic instruments to achieve its policy objectives and improvements in technical solutions and in innovative techniques and the concept of source control, which cannot easily be promoted under the present regime.

A3.4 Recommendations relating to possible restructuring within the NRA to improve cross-functional policy co-ordination (Operational improvements)

The recommendations are concerned with creating a mechanism nationally for improving cross-functional policy co-ordination within the organisation and for articulating corporate policy through such channels as Government circulars and advice notes, through the regional planning system and through Catchment Management Planning.

A3.4.1 Benefits

The study revealed a shortcoming in the NRA's policy co-ordinating function. Implementation of the recommended measures would improve the multi-functional practice within the authority resulting in a co-ordinated approach to environmental policy issues.

A3.5 Recommendations for improving links with the policy making institutions of the European Union. (Operational Improvements)

There are few recommendations to guide the NRA in this important field. They were concerned with the British degree of commitment to Agenda 21 and the desirability of putting regional planning on a statutory basis as is the case in other parts of the Union. However a further

potentially highly productive line of research could involve the common desire of both L'Agence de L'eau and the NRA to achieve a consistent role in influencing European Union legislation. In view of these mutual concerns both organisations would be in a stronger position to influence both the Commission and the European Parliament if they acted together. There is also potential for co-operation with water interests in Bavaria with which L'Agence enjoys twinning arrangements.

Clearly however the NRA needs advice on the following:-

Making contact with the appropriate Directorates and influencing the content of directives formulated by the Commission.

Advancing projects which might be eligible for Union funding where areas enjoy "Objective" status under the Regional Fund, eg The Lee Valley and parts of the East Midlands.

Entering into appropriate dialogue with the relevant representatives of the Committee of the Regions.

A3.5.1 Benefits

Liaison with the equivalent institutions in other member countries of the Union has suggested that there are channels for influencing European legislation that are not being effectively exploited by the NRA at present in the NRA's interests being better reflected in for example EU Directives. (Use of these channels would result).

A3.6 Recommendations for further research into aspects of policy, legislation and practice. (Extending Knowledge)

The study has identified that the French lead Europe in the field of source control. NRA (Thames) twinning agreement with L'Agence de L'eau Seine-Normandie, is resulting in the identification of increasing areas of common interest. Mutual shadowing of Thames 21 and the agencies SDAGE and SAGES which are the equivalent of Catchment Management Plans has identified the importance of Agenda 21 and its current interpretation to both initiatives. Furthermore Anglian Region's use of "external advisory panels" to guide the preparation of CMP's has direct parallels in Commissions for the implementation of SAGES. Further common ground exists in the French requirement for the mapping of flood risk areas (plans de surfaces submersibles) and our own Section 105 surveys.

A3.6.1 Benefits

The study identified a number of technical and economic topics whose investigation could widen the NRA's horizons in terms of policy and implement options resulting in a fresh ability for the NRA to take policy initiatives in these fields.

A3.7 Recommendations concerning input to the Environment Agency. (Role Clarification)

The recommendations were mainly concerned that the powers of the new Agency should be wide enough to ensure an integrated approach to environmental management.

A3.7.1 Benefits

The study identified a number of areas where it would be beneficial for the powers of the Environment Agency to be clarified.

A3.8 Recommendations for special initiatives to be carried out by the NRA (Profile Promotion)

These recommendations are primarily concerned with widening the power and scope of regional, structure and local plans, and with pursuing changes in legislation to overcome the problems of implementing source control measures.

A3.8.1 Benefits

The study has resulted in a number of heterogeneous ideas which the NRA may wish to pursue at a national level. Mostly they relate to measures which enhance both the NRA's profile and effectiveness and would have to be pursued largely through lobbying activities.