Carrying Capacity of Catchments

Scoping Study

B Carroll, H Barton, T Turpin and J Nelson

Research Contractor:

Nicholas Pearson Associates
Bath
with
The University of the West of England
Bristol

Environment Agency
Rio House
Waterside Drive
Aztec West
Bristol
BS32 4UD

R&D Technical Report W190

Publisher
Environment Agency
Rio House
Waterside Drive
Aztec West
Bristol BS32 4UD

Tel: 01454 624400 Fax: 01454 624409

ISBN: 1 85705 032 0

Dissemination Status
Internal: Released to Regions
External: Released to Public Domain

Statement of Use
This report presents a scoping study which investigates the feasibility of developing a methodology to assess the capacity of geographic areas to absorb certain types of land use change and to evaluate appropriate locations for development. It is for use by staff involved in environmental planning, environmental management and land use planning.

Research Contractor
This document was produced under R&D Project W4-006 by:

Nicholas Pearson Associates Ltd
30 Brock Street
Bath
BA1 2LN
Tel: 01225 445548 Fax: 01225 312387

with the University of the West of England, Bristol

Environment Agency's Project Manager
The Environment Agency's Project Manager for R&D Project W4-006 was:
Cathy Doidge - Southwest Region

R&D Technical Report W190

"Change is inevitable in a progressive country. Change is constant."

Disraeli, 1867

"As the world system grows towards its ultimate limits, what will be its most likely behaviour mode?"

Meadows, 1972

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

AMP	Asset Management Plan
CPRE	Council for the Protection of Rural England
DETR	Department of the Environment, Transport and Regions
EA	Environmental Assessment
EMS	Environmental Management System
ES	Environmental Statement
EU	European Union
GQA	General Quality Assessment
IPC	Integrated Pollution Control
IPPC	Integrated Pollution Prevention and Control
KPI	Key Performance Indicator
LA21	Local Agenda 21
LAC	Limits of Acceptable Change
LEAP	Local Environment Agency Plan
LGMB	Local Government Management Board
MAT	Multi-Attribute Technique
OECD	Organisation for Economic Co-operation and Development
RCEP	Royal Commission on Environmental Pollution
RDA	Regional Development Agency
RE	Rivers Ecosystem
RPG	Regional Planning Guidance
RSPB	Royal Society for the Protection of Birds
SDOS	Strategic Development Options Study
SEA	Strategic Environmental Assessment
SERPLAN	The London and South East Regional Planning Conference
SMP	Shoreline Management Plan
SOER	State of the Environment Report
TE21	Thames Environment 21
UNCSD	UN Commission on Sustainable Development
UWE	University of the West of England

EXECUTIVE SUMMARY

The overall objective of the R&D study was to investigate possible ways of assessing the carrying capacity of geographic areas to absorb certain types of land use change and to evaluate appropriate locations for development. The scoping study aimed to establish how the concept of carrying capacity would be applied to the Agency's work of integrating environmental issues into the land use planning system.

The study was carried out between June and October 1998 and included an overview of literature and current practice, a seminar and workshop with Agency staff, informal meetings and telephone discussions with selected local authorities and environmental organisations. This report has also incorporated comment from the Agency's R&D Project Board and the National Planning Liaison Group.

There are different interpretations with regard to the meaning and application of carrying capacity and environmental capacity when used in the land use planning system. Agency staff generally felt that *carrying* was a confusing concept and land use planners were rarely familiar with the term. There are few practical examples of using environmental capacity and those elements of the environment within the remit of the Agency have rarely been considered beyond lines on a map of constraints.

The need to resolve development pressures, particularly from housing, is encouraging local planning authorities to further explore environmental capacity as a tool for decision-making. It was clear from the study that there is a need and a role, which is more sophisticated than an information source, for the Agency to proactively inform the land use planning process and contribute at each stage of a capacity study. There is an iterative and interactive relationship between environmental capital, development potential and management options. The Agency is well placed to advise on options and their consequences which will particularly contribute to practical implementation. Capacity is about opportunities, not just constraints.

Capacity in the context of land use planning is not absolute or objective; it is dynamic and relates to policy objectives and management options. Capacity will change according to the management options chosen for a given objective, and it will vary with time and geographical area. For example, the capacity of a watercourse to receive treated effluent from a sewage treatment works serving a proposed housing development may vary, for example, with the degree of treatment available or the extent of any proposed greywater recycling. Most capacity studies consider only constraints, not opportunities or options. The Agency is well placed to identify opportunities for environmental enhancement and management options.

The study identified an approach, which is applicable at all levels, for the Agency and this involves proactive contributions to the emerging environmental capacity method. The Agency will need to develop clear and consistent policy objectives and a management options framework. It will also be necessary to define specific indicators with targets for each environmental resource within its remit and at each level: national, regional and local. This approach is compatible with the dynamic and geographical character of capacity within the land use planning system and the absolute limits and assimilative capacities, for example, those associated with EU directives, with which the Agency has to work.

It is recommended that the Agency carry out a full scale study to test this proposed approach. It is considered that advantage may be taken of opportunities available now to work with key planning authorities. Such a capacity approach could be promoted with an integrated guide to local authorities which sets out Agency objectives, thresholds and discretionary targets in the context of a capacity process. This could integrate with existing Agency tools such as the environmental assessment scoping handbook, and also could be applied to environmental appraisals, environmental assessments and Environmental Management Systems.

KEY WORDS: Carrying Capacity, Environmental Capacity, Environmental Planning, Environmental Management

1.0 INTRODUCTION

1.1 Scope of Study

The aims of the study were defined in the Agency's tender brief (ref SWCON 158) as follows:

- to investigate possible ways of assessing the carrying capacity of geographic areas to absorb certain types of land use change and the use of carrying capacity to evaluate appropriate locations for development.

- to assess the feasibility of identifying readily usable, quantifiable thresholds to be used in assessing the ability of catchments to absorb land use changes.

- to establish how the concept of carrying capacity could be applied to the Agency's work of integrating environmental issues into the land use planning system.

- to make recommendations on the form of a subsequent full study to demonstrate the practical application of the concept.

The brief required that the study should consider applicability across the full geographical area covered by the Agency and the broad remit of Agency responsibilities. It should build on current good practice and ongoing work, for example, s105 surveys and the new approach to environmental capital[1]. A wide interpretative role was expected. It was intended that the study would guide further Agency obligations towards sustainable development and form part of the Agency's contribution to the environmental capacity debate.

The aims and method of the study were further refined at the inception meeting. The approach was to focus on the Agency's duties and powers and particularly consider the impact of housing development pressures. It was recognised that definitions would need to be established and that the study would evolve and be iterative in its approach towards the issues addressed in order to achieve the required outputs.

1.2 Study Team

Consultants Team:

Project Manager	Barbara Carroll	Nicholas Pearson Associates
	Hugh Barton	University of the West of England
	Trevor Turpin	Nicholas Pearson Associates
	John Nelson	Nicholas Pearson Associates

Agency Team:		
Project Manager	Cathy Doidge	Cornwall Area
	Richard Howell	Head Office
	Hugh Howes	Thames Region
	Alan Rafelt	South Wessex Area
	Simon Slater	Midlands Region

1.3 The Need for the Study

A number of issues contributed to the need for the study. These included the following:

- Government guidance[2] to the Agency on achieving sustainable development suggests that the Agency may consider a number of assessment methodologies and procedures including *the carrying capacity of the environment.*

- The Agency is increasingly being asked by local authorities to provide data and expert advice on capacity limits particularly for water resources in relation to housing development pressures.

- The new approach to Environmental Capital[1], sponsored by the Countryside Commission, English Nature, English Heritage and the Agency, is based on the concept that sustainability is about whether a system can maintain itself without depleting, beyond certain limits, the goods and services provided by the environment. Few such limits have actually been measured or determined, but it is considered that if they could be identified, they would provide a practical basis for the application of the Environmental Capital concept.

1.4 Method

The study was carried out between June and October 1998 and included the following elements of work:

- Overview of literature and current practice with regard to assessing the context and role for the Agency.

- Seminar and workshop with Agency staff representing all the regions and including environmentalists, scientists, planners and managers in both policy and operational roles.

- Informal meetings and telephone discussions with selected local authorities, at regional, county and district level, and environmental organisations.

- Presentation to the National Planning Liaison Group.

1.5 Structure of Report

Sections 2 and 3 set the background to the study by reviewing concepts, the historical context, and the recent debate on using environmental capacity in land use planning. Section 4 sets out the context for the Agency. Potential approaches to capacity for the Agency are explored in Section 5 including proposals for a full scale study to test the concept. Conclusions and recommendations are given in Sections 6 and 7.

2.0 CONCEPTS, DEFINITIONS AND HISTORICAL CONTEXT

2.1 Carrying Capacity

2.1.1 Ecology, Land and Resource Management

The concept of carrying capacity has a fundamental scientific definition and use in ecological population studies. For example, the following is taken from a standard text book[3]:

> *"It is called a carrying capacity because it represents the population size which the resources of the environment can just maintain (carry) without a tendency to either increase or decrease."*

There are many variations to the basic definition, particularly as the concept of carrying capacity has been applied to human populations and activities since the 1970s. Human carrying capacity differs from traditional ecological concepts since we have the technical ability to change the carrying capacity of a defined resource and the extent of our impacts may be of greater significance. The variability of definitions is illustrated by the brief list presented to the Agency workshop on capacity as part of this study and reproduced here in Appendix I.

Early studies, particularly reported in North America, were associated with ecological and visitor capacities in relation to the recreational use of national parks and wildlands. Issues were identified with regard to the setting of the capacity standards, an insufficient understanding of the use - impact relationship, and an inadequate management framework for remedial actions[4]. Recognition that carrying capacity limits are actually value judgements in this application and that change is inevitable, led the US Park Service to develop the principle of Limits of Acceptable Change (LAC). This includes wider public involvement to focus resource management onto that change which is ecologically and socially acceptable[5].

It is interesting to note that at the same time during the 1970s and 80s, workers in the USA were gaining experience in the inter-relationships of impacts on the environment through environmental impact assessments as required by the 1969 National Environmental Policy Act. Although the term 'capacity' is not generally used in environmental assessment work, the process is essentially one of assessing the capacity of the environment to receive and adapt to the impacts of the proposed development.

There are many examples, particularly from North America, of carrying capacity terms and concepts being applied to land and resource management with regard to recreational, agricultural and nature conservation uses. The definitions vary but fundamental to the application of the concept is the idea that there is a limit to the resource and activity within a defined geographical area. This limit can change with changes in management practices which are implemented as a result of human choices.

When applied to renewable resources, such as fisheries, forests or rangeland stocks, the concept of maximum sustainable yield is used to define the largest harvest possible whilst maintaining the stock. When defined clearly within a particular objective the carrying capacity is that density of stock that allows *the manager to get what he wants out of the system*[6].

The complexity of the situation when considering human populations and activities is widely recognised and this application of the ecological carrying capacity concept remains a subject for debate. According to Cohen (1997), who is considering how many people the earth can support, human carrying capacity is *probabilistic, conditional and dynamic*[7]. It depends on natural constraints and human choices which are not captured by the ecological notions of carrying capacity.

Thus human carrying capacity is variable and constantly changing. Some authors, for example Boserup (1990)[8], suggest that rising population density facilitates the development of new markets, new knowledge and new technologies. Others such as Hawken (1993)[9] draw attention to the complacent attitude of the richer nations in the north where it is difficult for us to imagine that carrying capacity can significantly affect us. Although as Odum noted (1972)[10], in his classic ecological text, it is the more affluent regions where planning is required.

2.1.2 Pollution Control

The concept of a (carrying) capacity, i.e. a limit at which there is harm or unacceptable change, for an environmental resource has been applied to pollution control strategies for a considerable time. For example, the 1912 Royal Commission[11] set the 1:8 dilution standard for discharges of sewage to a river on the basis of the capacity for that river to self-purify itself but does assume that the river is 'clean'. Such an approach to standards of discharge consenting would not sufficiently consider the complexities of an ecosystem now in terms of integrated river basin management. Although the term capacity is not used commonly in consent standards, the concept of a capacity limit or threshold is implied.

Government guidance[12] to the Agency suggests that the term carrying capacity is sometimes extended to refer to the capacity of the environment to absorb pollution or waste. The depletion of the ozone layer is given as an important example, together with the concept of a critical load that an ecosystem can absorb of a pollutant. However, the term carrying capacity is not found commonly in pollution control literature and it is noteworthy that the term is not used at all in the recent RCEP Report (1998)[13] on setting environmental standards (although the *assimilative* capacity of the environment is discussed).

Although there are clearly different interpretations with regard to the meaning and application of carrying capacity, there is the commonality of a limit or threshold to an activity or environmental resource. The situation becomes more complicated as carrying capacity and environmental capacity have been used synonymously, particularly when applied to land use planning in the UK.

2.2 Environmental Capacity

The DETR (1997)[14] study on the application of environmental capacity in land use planning included a comprehensive literature review and discussions with practitioners. It was concluded that the term environmental capacity was of recent origin and had been subject to rapidly increasing use through the 1990s. It describes how there were misunderstandings and differences in interpretation for both the terms and concepts of carrying and environmental capacities. The study suggested that the term environmental capacity is concerned with taking an holistic or comprehensive approach which includes human value assessments. Carrying capacity is more appropriately used when one aspect of the environment or one activity impacting on specific aspects of the environment is being considered.

The concept of environmental capacity and its relevance to land use planning was explored by Jacobs (1997) for CPRE[15]. He concluded that environmental capacity can provide a useful conceptual framework for the planning system, if used with care and not as a rigid set of absolute limits. Most environmental features will have a number of different thresholds reflecting different degrees of value. He considers that all threshold 'limits' for human activity involve social value judgements including issues such as available water supply or pollution levels.

The current usage of environmental capacity in land use planning is considered in more detail in section 3. Concomitant with the observation that environmental capacity was being used from the 1990s is the increasing use during the period of sustainable development and/or sustainability principles as a framework for planning and managing the environment.

2.3 Sustainability and Sustainable Development

Clayton and Radcliffe (1996)[16] discuss a systems view of sustainability and suggest that sustainability is ultimately about whether the whole system can maintain itself within broad limits and assimilate external pressures without collapse or wild transitions. They include reference to carrying capacity as follows:

> *"The main factors in determining carrying capacity are levels of pollution, patterns of resource demand, environmental yield potential and resource flows, and environmental absorption capacity and impacts."*

The new approach to environmental capital[17] proposes a solution to issues raised by Clayton and Radcliffe.

The concept of sustainable development is now central to the UK land use planning system and the activities of such organisations as the Environment Agency. The consultation paper on a revised UK strategy for sustainable development (1998)[18] identifies four broad objectives:

- social progress which recognises the needs of everyone

- effective protection of the environment
- prudent use of natural resources
- maintenance of high and stable levels of economic growth and employment.

The combination of environmental, economic and social objectives is stressed, together with the commitment to intergenerational equity to ensure *a better quality of life for everyone, now and for generations to come.*

The potential use of environmental capacity as a pragmatic approach to highlight the importance of natural limits in planning for sustainable development was explored by Barton et al (1995)[19] in their guide on sustainable settlements produced as part of the Local Agenda 21 initiative.

> *"Sustainable development is therefore about maintaining and enhancing the quality of human life - social, economic and environmental - while living within the carrying capacity of supporting eco-systems and the resource base."*

Again, we have the concept of carrying capacity within the context of sustainability.

3.0 RECENT DEBATE AND USAGE OF ENVIRONMENTAL CAPACITY IN LAND USE PLANNING

3.1 Introduction

The concept and term "carrying capacity" are found in recent discussion documents and guidance. For example, it is seen as essential to an understanding of sustainable development in the UWE/LGMB design guide[20] and also in the conceptual discussion on environmental capacity presented by Jacobs[21]. However no application of carrying capacity *per se* was found in the recent use of environmental capacity in the UK land use planning system.

It is recognised that there has been a wide range of interpretations together with a lack of clear and consistent terms and methodologies. Criticisms of the capacity approach have included:

- Practical difficulty, particularly with defining constant/critical/negotiable capital and quantifying perceptual issues.
- The implication of the term that there are absolute limits, and that an area can be defined as full-up.
- Promotion of environmental primacy over social and economic considerations.
- Potential for change, ie new habitats.

Nonetheless, the DETR (1997) study did identify commonalities and concluded that elements of the approach have a valuable application to land use planning by providing a framework for measuring environmental stock and defining the significance and limits of acceptable change. This could be used in strategy and policy formulation, project evaluation and other areas[22].

3.2 General Approach to a Capacity Study

The general approach to a capacity study may be summarised as follows but it should be noted that very few examples actually consider development opportunities and the typical approach is based on constraints.

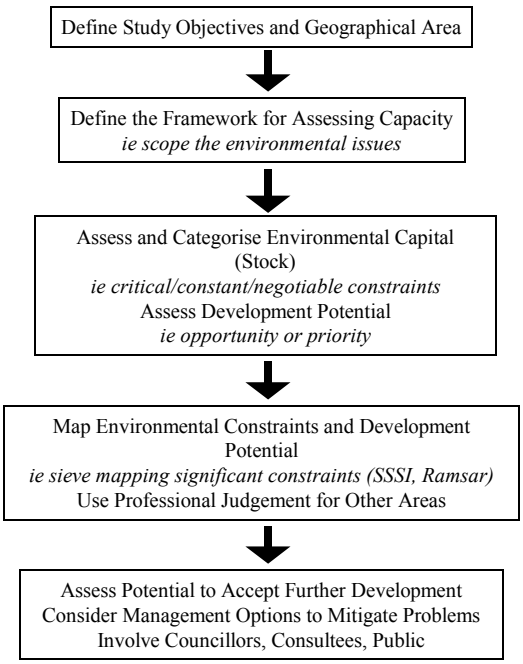


Figure 1: Outline General Approach used in a Capacity Study in Land Use Planning

3.3 Examples of Environmental Capacity

There are few examples of the practical application of environmental capacity. The DETR study considers that good practice is found particularly in the UWE/LGMB report[23], the Chester study[24] and the West Sussex work[25]. Other examples typically quoted are those studies for Hampshire, Berkshire and Hertfordshire. These are all areas of high development pressures.

The UWE/LGMB guide to Sustainable Settlements includes a capacity assessment framework which offers a technique for considering relative values of environmental stock that is part of the development plan process and promotes sustainability. The guide uses a similar environmental agenda (global, natural resources, local) to that set out in government guidance[26] to local authorities on how to appraise development plans for environmental sustainability. The potential and the limitations to the approach are further presented by Barton (1995)[27] who suggests that it might be more constructive to work with thresholds rather than capacities and that both these terms should be recognised as *policies* or *objectives* rather than *facts*.

The Chester study is noted for its consideration of perceptual capacities - how people feel about issues such as overcrowding, traffic congestion and aesthetic values such as the historical character of the city.

The West Sussex studies were particularly comprehensive and carried out as part of the County Structure Plan third review. It was perceived locally by the public and professionals that the county's environment was already under strain from development and that further development would adversely affect the quality of life for residents and future generations. The studies tested three propositions which had evolved from the perceptions of environmental decline:

- Potential irreversible decline in countryside resources.
- Environmental consequences of using development options on the edges of existing settlements.
- Impact on the urban quality of life and environment from continuing in-town development.

The assessment of rural and urban areas differed. The rural studies extended constraints mapping techniques within a sustainable development context whilst the urban studies considered housing figures and capacity. It was concluded that the housing figures supplied by Regional Planning Guidance for the Plan period up to 2011 would have potentially adverse environmental consequences, for example, on the preservation of strategic gaps between settlements. A reduction in the housing figures was agreed at the Examination in Public early in 1997 but the Secretary of State subsequently issued a direction requiring the county to provide additional housing to comply with regional guidance. The capacity approach itself was not criticised. The County Council challenged the direction and a judicial review took place in June 1998.

West Sussex is now looking towards the next structure plan review and is refining its capacity thinking towards a Strategic Development Options Study (SDOS)[28]. The Council considers that the new approach to environmental capital will resolve the difficulties of defining constant and critical capital; environmental thresholds will be explored and the study will seek the least un-sustainable locations for development. The main elements of the approach are to identify choices and consequences with increased stakeholder involvement to facilitate a 'bottom up' continuous testing of development options.

3.4 Current Issues

Much debate has been generated but the concept of environmental capacity is really an extension from traditional planning techniques such as threshold analysis and sieve mapping. Previously, capacity limits such as housing densities, traffic and conservation designations enabled choices about locations of development. Now, for some areas, particularly in the south-east, the number of such limits, together with the environmental strain from existing development and the extent of proposed development, suggest a limit to development itself not just choices about its location. The particular issue is the government household projections with regional guidance

for housing figures and, indeed, this has been the impetus for most of the environmental capacity studies.

Most of the issues debated have been concerned with perceptual values, such as the character of settlements and the quality of the countryside, which are matters of social judgement and political choices. Quantification of such values is clearly difficult. The ecological resource outside of protected areas was considered, depending upon availability of survey data over time. Here the difficulties of categorising the resource into constant/critical/ negotiable capital were identified.

The carrying capacity of the environmental resources of air, land and water to absorb pollution or waste has rarely attracted debate or contributed significantly to decision-making in the land use planning system. This may reflect the availability of relevant data and expertise to the local authorities and/or the extent to which available data has been utilised by local planning authorities. For example, source protection zones and river water quality data could have been used as constraints layers and, where available, s105 flood risk areas.

Source protection zones are clear constraints on certain activities. Flood risk areas would appear to be but are not always considered as such. However, it is perhaps the more sophisticated analysis, which might consider accumulative effects and existing environmental stress, of the environmental resources outside of these mapped areas which has generally been lacking from the practical examples.

The availability of the water resource has certainly generated debate, particularly in the south-east and in relation to additional demands predicted from household projections on a resource already under strain from historic and current usage, environmental needs and anticipated to further suffer adversely from climate change effects. Integration of water resource planning and management into the land use planning system has been constrained by legislation and guidance for the Agency (and NRA), water companies and local planning authorities. Perhaps this has been recognised by the present government but misconceptions persist with planners and the public regarding the role of the Agency. Some local authorities are still expecting black and white answers from the Agency to help with decision-making on impacts of housing. Nonetheless, there is progress with, for example, the Agency interim commentary on the potential impact of housing growth upon water resources in the SERPLAN region.

The emphasis has been on the water resource and particularly public water supplies. Related issues of infrastructure provision and river water quality/flow associated with wastewater discharges are rarely appreciated by planners and the public. These issues are often associated with the environmental needs of the water resource. There are examples of Agency influence but they are generally associated with some protective designation such as the EU Freshwater Fisheries Directive. This is the ongoing situation at Basingstoke, where there are proposals to discharge treated sewage from planned development into the sensitive River Loddon, and there is the important testing of sustainability principles including retaining water within its catchment.

A commonality to these limited practical examples of environmental capacity is a **constraints** approach. Yet it is clear that capacity in the context of land use planning is dynamic and changes with management options. This was clearly presented by, for example, Barton et al (1995) in the UWE/LGMB guide, who drew attention to considering opportunities for environmental enhancement and the potential for creative solutions:

> *"There needs to be space for creativity"*.

The requirement to comply with sustainable development principles is placing demands on land use planners to search out new and innovative techniques and applications, for example, with their consultation processes. Ecological footprinting is being considered for assessing on a common basis many of the most significant resource impacts of housing development[29]. Human environmental consumption can relate to the productivity or absorptive capacity of an area of land - the land needed to grow the necessary raw materials and/or assimilate the associated wastes. The method aims to assess (cost) everything in common 'land equivalent' terms. This is similar to the capacity quantification approach based on energy flow and utilisation in ecological systems and used to evaluate alternative land use options in parts of the USA in the 1970s.

Many authorities have not yet used environmental capacity because it is complex and there is no standard method. Others have continued to develop a practical application since they have to resolve the problems associated with their housing allocations and comply with sustainability principles. Thus land use planning is becoming increasingly complex and planners need sophisticated information and advice from organisations such as the Agency.

4.0 CONTEXT AND ISSUES FOR THE AGENCY

4.1 Context

The Agency has varied duties, powers and interests in various aspects of all environmental media: air, land and water. The Agency is required by Government to protect and enhance the environment through an integrated approach and with a principal aim of working towards sustainable development[28]. Whilst government has recognised the need for integrated environmental management, key duties and interests associated particularly with air and land are divided between the Agency and the local authorities. Certain duties are clear with regard to water but are complicated by the duties of Ofwat and the water companies.

With regard to development and the land use planning system, clearly the local planning authorities are the decision-makers. The Agency can advise and influence as a statutory consultee in the plan process. Its influence tends to be more effective when statutory powers, such as land drainage consenting and pollution control, are also involved.

The government requires all authorities to have prepared an environmental appraisal of their development plan by 2000. The emerging EU directive will further enforce the need for such strategic environmental assessment (SEA). It has been recognised for a long time that we need to sort out the sustainability of plans and policies first, and then it will be easier for the projects, for example, Lee (1997)[30]. The planning system itself is being revised and the implementation of more regional powers has commenced. The national Air Quality Strategy is being revised and a new Soil Strategy is to be produced this year. These new strategies and change offer opportunities for the Agency to secure effective policies and objectives to better influence the land use planning system.

Revised guidance on sustainable development is imminent for local authorities. Since the principle became established in the land use planning system, local authorities have begun exploring innovative ways of consultation and participation in order to comply with requirements of sustainability. This has included citizen's juries and visioning groups. Anecdotal evidence suggests that the Agency's experience with LA21 is varied and can consume resources as an information source.

The context is further set with a perception amongst environmental groups, such as the Wildlife Trusts, that all new developments must include environmental enhancement in order to comply with sustainability principles. This approach is also inferred by the revised UK Strategy on Sustainable Development. Debates about how much the developer should be expected to pay have stimulated debate on the use of economic instruments including tradable permits (which, of course, will need to be considered within the context of 'capacity').

Although this study has focused on the land use planning system, it should not be forgotten that the Agency has a role (and is consulted on) with respect to non-town & country planning matters. These include highways, pipelines and forestry

developments, which can have profound impacts on the environment, and should be included in any Agency approach to environmental capacity.

4.2 The Need for Involvement and the Agency's Role

The major allocations for housing development, and media/public attention towards public water supplies, have encouraged planning authorities to seek advice from the Agency in order to inform strategic and locational decision-making. Whilst the concept 'capacity' may or may not have been used, the requests were associated with the ability of the land to absorb such change and, in some areas, a recognition that the environment was already under strain. It is however noteworthy that while some planning authorities have requested support from the Agency, it has been reported that others have not welcomed the Agency (see also later 5.6) contributing so proactively. These contrasting approaches, enthusiasm on the one hand and coolness on the other, both make an equally strong case for the Agency to inform the planning process on a consistent and equitable basis.

Other than strategic and locational development options, there are also the instances of specific developments where it can be argued that there is a need for the Agency to advise on the scope of environmental assessments and make judgements (on the basis of sound science or professional opinion) on the information supplied in Environmental Statements as to the ability of locations, habitats and resources etc to absorb change. As a consultee in such circumstances this represents an opportunity for the Agency to promote best design and management options, such as source control, to mitigate impacts or produce environmental enhancement. The draft amended Environmental Assessment Regulations require consideration of the sensitivity (capacity) of the receiving environment when deciding whether a Schedule 2 project needs an environmental assessment.

There is consensus that environmental issues cannot be considered in isolation from the social and economic elements of sustainable development, for example, Mulgan(1998)[31], who believes that government policy on the environment must be dealt with in an integrated and holistic manner. This was further confirmed during the Agency Workshop - even though the Agency only has part of the agenda, those parts within its remit have to be considered within the context of sustainable development.

The role for the Agency is to inform and contribute expert advice to the planning process. The Agency is different from the other environmental agencies, who are single issue led. It has guidance from government to integrate management of the environment and, therefore, it is important and appropriate for the Agency to present an integrated response to any capacity studies for those elements (air, land, water, biodiversity) of the environment within its remit. The Agency can also offer national consistency translated to the local context through both its regulatory and advisory roles. Nonetheless, the Agency is not the only regulator and it will be necessary for an equitable distribution of responsibility towards capacity studies.

4.3 Policy and Strategic Framework

It is generally accepted that application of an environmental capacity approach to the land use planning system has to be set within a clear framework of policies and objectives. The Agency has published its Environmental Strategy for the Millennium and Beyond, which includes the main issues to be addressed, together with its Functional Action Plans. There are various strategies at regional level, for example, water resources and recreation, but they do not necessarily list objectives. At the catchment level, LEAPs include issues to be resolved (objectives) and there is support for a 'bottom-up' approach. However, the need to focus resources within an overall policy/objective framework, which cascades from national to local level, has clear advantages. This would be necessary for a robust and defensible contribution to environmental capacity studies.

4.4 Definitions and Semantics

Definitions and semantics (see Section 2) will have to be resolved since whatever approach is taken by the Agency needs to be clearly understood by planners, developers and the public. At the Agency workshop there was a consensus that the concept of "carrying" was not appropriate since it was confusing and open to misinterpretation with respect to the Agency's remit. "Environmental" may be more acceptable but one respondent suggested that perhaps "capacity" is the misleading term. The situation is further confused by differing common usages since most planning authorities, when talking about their 'environmental' approach and achievements, are actually referring to issues such as schools, transport, quality of the countryside, wildlife and landscape, access and recreation. Issues of concern to the Agency are not always included. Few planners appear to comprehend carrying capacity. Therefore, any methodology must have clear terms of reference and be understood by planning authorities. Since they seem to have embraced the concept, if not the use, it may be most readily effective for the Agency to inform and influence the environmental capacity process.

4.5 Use of Limits, Indicators and Thresholds

Whilst advocates of environmental capacity suggest that overall development 'limits' are inappropriate and thresholds should be used, the Agency **has** to work with certain limits and, indeed, such standards may be the first layer in traditional sieve mapping. The Agency enforces standards such as ambient qualities, performance standards or prohibition of activities. These standards are set by national or international legislation and are frequently derived from EC environmental legislation: limit or guideline values are often used.

Thus, the Agency does have to work with some limits. Ambient (environmental quality) qualities are assessed in relation to potential damage to health of the environment (or components of it) (eg bathing water directive) and individual emission standards are then set to comply with or achieve the ambient standard (eg IPC authorisations). Specification or design standards may be set when, for example, monitoring may not be effective (eg stack height). Other standards in frequent use are

exposure standards (eg radiation) and product standards (eg drinking water quality). The setting of such standards is not necessarily based on sound science but may be based on an existing situation (eg Freshwater Fish Directive) or may be influenced by limits of detection or analytical techniques (eg Dangerous Substances Directive).

In the UK traditionally the approach of regulating such standards has been discretionary whereas the EC has imposed strict limits. Such limits have also usually been set for individual elements of the environment, eg air, land, water, whereas the emerging IPPC directive tends to take a more holistic approach and follows the UK's IPC. Therefore, the Agency is accustomed to applying standards which may be integrated into a 'capacity' approach. Frequently it already uses a wide ranging objective-led approach in carrying out its functions, for example, the preparation of water level management plans, and is well-placed to offer a pragmatic approach.

Considerable work has been carried out to develop indicators to measure sustainable development for decision-making on policy. The use of indicators aims to simplify complex information by communicating the relevant and quantifiable data to explain change with time.

Much of the UK work is based on ongoing international work, for example, OECD[32] and UNCSD[33]. In 1996 DOE[34] produced a preliminary set of around 120 indicators which are currently being revised to address issues of social equity and lack of targets. The Local Government Management Board (LGMB) produced a list of indicators for use by local authorities in LA21[35]. Business and industry have also embraced the use of indicators and, for example, the draft ISO 14031 suggests key performance indicators (KPIs) for use within Environmental Management Systems (EMSs). This has a particular relevance to the Agency's regulatory function.

The UK Round Table on Sustainable Development[36] recommended that a restricted set of key indicators should cover areas of crucial importance as follows:

- consumption of non-renewable resources
- pollution of air, water and land
- social issues
- biodiversity
- landscape and cultural resources

The work with indicators traditionally follows a pressure/state/response approach where human activities exert pressures on the environment which changes its state. Society responds to these changes by institutional, legal or financial measures which in turn affect the pressures by reducing them or moving them elsewhere. The application of this approach has been recently illustrated by the admirable Thames Region State of the Environment Report[37]. The Agency nationally is preparing a core set of indicators (see also later 5.5).

Thresholds identify the level in an indicator, standard or objective, when change may be significant and require an action. Such thresholds will vary according to policy objectives, management options, geography and time.

Frequently professionals have to use thresholds which may be subjective by their very nature, eg odour, taste, visual impacts. The use of such characteristics should not be rejected merely because of such subjectivity: it has however to be recognised and used with caution as appropriate.

A particular issue for limits and thresholds is integration within an holistic approach. Work is ongoing and an application to land use planning is illustrated by one research project, for example, in South Wales as part of the Sustainable Cities programme. A model has been developed to understand relationships between policy decisions, air quality and the state of the economy[38].

The use of standards and limits for specific media or environmental variables do not in themselves define absolute development limits but thresholds for action. The Agency need not be concerned with **overall** capacities (which involve the full gamut of sustainable development) but with consistent advice to local authorities (and recognition by them) on those elements of water/air/land/biodiversity in its remit.

4.6 Boundaries

Land use planning decisions have to be made through administrative boundaries which may not correlate with appropriate environmental boundaries. Catchments are clearly the most suitable planning and management boundary for water, although water resources are best considered within regions for a land use planning context. Air pollution varies with the characteristics of the pollutant and weather patterns; transfrontier boundaries are involved. These factors need to be taken into account in capacity studies and the Agency is well-placed to contribute according to the appropriate environmental boundary. Working with both geographical and environmental, including assimilative, capacities has perhaps contributed to the difficulties for local planning authorities with the practical implementation of environmental capacity.

4.7 Consultation and Partnerships

Local authorities are exploring different ways of consulting/participating during development plan preparation as part of their commitment to the social/economic elements of sustainable development. The Agency has also recognised the value of partnerships and, for example, made significant progress on waste minimisation through partnerships with industry. Furthermore, the Agency is also exploring wider consultation, for example, with the setting of contentious licensing. There may be opportunities for collaboration.

5.0 POTENTIAL AGENCY APPROACHES TO CAPACITY IN LAND USE PLANNING

5.1 Introduction

Carrying capacity implies scientific and absolute limits. It is generally not understood by land use planners and Agency staff feel that it is a confusing term in the context of land use planning. 'Capacity' itself may also be inappropriate and misleading but it is being embraced by the land use planners and, therefore, it is likely to be most effective for the Agency to contribute proactively to this approach which is ongoing in areas under great housing development pressure.

Such an approach will also still be applicable to those authorities using traditional sieve (constraints) mapping by offering a mechanism to better address environmental issues that are outside designated or protected areas. By taking a lead on integrated environmental management, the Agency is well placed to advise on thresholds at which development impacts may effect significant change, together with management options for mitigation and enhancement. Clearly the process will need to be iterative and interactive with the planning authorities.

5.2 Ground Rules for an Agency Approach

The Agency's approach to environmental capacity should:

- involve strong sustainable development policy and strategic framework with clear objectives and targets, together with appropriate monitoring systems.
- be accessible, simple to use and understand, pragmatic.
- be relevant, measurable and economically beneficial.
- be consistent, integrated and transparent.
- be technically sound and robust enough to withstand public examination.
- be flexible to be able to anticipate future trends in legislation and development pressures and adaptable to the needs of different planning authorities and all levels of the planning process.
- be compatible with methods used by planning authorities and integrated with other methods used by the Agency.
- be applicable to all geographical areas (ie receiving environments) within England and Wales.
- include public involvement and consider the global impacts to comply with sustainability principles.

- consider the longer term, ie 30 years and beyond.

- accept that change is implicit to the nature of ecosystems, including our own, and that we are considering the limits of acceptable change.

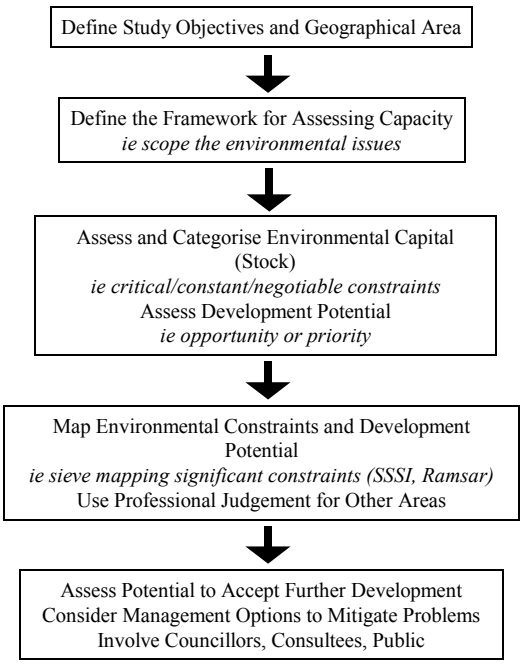
5.3 Outline Agency Approach to Inform the Environmental Capacity Process

5.3.1 Overview

We suggest the Agency contributes expert advice and relevant information on those elements of the environment for which it has duties, powers and interests for those elements within its remit. The Agency is already supporting a systems approach to the environment through the new approach to environmental capital. This is compatible with the existing systems approach to land use planning. Elements of the environment, eg emissions to atmosphere from complex industrial processes, status of salmonid fisheries, may be assessed individually and then aggregated so that the Agency presents an integrated response. (It may be noted that integration can be an issue for local authorities themselves with departments such as building control, environmental health and planning working separately).

The approach outlined would be applicable to a housing capacity study at regional, county, unitary and district levels of development plan preparation. It could also be used more generally in policy and strategy formulation during plan preparation at each of these levels, as well as being applied to specific development proposals. Studies carried out by planning authorities may not be called "capacity" work but they are essentially concerned with "capacity" issues, ie the ability of the land to accept further development. For the purposes of this report we will use the term "capacity" notwithstanding the debate about the suitability of the definition.

The potential input from the Agency is considered in the following sections for each stage of a typical approach which may be taken by a planning authority (see previously 3.3 and Figure 1) is reproduced here. This stepped approach will be relevant to those authorities effectively extending traditional sieve mapping techniques. However, for those authorities exploring innovative consultation/participation techniques during, for example, plan preparation, the approach may be more circular (iterative and interactive).



5.3.2 Defining the Objectives and the Geographical Area

This is a vital initial stage to a capacity study since the concept itself is dependent on clearly defined objectives. It may take the form of propositions, as with the West Sussex studies, for example:

> *"the physical environment of the county is deteriorating at a rate which suggests that increase in development and activity beyond what the Structure Plan Deposit Draft proposes could, in combination with other trends, produce an irreversible trend in the quality of life and the environment"*.

The SERPLAN Regional Housing Capability Study included an aim to demonstrate some of the impacts and consequences associated with different levels and distributions of housing growth in the south-east over the period 1995-2016. This is discussed further in 5.3.4.

Generally these objectives have been set by local authority officers and members; organisations such as the Agency have not been invited to contribute at this inception

stage. This may change within the wider embrace of sustainability principles. Clearly the Agency would be best placed to advise on the applicability of a county boundary to a significant water resource issue which may need to be assessed at a regional level. **We recommend that the Agency should seek to contribute at this initial stage as a matter of course, in order to help to identify any key natural resource issues which might shape the study.**

It is interesting to note the studies currently proposed by Kent County Council in response to the emerging regional strategy which emphasises the role of recycled urban land to meet development requirements. The County has a target to maximise the use of recycled urban land for housing. Urban capacity is to be evaluated through the following studies of the major Kent towns:

- Identification of previously used land.
- Assessing the environmental capital.
- Assessing the sustainability characteristics.

These are key studies proposed by a county under considerable development pressure and with environmental resources already under significant strain. These studies could be considered to be "capacity" work with the objective of maximising the use of recycled land for housing and the Agency approach outlined here would also be applicable.

An example at the district level may be found with Horsham District Council which has considerable housing pressures and very limited space identified after initial sieve (constraints) mapping. The district is interested to explore environmental capacity as a tool to assist with locational choices, particularly with reference to maximising opportunities for gain and environmental enhancement, together with promoting management options such as water recycling and use of efficient appliances in development briefs. Again, it is believed that the approach outlined could be applied here where the objective is basically that development land must be found.

5.3.3 Defining the Assessment Framework and Scoping the Relevant Environmental Issues

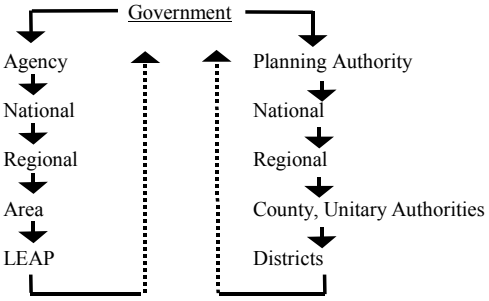
This identifies the issues or elements of environmental capital (stock) to be assessed in order to achieve the objectives. If a full environmental capacity study was proposed, a planning authority may consider using the categories in a standard strategic environmental assessment of plans and policies. For example, the categories proposed in the Step by Step Guide to Environmental Appraisal (1996) by Bedfordshire CC/RSPB[39] are as follows and may be correlated with the issues in the Agency's Environmental Strategy for the Millennium and Beyond; although we suggest that the Agency should **identify the relevant** issues and advise the local authorities:

Table No. 1: Environmental Issues from Strategic Environmental Assessment (SEA) correlated with the Agency's Environmental Strategy

Category	**Factors**	*Millennium Strategy Issue*
GLOBAL ENVIRONMENT	Global Footprint	
	Emissions:	
	• Transport	*Improving Air Quality* *Addressing Climate Change*
	• Industrial	*Improving Air Quality* *Addressing Climate Change* *Regulating Major Industries*
	Energy/Fossil Fuels	*Improving Air Quality* *Addressing Climate Change*
	Global Biodiversity	*Enhancing Biodiversity*
USE OF NATURAL RESOURCES	Air	*Improving Air Quality* *Regulating Major Industries*
	Water Quantity and Quality	*Managing our Water Resources* *Delivering Integrated River-Basin Management* *Conserving the Land* *Managing our Freshwater Fisheries*
	Mineral Extraction	*Conserving the land*
	Land and Soil	*Conserving the land*
	Waste	*Managing Waste*
QUALITY OF THE LOCAL ENVIRONMENT	Landscape Character and Open Countryside Quality of Life in Towns and Villages Cultural Heritage Open Space and Public Access Quality of Townscapes and Individual Buildings	*All 9 issues* *plus* *educate/inform*

If we accept the "capacity" concept in the context of land use planning to be founded on policy objectives and management options, the Agency's Environmental Strategy issues can be equated to overarching policy objectives at the national level.

5.12 Policies/objectives need to be relevant to the scale of the study and would cascade through from the national to the local and feed back up to government. Functional disaggregation may need to precede an integrated response.



This is an area where the Agency may need to strengthen its strategic environmental planning to identify relevant objectives at each level, particularly the regions and areas. For example, TE21 (and subsequently the Thames SOE Report) and the North Wessex Area Plan were prepared in response to pressures from planning authorities needing to know Agency concerns/objectives within a wider context than the local detail of LEAPs.

Scoping the relevant issues is an essential part of the environmental assessment process which assesses the impacts of proposed development projects and suggests mitigation measures to resolve adverse effects. We are extending the application here but the process is comparable and practical experience can be utilised. It is noteworthy that the UWE/LGMB guide suggests carrying out a "*mini EA*" for each potential development location (and, indeed, this is undertaken by some planning authorities) and we have designed a practical approach for the Forest of Dean (1998) residential design guide.

5.3.4 Assess and Categorise Environmental Capital; Map Environmental Constraints; Identify and Map Development Potential

Clearly there is an important proactive role for the Agency to contribute elements of the sustainable development agenda at this stage and particularly to assist with assessing and categorising the environmental capital and against key thresholds. Practitioners had found it difficult to categorise environmental capital into constant, critical and negotiable. The new approach to environmental capital may offer a way of assessing which attributes of the capital actually matter for sustainability and to reconcile, rather than trade-off, environmental and development objectives. The approach may also help justify enhancement but decisions on protection, substitution and enhancement still need to be assessed against environmental standards and

targets. However, the new approach is very time-consuming and, as noted below, planning decisions are currently often made on the basis of simple sieve maps and political hunches. The quality and consistency of Agency input could help upgrade the process as a whole.

Constraints mapping of those environmental resources which are the interest of the Agency, has tended to use readily available information (which may or may not have had relevance to the study and perhaps was rarely interpreted further than lines on a map). This may have included, for example, the following:

s105 flood risk areas
source protection zones
river water quality - status and objective

Rather than just supplying the information requested, the Agency could have a more proactive and sophisticated role by advising the appropriate elements and indicators for each environmental resource relevant to the objectives of the 'capacity' study. The level of sophistication, analysis and resource requirement will depend upon the specific objectives of the study (albeit that we are primarily considering the impacts of housing on the environment) and the scale within which it is set - regional or local.

The Agency can provide professional judgement in a cost-effective way as indicated by the Hampshire County Council housing development locations study. The planning authority needed to make locational decisions on some 23 options including sensitive sites. The Agency was invited at area level to work with the planners. The approach used was the overview screening method for assessment of development pressures by county, which had been prepared for Thames Environment 21. A pragmatic and integrated approach was taken by using internal workshops with staff from each relevant function and considering a green, yellow and red response to each proposed development location:

Green	:	No environmental problems
Yellow	:	Potential problems
Red	:	No development

As this was a strategic screening approach boundaries were only approximate. Professional judgement was utilised to give an integrated response which did identify a small number of red and green locations (most were yellow) which was much appreciated by the planning authority.

``

At the Agency capacity workshop, this approach was debated with additional modifications as follows:

Amber:
Yellow: Possible difficulties
Orange: Known difficulties
} and mitigation/negotiation needed

Many Agency staff felt that this was too simplistic. However, it was noted from discussions with planners that this is actually more sophisticated than the sieve

(constraints) mapping carried out by most planning authorities and, therefore, does offer a useful start. It is much more simple and readily applied than the new approach to environmental capital and, for example, is currently being successfully used with the Agency and Surrey County Council working together at an earlier stage of plan preparation. A similar colour-coded screening approach was included by the Midlands Region in their document *Our Midlands Region* (1997) to indicate the relative status of surface waters impacted by abstraction. Clearly there is a need for further detailed study and consultation on the most effective way the Agency could contribute at this stage.

The water resources study for SERPLAN is another example of an issues-led approach but at a regional level. Fundamental issues for planning in the south-east are whether the availability of water resources is likely to become an environmental constraint and the scale and location of the future housing development. The Agency has provided an interim commentary, following discussions with the water companies, which identifies key pressure areas for water resources and infrastructure. Management options such as reducing leakage, promotion of water efficiency, waste minimisation schemes, metering and conservation tariffs, are highlighted. It is also noted that related waste water disposal and river water quality issues could be equally significant. (This is a particular aspect which few planners have appreciated and perhaps a stronger message needs to be sent from the Agency). The challenge remains for the land use planners to utilise this information into the revised RPG9.

These two examples illustrate the effectiveness of an approach based on relevant and available data with professional judgement. This is compatible with the land use planning system which relies on guidance and professional judgements. Compatibility includes the Agency's regulatory and pollution control functions where a discretionary approach has been traditional in the UK.

As recognised at the Agency workshop, a constraints approach is easy, although not all can be mapped and presentation may be an issue. However, we need to go further than such a black and white approach, but will a more sophisticated approach (which considers an integrated response and mitigation/enhancement opportunities through management options) demand excessive data, time and resources?

'Capacity' in this context only has validity within a strong policy framework (based on sustainable development) and with clearly defined policy objectives and management options. For each objective/policy specific thresholds must be defined which identify the levels at which an impact/change/interaction require an action or decision, and targets identified. Progress and measurement of change by using indicators can limit data requirements by focusing on monitoring these key indicators relevant to the specific study/objective. This, together with a prioritised issues-led approach, could reduce resource demands. Effective and comprehensive input to the plan making stage can also save time later in responses to specific projects.

Thresholds will be needed to identify characteristics of change such as:

- Potential for non-compliance with standards (statutory and non-statutory)

- Interactions (antagonistic, synergistic, accumulative)

Thresholds may vary according to geography, time, policies and the objectives of the capacity study.

Indicators generally simplify a complex concept such as sustainable development by aiming to quantify selected aspects of it so that change can be monitored and information can be communicated. Indicators may be applied to 'capacity' studies and their use can focus the relevant information applicable to a study so that data resource demands are optimised. The challenge, of course, is to choose sets of indicators which facilitate the capacity assessment.

Perhaps, ideally, the Agency needs a set of indicators appropriate at each level: national, regional and area. It is understood that preparation of a core set of environmental indicators is ongoing, initially compiled from the many lists of indicators used to monitor progress on sustainable development. Indicator sets for individual functions and the Environmental Strategy issues may also be needed. It is important to remember that indicators are not absolutes and that they may equate to specific objectives at the local level.

The use of the traditional state/pressure/response approach to indicators will also help identify, at each level, priorities for protection and enhancement. The cascade-down approach (national $\rightarrow$ area) is necessary to ensure consistency but there can also be input from aggregating issues and indicators at the area/LEAPs level to promote a "bottom up" approach. This has similarities to the *"virtuous circle"* approach, which includes iterative consultation of development options, now proposed at West Sussex CC.

Are environmental, sustainable development and capacity indicators the same? If we accept that the environment cannot be dissociated from the social and economic aspects of sustainable development, even though the Agency only has part of the agenda, nonetheless the environmental elements of that part must be within a context of sustainable development. Therefore, it seems likely that there will be correlation with environmental indicators used in sustainable development studies. Furthermore, since capacity studies must also be set within the context of sustainable development, generally the indicators should be interchangeable.

The Agency, through *Viewpoints on the Environment*, is already re-evaluating what needs to be monitored in order to fulfil its functions and to report on the environment. There will be environmental capacity indicators for which there is limited or un-reliable quantification and these will need to be acknowledged. Experience from using the approach with quantifiable indicators will identify whether new measurement techniques are needed. The following figure illustrates an approach to identifying indicators within a policy objectives framework:

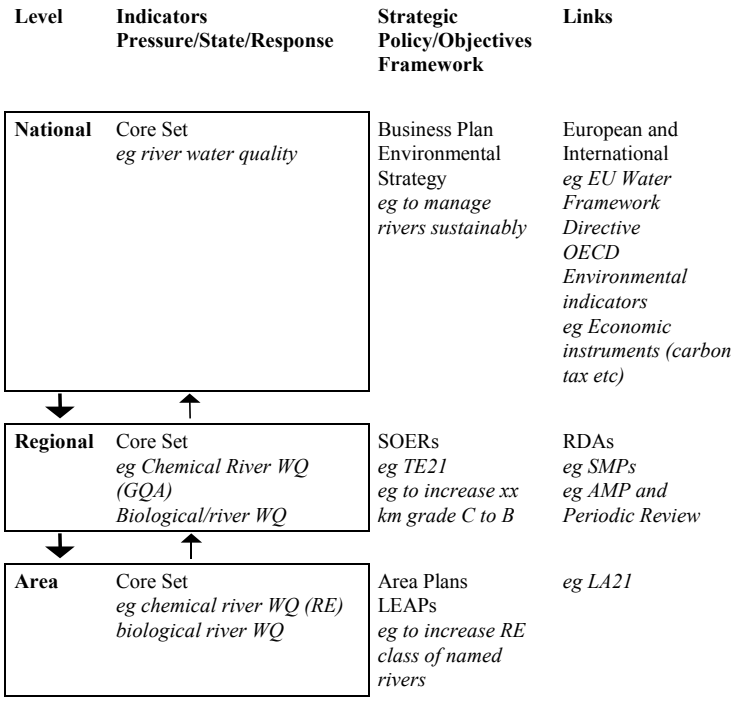


Figure 2: Illustrative Approach to Indicators and Policy/Objectives Framework

5.3.5 Consider Management Options, Complete Capacity Assessment

The potential impacts from different development types are well documented from environmental assessment studies and, for example, the Agency is updating the NRA's Scoping Document which detailed impacts of relevance to water interests. Clearly impacts vary according to the state (and type) of the receiving environment and the mitigation (management options) chosen to resolve any adverse effects. It would be helpful to categorise management options with key environmental impacts, for example, as follows:

Table 2: Illustrative Approach to Impacts and Management Options

Development Type	Environmental Impact	Management Option
Housing	Increased surface water run-off	Source control
	Changed river flow regime	Recycling and reuse
	etc	Creative design
		Increased biodiversity
		Environmental enhancement
		etc

For a given objective and thresholds, the application of management options will change the environmental capacity and there is an iterative and interactive relationship:

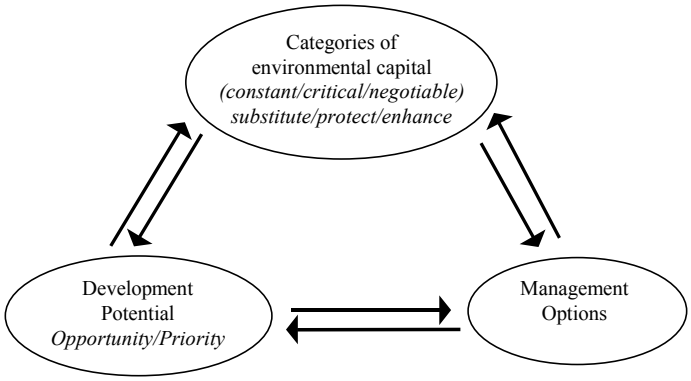


Figure 3: Relationship between Environmental Capital, Development Potential and Management Options to Change Capacity

Thus environmental capacity can change with different choices and consequences. For example, the impacts of housing developments on the water environment may vary considerably depending upon the availability and extent of options associated with the water resource itself, distribution, treatment and discharge of wastewaters, and management of flood risk (see also above Table 2). The capacity of a watercourse to receive treated effluent from a sewage treatment works may vary with the extent of greywater recycling and use of water-efficient devices; the capacity of a watercourse to receive increased surfacewater runoff may vary with recycling and reuse and/or be mitigated/ameliorated by creative design and habitat enhancement.

This proposed iterative and interactive approach here should facilitate practical implementation of environmental capacity studies. Whilst the Agency does have to operate within some absolute limits and standards, there is flexibility and choices in other areas.

The ultimate development decision is clearly with the planning authorities and the extent of Agency influence will vary with personalities and authority approaches. Those authorities with the most development pressure may be most receptive to a more sophisticated input from the Agency which could be integrated for those environmental resources within its remit as follows:

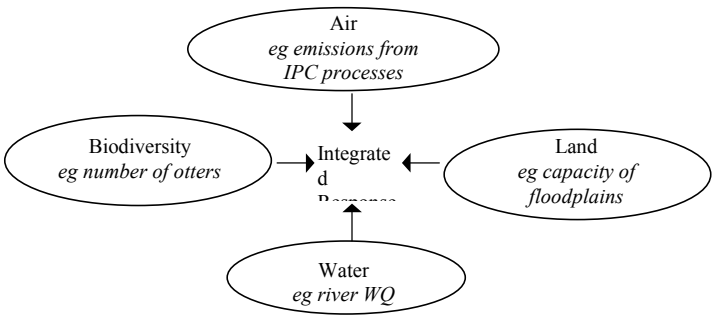


Figure 4: Integration of Agency Response to Capacity Studies

There are, of course, other interactions, such as the consultation and participatory processes used by local authorities. The relationships between planning authorities, the Agency, the Water Companies and Ofwat are clearly a special consideration. External influences include AMP, EU directives and scientific advances. The detail is beyond the scope of this study but it is interesting to note that several participants at the Agency capacity workshop suggested that environmental capacity is controlled by AMP and the Periodic Review. It is widely recognised now that the planning authorities have to involve the Agency and water companies more in development decision-making but attitudes and experience vary across the country.

5.4 Other Approaches

There has been a continuing issue since the 1960s that environmental impacts and 'capacity' of natural resources could be better evaluated if all the elements were in common units. Money would be a convenient denominator for politicians and economists. There is general consensus amongst environmental practitioners that money is not the right approach because, for example, there is the tendency to "add it up" and methodologies remain open to considerable debate. The decision reached on the River Kennet is a salutory reminder of the potential consequences. However,

development of methodologies will continue since there may be advantage such as justifying benefits from the use of economic instruments and integrating environmental 'value' into land values.

There has been a recent reinterest in the use of ecological footprinting (see also 3.4) as a potential tool for putting some impacts from housing onto a common basis. It is thought to have particular applicability for energy issues and the physical occupation of the land. Since energy and transport (including energy use associated with transport) are considered to be the major issues to be resolved for progress towards sustainable development, at least in Britain, this approach may assist 'capacity' decision-making. Footprinting does not deal directly with biodiversity or quality of life aspects which are better approached through environmental capital[40]. If this approach becomes attractive to land use planners, the Agency will need some input since this 'land equivalent' approach includes, for example, water use for biomass crops and assimilation of wastes.

The Agency may influence 'capacity' decision-making not just directly through specific capacity studies. For example, the use of an accredited EMS by business or industry will effectively increase environmental capacity through achievement of higher standards and targets. Similarly, achieving enhancement through mitigation in environmental assessments will effectively increase capacity (although it should be noted that mitigation commitments in ESs are often not implemented through lack of local authority enforcement resources). Additionally, the quality of the environmental appraisals of development plan policies will indirectly affect 'capacity'.

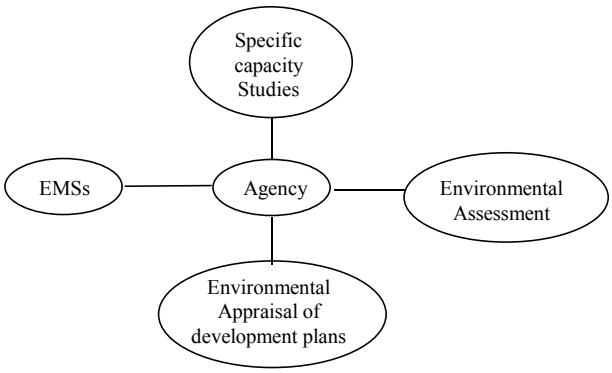


Figure 5: Routes to Influence Environmental Capacity

5.5 Feasibility of Identifying Readily Usable Thresholds

Those thresholds relating to compliance with statutory requirements, and certain non-statutory objectives and performance targets will be readily identified and applied to

policy/objectives and management options. Others will be less clear and there may not yet be available suitable measurements or adequate data. As previously discussed (see 3.4) this would not necessarily limit progress of a 'capacity' assessment.

The process of identifying sets of indicators will reveal the availability of those which are readily quantifiable. Such characterisation could be achieved through a simple matrix approach, for example, assuming assessment of housing capacity, as follows:

Thus, there is potential for added value to environmental capacity as an environmental planning tool. It can interact and build upon existing Agency tools, such as EA Scoping, environmental capital and LEAPs. It can also inform and interact with other key elements of the land use planning and pollution control systems - environmental appraisals and assessments, and environmental management systems.

The Agency may also influence capacity through influencing development briefs. For example, at Stevenage with the contentious housing proposed in Green Belt, the Agency has presented a position statement which includes a requirement that the housing should incorporate the latest techniques for water-saving etc.

In Sussex, the Agency is working with a district planning authority to prepare specific details of requirements for sustainable water management to incorporate into housing design briefs.

Table 3: Characterisation of Indicators

Characteristic	**Indicator eg Chemical WQ**	**Indicator eg Biological WQ**
Available measurement technique		
Available data		
Reliability		
Relevance to capacity		
Interactions: Synergistic Antagonistic Accumulative		
Etc		

Such analysis will help identify links, duplication, gaps and potential conflicts between indicators, and facilitate development of core sets.

Thresholds will vary according to regional (and area) differences in environmental objectives. For example, in the south-west an objective might be to **maintain** otter numbers, whereas in the Midlands the comparable objective might be to **introduce** otters. The threshold of otter numbers for consideration in a housing capacity study

will be different (as well as the management options). Other techniques such as the Multi-Attribute Technique (MAT) for water quality (which includes weightings from public value judgements) may be useful in determining appropriate thresholds. Indicators may become (limits) objectives at the local level and here there is an obvious mechanism with LEAPs.

5.6 Practicalities of Working with Planning Authorities

There is wide variation among planning authorities regarding the extent of Agency involvement. This tends to correlate with the amount of development pressure and, for example, comments such as *"it's an open door", "help us as much as you can"* and *"this is an urgent area of work"* were received from planning authorities under pressure in the south-east. This also included invitations for proactive inputs to consultation/participation trials for plan preparation. There are resource implications and the benefits to the Agency must be clear but it is recognised that the Agency can be more effective the earlier it influences the planning process.

At a regional planning level it was suggested that while planning authorities and others want to work with the Agency it does not cover the totality of the environment. It is perceived that the Agency is not clear about its own objectives and *"where its teeth are"*. It is acknowledged that a new Agency needs time to establish and, additionally, the land use planning system has become complacent. Exploring the Agency's role in carrying/environmental capacity was seen as an urgent, and welcome, area of work.

Several authorities expressed concern that the Agency should consider developing a separate method and felt that the Agency's role was to inform and contribute to the planning process. A common concern voiced by planners around the country was that they needed to know **what exactly** the Agency wanted - clearly and consistently. This is an interesting observation and illustrates the continuing need to get the message through. Clear objectives at regional and local levels would help and feed into other processes as well as capacity studies.

There is the potential for the Agency to contribute an integrated response for those environmental elements within its remit to capacity studies associated with the following:

- Strategic plan preparation - regional and county
  (broad locational decisions)
- Local plan preparation - district and unitary
  (detailed siting decisions)
- Design Guides and Supplementary Planning Guidance
- Local - specific development proposals
  (nb. if the other levels are working, this becomes easier/more standard).

5.7 Progression to Full Scale Study

Ideally policy objectives and management options would be needed for each region to reflect regional political and geographical differences, correlated with key indicators for each applicable environmental issue. This will take time and resources and, for example, the core set of indicators have not yet been agreed at national level. However, this need not preclude progression to a full-scale study to test the concept and approach outlined here previously.

We suggest a pragmatic and issues-led approach. There are a number of planning authorities who actively want to explore the practical application of the capacity concept and are seeking Agency involvement. This includes Hampshire and Surrey CC who are already working with the Agency in respect of housing locations, and Sussex CC who are proceeding with their Strategic Development Options Study (see also 3.3). As a result of a meeting on this Agency research study, it was acknowledged that issues within the Agency's remit had not been adequately addressed previously and that the planners were keen to incorporate these elements in the SDOS (which is already trialling the new approach to environmental capital).

The time is now and it is proposed that the Agency seizes the opportunities to work with key authorities on practical development. This would place resource demands on Agency staff in the selected trial areas but this would be a temporary pressure during the period of the study. Local objectives will need to be established initially as the foundation for the integrated response from the Agency. It is suggested that, as a minimum, one region, one county and one district is selected. If/when resources are available then additional authorities can be explored, in Cornwall, for example, to test the application against peak visitor inputs and high unemployment, and elsewhere to test the different characteristics of the regions.

6.0 CONCLUSIONS

6.1 Carrying capacity implies scientific and absolute limits whereas environmental capacity is a wider concept and recognises principles of sustainable development. Agency staff generally felt that "carrying" was a confusing concept and land use planners were generally not familiar with the term.

6.2 Definitions and methods of using environmental capacity in the land use planning system are diverse. A study for DETR (1997) concluded that there was a role for environmental capacity in the system. There are few practical examples and those elements of the environment within the remit of the Agency have rarely been considered beyond lines on a map of constraints (although, for example, the use of environmental standards and water quality objectives is commonplace in environmental studies).

6.3 The need to resolve development pressures, particularly from housing, is encouraging authorities, such as West Sussex County Council to further refine environmental capacity as a tool for decision-making. Others are starting to explore additional ways, such as ecological footprinting, to assess the impacts of housing.

6.4 There is a need and a role, which is more sophisticated than an information source, for the Agency to inform the land use planning process at all levels. Planning authorities need advice on the ability of the environment to absorb land use change. The Agency can better influence and achieve its objectives towards sustainable development by taking a more proactive lead in integrating environmental management.

6.5 "Capacity" in the context of land use planning is not absolute or objective; it is dynamic and relates to policy objectives and management options. These need to be clearly defined, with thresholds, by the Agency for those elements of the environment within its remit. 'Capacity' will change according to the management options chosen for a given objective. The Agency has to work with some absolute limits but there is flexibility and choices in other areas.

6.6 The Agency must take an integrated environmental approach, unlike the single-issue agencies and groups. It is agreed that the environment cannot be separated from the social and economic elements of the sustainable development agenda.

6.7 Most capacity studies only consider constraints, not opportunities or management options. The Agency is well placed to identify opportunities for environmental enhancement and advise management options such as water demand management, source control, and creative design solutions.

6.8 Although the development decision-making has to be made according to administrative boundaries, tools such as environmental capacity and capital can identify appropriate environmental boundaries and advise the interactions between resources. This will also integrate geographical and assimilative capacities. The Agency can facilitate between planning authorities (and departments) by promoting a consistent environmental approach.

6.9 Any methodology on capacity from the Agency needs to be set within a sustainable development framework with clear objectives and targets. It needs to integrate with approaches being used by planning authorities. Local authorities are exploring innovative approaches to consultation and participation in order to comply with the social/economic elements of sustainable development.

6.10 The Agency's approach to capacity must be understood, transparent, credible, technically sound, consistent, relevant, measurable, accessible and robust enough to withstand public examination. There must be public involvement in order to comply with the principles of Sustainable Development: the LEAPs process may be utilised.

6.11 An approach which could be readily tested is proposed and this involves proactive contributions at each stage to the emerging environmental capacity method. This would integrate with other significant environmental planning tools: environmental appraisal of development plans (strategic environmental assessment SEA), environmental impact assessment of development projects, and environmental management systems (EMAS and ISO 14001).

6.12 The approach is applicable at national, regional and local levels. The Agency will need to develop clear and consistent policy objectives and a management options framework which cascades from national to regional and local levels. It will also be necessary to define specific indicators with targets for each environmental resource within its remit and at each level.

6.13 The time is now and rather than spend time on complex method development, it seems more important to work with key local authorities and take advantage of emerging opportunities by an issues-led approach. There will be initial (and temporary) resource implications to improve strategic planning, strengthen environmental objectives, and complete indicator sets.

6.14 A capacity approach could be promoted with an integrated guide to local authorities which sets out Agency objectives, thresholds and discretionary targets in the context of a capacity process which can be applied to environmental appraisals, environmental assessments and EMSs.

7.0 RECOMMENDATIONS

7.1 A clear need and role has been identified for the Agency to inform and contribute to the emerging environmental capacity method within the land use planning process. An approach to capacity is proposed which offers potential for integrating geographical and assimilative capacities, thus enabling practical implementation. The Agency should progress to a full scale study as soon as possible to test the proposed approach to contribute a proactive and integrated response for those elements of the environment within its remit.

7.2 Whilst the Agency works with some absolute limits, it has choices and flexibility in other areas; this is compatible with the dynamic character of environmental capacity. There is an iterative and interactive relationship between environmental capital, development potential and management options. The Agency is well-placed to advise on options and their consequences, which will contribute to practical development of the method. Capacity is about opportunities, not just constraints. This should be tested as part of the full scale studies.

7.3 Advantage should be taken of opportunities available now to work with forward-thinking planning authorities who are under considerable development pressure and are actively seeking Agency involvement. In the immediate term, it is suggested that one region, one county and one district is selected. If resources are available, additional authorities can be tested in regions with different development and environmental characteristics.

7.4 In the longer term, the Agency should develop a clear integrated and consistent set of policy objectives and management options framework which cascades from national to local. Core sets of indicators with targets should be developed at national, regional and local levels. These should be compatible with other indicators, for example, those used by local authorities and industry.

7.5 There is potential for added value to environmental capacity. It can interact and build upon existing Agency tools, such as environmental capital, environmental assessment scoping and LEAPs; it can also inform and interact with other key elements of the land use planning and pollution control systems - environmental appraisals and assessments, environmental management systems. It is recommended that these connections are further explored to optimise the effectiveness of the environmental planning and management tool kits. The Agency should consider promotion of a capacity approach within an integrated guide to local authorities which sets out Agency objectives, thresholds and discretionary targets in the context of a capacity process which can be applied to SEA, EA, EMSs, design briefs etc.

REFERENCES

1. CAG and LUC (1997). *Environmental Capital: A New Approach.* A Provisional Guide on behalf of the Countryside Commission, English Heritage, English Nature and the Environment Agency.

2. Department of the Environment (1996). *The Environment Agency and Sustainable Development.*

3. Begon, Harper, Townsend (1986). *Ecology.* Blackwell Scientific Publications, Oxford.

4. DETR (1997). *The Application of Environmental Capacity to Land Use Planning.* HMSO, London.

5. For example, National Park Service (1998) *The General Management Plan for Arches National Park* NPS, Utah and Washington DC. See also references quoted in Note 17 for Chapter 4. *The Application of Environmental Capacity to Land use Planning.* DETR (1997).

6. R Bell. (1985). *Carrying Capacity and Offtake Quotas.*

7. J Cohen. (1997). *Population, economics, environment and culture: an introduction to human carrying capacity.* J. Applied Ecology **34:** 1325 - 1333.

8. E Boserup. (1990). *Economic and Demographic Relationships in Development.* John Hopkins University Press, Baltimore MD.

9. P Hawken. (1993). *The Ecology of Commerce - a declaration of sustainability.* Harper Collins, New York.

10. Odum (1972). *Ecology*, New York.

11 Royal Commission on Sewage Disposal. 8th Report, Vol 1. (1912). *Standards and tests for sludge and sewage effluents discharging into rivers and streams.* HMSO, London.

12. DETR (1996). *op cit,* p12.

13. Royal Commission on Environmental Pollution (1998). *Setting Environmental Standards.* Twenty-first Report HMSO, London.

14. DETR (1997). o*p cit,* p24-25.

15. M Jacobs. (1997). *Making Sense of Environmental Capacity,* CPRE.

16. A Clayton and N Radcliffe. (1996). *Sustainability - A Systems Approach.* Earthscan, London.

17. CAG and LUC (1997). *op cit,* p91-92.

18. DETR (1998). *Opportunities for change. Consultation paper on a revised UK strategy for sustainable development.* HMSO, London.

19. H Barton, G Davis and R Guise. (1995). *Sustainable Development - A Guide for planners, designers and developers,* UWE/LGMB, Luton.

20. *ibid,* p8

21. M Jacobs. (1997). *op cit* p.

22. DETR (1997). *op cit* p 80

23. Barton et al (1995). *op cit.*

24. Ove Arup (1993). *Environmental Capacity and Development in Historical Cities.* Cheshire County Council, Chester City Council, DoE, English Heritage.

25. West Sussex County Council (1996). *Environmental Capacity in West Sussex* and *Urban Capacity in West Sussex.* Structure Plan Third Review.

26. DoE (1993). *Environmental Appraisal of Development Plans.* HMSO, London.

27. H Barton. (1995). *The Capacity to Deceive*. ECOS 16 (3/4).

28. B Connell and C Cousins. (1998). *Accommodating Development: A View from West Sussex. Environmental Capacity and Strategic Development Choices.* LI/RTPI Conference.

29. R Levett. (1998). *Urban Housing capacity and the Sustainable City. Monitoring, measuring and target setting for urban capacity.* TCPA, London.

30. N Lee. (1997). IEA/EARA Conference.

31. G Mulgan. (1998). Guest lecture, Forum for the Future.

32. OECD (1998). *Towards Sustainable Development - Environmental Indicators.* Paris, France.

33. UN Commission on Sustainable Development (1995). *Indicators of Sustainable Development for Decision-Making*, UNCSD, Belgium.

34. DOE (1996). *Indicators of Sustainable Development for the UK.* HMSO, London.

35. Local Government Management Board (1997). *Indicators for Local Agenda 21 - A Summary*, LGMB, London.

36. UK Round Table on Sustainable Development (1997). *Getting the Best out of Indicators.* London.

37. Environment Agency (1998). *Thames Region State of the Environment Report.*

38. P Cooke, P Jones, K Wilson and C Davies. (1998). *South-East Wales Eco-Model: A Planning Tool for the Environment and Economy* for EPSRC, Cardiff.

39. Bedfordshire CC/RSPB (1996). *A Step by Step Guide to Environmental Appraisal.* Bedfordshire CC, Bedford.

40. R Levett. (1998). *op cit.*

APPENDIX 1: REPORT OF WORKSHOP MEETING
Steel House, London 19 August 1998

Attendees:

Red Group		
Cathy Doidge	Team Leader - LEAPs	Cornwall Area
Regina Duggan	Environmental Planning - Business Planner	Midlands.
Gillian Hill	Principal Scientist - Technical Information	North West
Paul Wheeler	Planning Liaison Officer	Ridings Area
Peter Wilkinson	Environmental Planning Manager	Welsh - South West Area
Yellow Group		
Simon Slater	Technical Planner	Midlands
Hilary Carrick	Planning & Customer Services Manager	North West
Rachel Spence	Hydrologist (Resource Planning)	Midlands
John Weir	Environmental Planning Manager	Thames - West Area
Jenny Lowe	Planning Liaison Officer	Dales Area
Toby Hutcherson	Regional R & D Coordinator	South West
Orange Group		
Alan Rafelt	Team Leader - Planning Liaison	South Wessex Area
Alan Barnden	Regional Freshwater Officer	Anglian
Paul Collins	Development Planner	Head Office
Ros Deeming	Development Liaison Engineer	Thames - West Area
Prosper Paul	Regional Technical Officer	Thames
Tony Warn	Regional Water Resources Manager	Anglian
Blue Group		
Hugh Howes	Principal Strategic Planner	Thames
Ashley Holt	Consent Scientist - Water Quality	Head Office
Jonathon Jenkin	Manager - Technical Planning	Midlands
Jean-Paul Penrose	Environmental Assessment Officer	Thames
Tom Warburton	Team Leader - Customer Services	Northumbria Area
Viki Hirst	Ecologist	Ridings Area
Facilitators		
Barbara Carroll	Nicholas Pearson Associates	
Hugh Barton	University of the West of England	
Trevor Turpin	Nicholas Pearson Associates	
Paula Smith	Workshop Organisation Support	Thames

Project and Workshop Objectives

The Project is a scoping study to establish whether carrying capacity would be a useful tool for the Agency, to assess experience of applying carrying capacity and to identify ways in which the Agency could apply the methodologies to its work. The workshop explored the experience of a wide range of professionals from all regions within the Agency in order to identify ways in which carrying capacity could or should be applied.

Workshop Format

All attendees were provided in advance with a range of published definitions of environmental capacity and carrying capacity together with a briefing note on the new approach to environmental capital. An introduction to capacity was presented and a list of propositions was provided to stimulate debate.

Introduction to Environmental Capacity & Carrying Capacity

- Environmental capacity was defined as the level of human activity that can be sustained without unacceptable deterioration in the resource base. Different types were identified: natural, human and perceived (e.g. congestion).

- Frequent distinction between urban (often using traffic as a limiting factor) and rural (using sieve mapping to identify constraints and corresponding areas for potential growth). Recreational capacity studies tend to conclude that there is no absolute limit on numbers with levels dependent on management and policies.

- Suggested that the Agency should perhaps focus on the protection of natural resources in any involvement in environmental capacity as part of its role in promoting sustainable development.

Critique of Environmental Capacity Techniques

1. Stress environmental factors at the expense of social and economic factors

2. Deal effectively with locally-manifest spatial constraints but not global

3. Inconsistent treatment of urban and rural areas

4. Provide black and white answers, down-playing the potential of management

5. All about constraints, not needs or potential

The potential links between the Agency and local planning authorities can be demonstrated by the requirement in PPG 12 for local authorities to undertake environmental appraisal of Development Plans. This process involves:

- Characterising the environment - SOE reports, data for environmental capacity, etc.

- Scoping and best practice analysis - What are the key issues? Which policies are required?

- Evaluation of options - spatial and temporal (policies) - how to cope with through development of RDA?

The Agency could potentially be involved in all 3 stages.

Principles

The morning session covered the theoretical concept of environmental and carrying capacity. Initially, the key principles involved had to be identified; some ideas were suggested in the form of propositions (see attachment) to be explored in greater detail. Listed are the key points raised during the morning general discussion:

- Agency to be firm and clear from the outset of any discussions and have a clear agenda and vision. The Agency has a need to inform, educate and influence, and has a duty to provide reliable information.

- The Agency's role should be limited to advice and guidance on technical environmental matters rather than social and political although politics cannot be ignored. However it should actively and firmly articulate its opinions on environmental principles and contribute to the debate.

- Need to use recognisable language for our audience in setting out our opinions and guidance. Our advice will then be more readily received by local planning authorities and incorporated in local plans - need to be transparent and simple.

- Case studies suggested to demonstrate to Agency and wider world that carrying capacity is a valid tool.

- Need to ensure early influence in the planning process - with members as well as officers. Agency should be proactive rather than reactive - dependent on resources available.

- Agency can suggest principles using threshold criteria to identify constraints on development rather than where development should go. However Agency thresholds are frequently ignored.

- AMP 3 has set out Agency requirements and there is a difficulty in making changes during the plan period.

- Even though the Agency can have standard criteria it also needs to be flexible to maximise opportunities in widely different circumstances.

- Local planning authorities should be actively encouraged to contribute to the AMP process using capacity studies if appropriate - but recognise that AMP is a

technocentric process rather than a democratic one. The Agency can demonstrate to LPAs how AMP can be beneficial.

- Terminology of carrying capacity may further confuse planning authorities - who already struggle to understand the concepts currently employed in LEAPs.

- Need good data to implement carrying capacity techniques - which again has resource implication. It should be up-to-date and reliable.

- Legislation under which Agency operates - including EU Directives are not capacity based so if Agency implements carrying capacity principles it will have a dual approach to environmental control.

- Agency cannot by itself undertake carrying capacity exercise but can assist planning authorities - and work with others, e.g. EN, EH, CoCo, - and thereby guide and influence the process.

- Through partnerships and planning liaison the Agency can have greater influence. Influencing people's perceived values is an indirect way for the Agency to achieve its objectives.

- The Agency supports and promotes the concept of sustainability and this may have a direct link to catchment capacity.

Conclusions from the morning session

- The general consensus was that carrying capacity, in some form, would be a useful tool for the Agency to influence LPAs, especially in development plan making; "Carrying" not acceptable because open to misinterpretation and "environmental" capacity preferred.

- Capacity needs to recognise the social/environmental/economic agendas of sustainable development.

- Capacity is not absolute or objective.

Implementation

The afternoon session covered the practicalities and reality of using capacity, the mechanisms the Agency can use as a forum to implement and what form should the tool take. Again, a number of propositions were put forward for debate. Key points raised were:

- The Agency should work from national to local levels with developers as well as local authorities. Need to be consistent and advise on results of emerging decisions. Identify how information is best shared with LPAs - i.e. Agency experts attending planning committees, working closely with planning officers, etc. Regional dimensions - produce regional guidance (e.g. Midlands already work jointly with RDA board and environmental groups).

- LPAs need to understand the indicators that the Agency uses and why we use them. Different indicators may be useful in different areas to contribute to achieving goals. No reason why different indicators cannot be developed and applied to suit or deal with different local sensitivities. Monitoring would be useful to make comparisons.

- Can use a wide range of existing indicators including environmental health, DETR list and "Blue Flag" as well as chemical/biological parameters. Use national indicators to be consistent - can also use those from EMSs used by industry.

- Need to build bridges between LEAPs and local plans and change LEAPs if they are not achieving their objectives. LEAPs are the best vehicle for public involvement but must be aware of hijacking by single issue groups. Agency need to establish who are the customers when considering capacity; if LPAs then LEAPs are not the best vehicles at present but possible if revised.

- Need a top level policy framework in place which can be successfully cascaded down to the lower levels - technique must be put into the system to account for the environment itself.

- Action in one area may impact on another - a multi-attribute approach should be developed; this will assist in trade-offs and can incorporate attributes outside of the Agency's remit.

- Catchment capacity may be influenced by how much money is available for particular development proposals. For example, sewage or surface water disposal may be a limiting factor if disposed of locally but, if major (and perhaps costly) infrastructure changes can occur, then this may negate the local problem. But, it may create additional problems in adjacent areas.

- The latest version of the Water Companies Asset Management Plan (AMP3) may be a constraint to development, which could result in planning embargoes. Other environmental or constraint data that the Agency has access to includes - Groundwater Protection Zones, Nitrate Sensitive Areas, designated Conservation areas, Areas liable to flood (section 105 Surveys) etc.

Conclusions of the afternoon session

Overall there was a general, but not total, acceptance of capacity. The Agency must be clear on where it is going and what it wants to achieve.

Interaction between the indicators and what context they are used in is very important and should be looked at more closely. Care should be taken when using certain indicators as they may have huge resource implications.

LEAPs and Development Plans can be useful vehicles for involving the public in the consultation process. More effective liaison at policy stage using capacity, could reduce work for Agency on individual cases.

WHAT IS CARRYING CAPACITY?

- *The maximum number (or density) of individuals of a species that an ecosystem will sustain.* (Beeby, 1993)

- *The optimum population size that a given habitat can support indefinitely under a given set of environmental conditions.* (Jones et al, 1990)

- *The maximum population of a given species that can be supported indefinitely, in a particular region, allowing for seasonal and random changes, without any degradation of the natural resource base that would diminish the maximum population in the future.* (from Barrow, 1991)

- *The maximum intensity of use an area will continuously support under a management programme without inducing a permanent change in the biotic environment.* (from Barrow, 1991)

- *The carrying capacity of a rangeland does not depend solely on botanical characteristics but also on the management practices of rangeland users. The ecological carrying capacity may differ from the economically profitable stocking rate, the latter being more sustainable.* (World Bank, 1995)

- *VERP (visitor experience and resource protection) program of VIM (visitor impact management program) of the US Park Service interprets carrying capacity as a prescription of desired ecological and social conditions. The US Park Service is required by law to address carrying capacity in planning for parks, primarily in relation to visitor carrying capacities. We conclude, therefore, that the only embracing definition of carrying capacity is: "That density of animals and plants that allows the manager to get what he wants out of the system". Thus, any specific definition of carrying capacity must be expressed in relation to a particular objective, and it must be defined very precisely since there are no 'natural' stability points in such interactive systems that act as foci for self-defining concepts.* (Bell, 1985)

- *The fact is that no single number exists to answer 'how many people can the earth support?' because human carrying capacity is dynamic and uncertain. The capacity depends on natural constraints and human choices, which are not captured by the ecological notions of carrying capacity we use for nonhumans. Instead, we must consider in our calculations the interactions of such constraints as food, water and liveable land and choices about economies, environment, values and politics.* (Cohen, 1995)

- *Ecological criteria have a central role to play. The concept of* ***carrying capacity*** *can be used to determine not only the ability of a habitat or ecosystem to sustain a population of a particular species but also the capacity of the environment to absorb pollution or waste such as the calculation of the critical load of a pollutant that an*

ecosystem can absorb. (Explanatory Guidance on the Agency's contribution to Sustainable Development, DOE 1996)

WHAT IS ENVIRONMENTAL CAPACITY?

- *The ability of a particular environment to perform, and continue to perform its various natural functions.* (Environmental Appraisal of Development Plans, DOE 1993)

- *The environment provides for society and the economy but there are limits to the extent that it can do so without causing intolerable strains, both to natural ecosystems and to the quality of life. In this way we can talk of environmental capacities.* (CPRE, 1993)

- *When considering the levels of use a given area or resource system is able to sustain, an understanding of its environmental capacity or carrying capacity is important. This represents the amount of use the area or resource is able to sustain without damage to its important environmental features, based on its natural or physical properties.* (Biodiversity: The UK Action Plan, Department of the Environment, 1994)

- *In planning for sustainable development the aim must be to understand the limits of acceptable environmental change. This means making judgements about the ability of environmental resources to accept demands upon them without irreversible or otherwise unacceptable loss or damage.* (Countryside Commission et al. 1993)

- *Some upper limit to development which claims to be justified on the basis of severe environmental change.* (Grigson, 1995)

A NEW APPROACH TO ENVIRONMENTAL CAPITAL

The new characterisation-based approach to environmental capital is jointly proposed by the Countryside Commission, English Nature, English Heritage and the Environment Agency. The metaphor of the environment as consisting of assets conveys an important concept of sustainability. The usual division into 'critical', 'constant' and 'tradable' environmental capital reflects the intuition that some are more important and less replaceable than others. However the concept has proved surprisingly problematic in use. Actual environmental assets often do not seem to fit neatly into just one of the three categories. Even when they do, defining an asset as 'critical', 'constant' or 'tradable' often does not help much in deciding how to manage it.

The key difference in the new approach is to stand back from environmental *things* or *features*, and consider the *environmental functions* they perform, or the *services* they provide for human well-being. Having decided what area, feature or group of features is to be studied (which depends on the purpose of the assessment) the new approach asks:

- What are the *characteristics* or *attributes* of this place or object(s) which matter for sustainability?;
- How *important* is each of these, to who, and for what reasons or purposes?;
- What (if anything) could replace or *substitute for* each of these benefits?;
- On current trends do we expect to have *enough* of each of them?

This new way of thinking about environmental capital brings four benefits:

- a given feature may provide several different environmental benefits or 'services', each of which may be important in different ways and have different management implications.
- a wider and subtler range of management responses than the three tier gradation of 'critical', 'constant' and 'tradable'.
- by distinguishing the desired *level* of an attribute from its substitutability and importance the new approach can deal with *enhancement*.
- the new approach draws on and extends the application of identifying and defining the particular characteristics which make each area distinctive.

This new approach is currently being piloted by a wide range of planning authorities and results are scheduled in early 1999.

CARRYING CAPACITY OF CATCHMENTS: SCOPING STUDY
WORKSHOP 19 AUGUST 1998 LONDON
MORNING SESSION 11:00 - 12:45

PRINCIPLES

PROPOSITION 1:

Any estimates of capacity need to recognise the whole social/economic/environmental agenda of Sustainable Development. It is not sufficient to consider those factors with the most obvious physical and political limits. Consideration must also be given to the **potential** for human habitation as well as **constraints**.

PROPOSITION 2:

The Agency's remit does not include the whole sustainable development agenda and it relies on presenting systematic evidence to Planning Authorities, who **should** be taking the rounded view. There is great benefit in establishing a common capacity approach between neighbouring authorities and the Agency can be a catalyst through the methods it adopts.

PROPOSITION 3:

"Capacity" is not absolute or objective. It relates to policy objectives and management of the environment. It is necessary to be specific about objectives/management policy and define **thresholds** in relation to these. The Agency cannot take a black and white view, unlike the lobbying environmental groups.

PROPOSITION 4:

The approach must be simple/transparent/adaptable. A "traffic-lights" approach gives a good start:

Green:	no problems		
Amber:	Yellow	- possible difficulties	} mitigation/
	Orange	- known difficulties	} negotiation needed
Red:	No!		

CARRYING CAPACITY OF CATCHMENTS: SCOPING STUDY
WORKSHOP 19 AUGUST 1998 LONDON
AFTERNOON SESSION 14:20 - 16:00

IMPLEMENTATION

PROPOSITION 5:

The Agency should give two levels of advice to planning authorities:

Strategic	- broad locational decisions
Local	- detailed siting decisions

PROPOSITION 6:

The Agency should define specific indicators with targets for each environmental resource within its remit and oblige local authorities to use them.

PROPOSITION 7:

How to take account of interactions between resources? This is the decision of the planning authority. The Agency can ensure this is addressed by requiring the local authorities carry out a Compatibility Appraisal as part of the process.

PROPOSITION 8:

There must be public involvement in order to comply with the principles of Sustainable Development. The Agency can use its' LEAP process.