



WATER QUALITY MANAGEMENT PLANNING IN IRELAND

ENVIRONMENTAL PROTECTION AGENCY
An Ghníomhaireacht um Chaomhnú Comhshaoil
PO Box 3000, Johnstown Castle Estate, Co. Wexford, Ireland.

Tel: +353-53-60600 Fax: +353-53-60699
e-mail: info@epa.ie Website: <http://www.epa.ie/>

© Environmental Protection Agency 1999

Parts of this publication may be reproduced without further permission, provided the source is acknowledged.

Although every effort has been made to ensure the accuracy of the material contained in this publication, complete accuracy cannot be guaranteed. Neither the Environmental Protection Agency nor the author(s) accept any responsibility whatsoever for loss or damage occasioned or claimed to have been occasioned, in part or in full, as a consequence of any person acting, or refraining from acting, as a result of a matter contained in this publication.

**WATER QUALITY MANAGEMENT PLANNING
IN IRELAND**

Published by the Environmental Protection Agency, Ireland.

The Agency personnel involved in the preparation of this document were Mr. Andy Fanning, Dr. Matt Crowe, Mr. Gerry Carty and Dr. Conor Clenaghan.

ISBN 1 899965 95 5

Price IR£15.00

€19.05

02/99/500

TABLE OF CONTENTS

| | |
|---|-----------|
| ABBREVIATIONS | vi |
| 1. INTRODUCTION | 1 |
| 1.1 OVERVIEW | 1 |
| 2. LEGAL AND POLICY FRAMEWORK | 5 |
| 2.1 LEGAL INSTRUMENTS | 5 |
| 2.1.1 Local Government (Water Pollution) Act, 1977 and Local Government (Water Pollution) Amendment Act, 1990 | 5 |
| 2.1.2 Environmental Protection Agency Act, 1992 | 5 |
| 2.1.3 Waste Management Act, 1992 | 6 |
| 2.1.4 Local Government (Water Pollution) Act, 1977 (Water Quality Standards for Phosphorus) Regulations, 1998 (S.I. 258 of 1998) | 6 |
| 2.1.5. Existing European Legislation | 7 |
| 2.2 POLICY INSTRUMENTS AND DISCUSSION DOCUMENTS | 7 |
| 2.2.1 Sustainable Development, a Strategy for Ireland | 7 |
| 2.2.2 Managing Ireland's Rivers and Lakes - A Catchment Based Strategy Against Eutrophication | 8 |
| 2.2.3 Coastal Zone Management, a Draft Policy for Ireland, Discussion Document | 8 |
| 2.2.4 Environmental Quality Objectives and Environmental Quality Standards, The Aquatic Environment, a discussion document | 9 |
| 3. IMPLICATIONS OF DEVELOPMENTS IN NATIONAL SITUATION AND THE DRAFT EU WATER FRAMEWORK DIRECTIVE | 11 |
| 3.1 DEVELOPMENTS IN NATIONAL SITUATION | 11 |
| 3.2 DRAFT EU WATER FRAMEWORK DIRECTIVE | 11 |
| 3.3 LIKELY IMPACT ON NATIONAL SITUATION | 12 |
| 4. ADVANCES IN ENVIRONMENTAL MANAGEMENT TECHNIQUES AND TECHNICAL TOOLS | 15 |
| 4.1 ENVIRONMENTAL MANAGEMENT TOOLS | 15 |
| 4.1.1 Environmental Management Systems | 15 |
| 4.1.2 Farm Environmental Resource Planning and Nutrient Management Planning | 16 |
| 4.1.3 Riparian Management | 17 |
| 4.1.4 Strategic Environmental Assessment | 17 |
| 4.1.5 Risk Assessment | 17 |
| 4.1.6 Groundwater Protection Scheme and Responses | 18 |
| 4.1.7 Environmental Indicators | 18 |
| 4.2 TECHNICAL TOOLS | 19 |
| 4.2.1 Geographical Information Systems and Computer Assisted Cartography | 19 |
| 4.2.2 Computer Modelling | 20 |
| 4.2.3 Satellite Imagery | 21 |

| | |
|---|-----------|
| 4.2.4 Remote Sensing | 21 |
| 4.2.5 Data Logging Systems | 21 |
| 4.2.6 Global Positioning Systems | 21 |
| 4.3 ASSOCIATED REGULATORY ENVIRONMENTAL TECHNIQUES | 21 |
| 4.3.1 Planning and Environmental Impact Assessment | 21 |
| 4.3.2 Integrated Licensing Systems | 22 |
| 4.3.3 Effluent Discharge Licensing | 23 |
| 4.3.4 Environmental Designations | 23 |
| 5. CURRENT STATUS AND IMPLEMENTATION OF WATER QUALITY MANAGEMENT PLANNING IN IRELAND | 25 |
| 5.1 INTRODUCTION | 25 |
| 5.2 PLANS | 25 |
| 5.2.1 Water Quality Management Plans | 25 |
| 5.2.2 Draft Plans | 27 |
| 5.2.3 Water Quality Catchment Management Strategies | 28 |
| 5.2.4 Catchment Monitoring and Management Systems | 29 |
| 5.2.5 Groundwater Protection Schemes | 30 |
| 5.2.6 Developments in Water Quality Management Planning | 30 |
| 5.3 IMPLEMENTATION OF WATER QUALITY MANAGEMENT PLANS | 32 |
| 6. CONCLUSIONS AND RECOMMENDATIONS FOR A FRAMEWORK FOR FUTURE WATER QUALITY MANAGEMENT PLANNING IN IRELAND | 35 |
| 6.1 CONCLUSIONS | 35 |
| 6.2 RECOMMENDATIONS | 35 |
| 7. REFERENCES AND FURTHER READING LIST | 37 |
| 8. USER COMMENT FORM | 39 |

LIST OF FIGURES

| | | |
|----------|--|----|
| Figure 1 | Status of water quality management plans in Ireland | 2 |
| Figure 2 | Total Quality Management (TQM) system | 4 |
| Figure 3 | Generalised Environmental Management System | 16 |
| Figure 4 | Components of Groundwater Protection Schemes | 18 |
| Figure 5 | Mechanics of a conventional water quality management plan | 53 |
| Figure 6 | Method proposed by An Foras Forbartha for the setting of emission standards for point sources within a planned catchment | 56 |

LIST OF TABLES

| | | |
|---------|---|----|
| Table 1 | Summary of significant developments in water quality management plan preparation since original An Foras Forbartha system | 31 |
| Table 2 | Review of Water Quality Changes in Water Resource Regions between 1987 and 1994 | 33 |
| Table 3 | Procedure for the preparation of water quality management plans. | 54 |
| Table 4 | EQS proposed by An Foras Forbartha for freshwater reaches of catchments | 55 |

LIST OF APPENDICES

| | | |
|------------|--|----|
| Appendix A | Water Quality Improvements required under the Local Government (Water Pollution) Act, 1977 (Water Quality Standards for Phosphorus) Regulations, 1998 (S.I. 258 of 1998) | 41 |
| Appendix B | Relevant European legislation and associated Irish Regulations | 45 |
| Appendix C | An Foras Forbartha Methodology for Preparation of Water Quality Management Plans | 51 |
| Appendix D | List of Water Quality Management Plans and Strategies and Catchment Management Systems | 59 |
| Appendix E | Summary of Environmental Quality Standards contained in Water Quality Management Plans | 65 |
| Appendix F | Assessment of the implementation of capital expenditure for provision of Urban Waste Water treatment recommended by adopted water quality management plans | 69 |

ABBREVIATIONS

| | |
|----------|---|
| AFF | An Foras Forbartha |
| BATNEEC | Best Available Technology Not Entailing Excessive Costs |
| CAC | Computer Aided Cartography |
| CORINE | Co-ordinated Information on the European Environment |
| EIA | Environmental Impact Assessment |
| EIS | Environmental Impact Statement |
| EQO | Environmental Quality Objective |
| EQS | Environmental Quality Standard |
| EU | European Union |
| EMAS | Eco-Management and Audit System |
| EPA | Environmental Protection Agency |
| GMO | Genetically Modified Organisms |
| GIS | Geographical Information System |
| GPS | Global Positioning System |
| GSI | Geological Survey of Ireland |
| ICZM | Integrated Coastal Zone Management |
| INTERREG | Inter Regional Fund |
| IPC | Integrated Pollution Control |
| NMP | Nutrient Management Planning |
| 99.9%ile | 99.9 percentile flow(flow equalled or exceeded 99.9% of the time) |
| 95%ile | 95 percentile flow(flow equalled or exceeded 95% of the time) |
| 50%ile | 50 percentile flow(flow equalled or exceeded 50% of the time) |

1. INTRODUCTION

Many developments have taken place since the subject of Water Quality Management Planning was last reviewed (Stapleton, 1993) and it is timely to consider it in the light of these developments. This paper sets out to:

- summarise the legal and policy instruments relevant to water quality management planning;
- analyse the implications of forthcoming developments and in particular, the impact of the draft EU Water Framework Directive;
- assess the tools available to facilitate water quality management planning;
- report on the current status and implementation of water quality management planning in Ireland; and
- recommend a framework for future water quality management planning in Ireland

1.1 OVERVIEW

Water quality management planning was introduced to Ireland with the enactment of the Local Government (Water Pollution) Act in 1977. This followed an international trend towards catchment-based management of waters which was designed to provide a coherent framework for the control of man's effect on the aquatic environment and to protect both the quality of that environment and the beneficial uses to which it may be put.

Since 1977, a total of fifteen plans have been adopted by local authorities in Ireland. In addition to these adopted plans, a number of draft plans have also been prepared together with two cross-border water quality strategies. A number of catchment monitoring and management programmes have been prepared and are currently being implemented. The geographical coverage of the plans and strategies is illustrated in Figure 1. Adopted riverine plans account for 39% of the land cover of the Republic of Ireland with another 14% being accounted for by draft plans.

Generally speaking, water quality management planning in Ireland has been restricted to the management of surface waters with groundwater

protection being addressed through the preparation of groundwater protection schemes. However, it is worth noting that the broad definition of "waters" in the Local Government (Water Pollution) Act means that the Act can be used to plan for the management of the vast bulk of surface waters and groundwaters in the State. By anticipating the possibility of integrated groundwater and surface water planning, the Act should be viewed as a particularly enlightened and forward-looking piece of legislation.

Early plans focused almost entirely on point-source discharges to surface waters and did not deal with the protection of aquifers or with non-point source pollution. The scope of these plans was restricted due to information gaps and the lack of data available at the time the plans were formulated. In addition, the control of point-source industrial and domestic discharges was considered a priority at that time. Later plans and in particular the cross-border water quality management strategies, prepared with INTERREG funding, were more comprehensive, covering non-point source pollution and domestic sources of pollution such as septic tanks as well as assessing the phosphorus budgets for the catchments. Their scope has in some cases been expanded to take account of the potential impacts of physical planning issues pointing the way towards an integrated planning approach.

How successful has water quality management planning been? The main purpose of water quality management planning is to ensure that the quality of waters covered by the plan is maintained so that existing and future beneficial uses are protected. On a national level, there has been a marked reduction in the length of seriously polluted channel from at least 6% in 1971 (original surveys covered only 2700km and are not directly comparable with the more recent extended surveys) to 1% in 1994. However, the relative success of water quality management planning is called into question by the continuing deterioration in the quality of freshwaters (EPA, 1996). Long term trends based on some 2,900 km of river channel, which have been surveyed periodically since 1971, have shown a continuing decline in the length of unpolluted water channel from 84% in 1971 to just 57% in 1994 with the most striking trends being a five-fold increase in the extent of slight pollution and a three fold increase in moderate pollution. These trends have

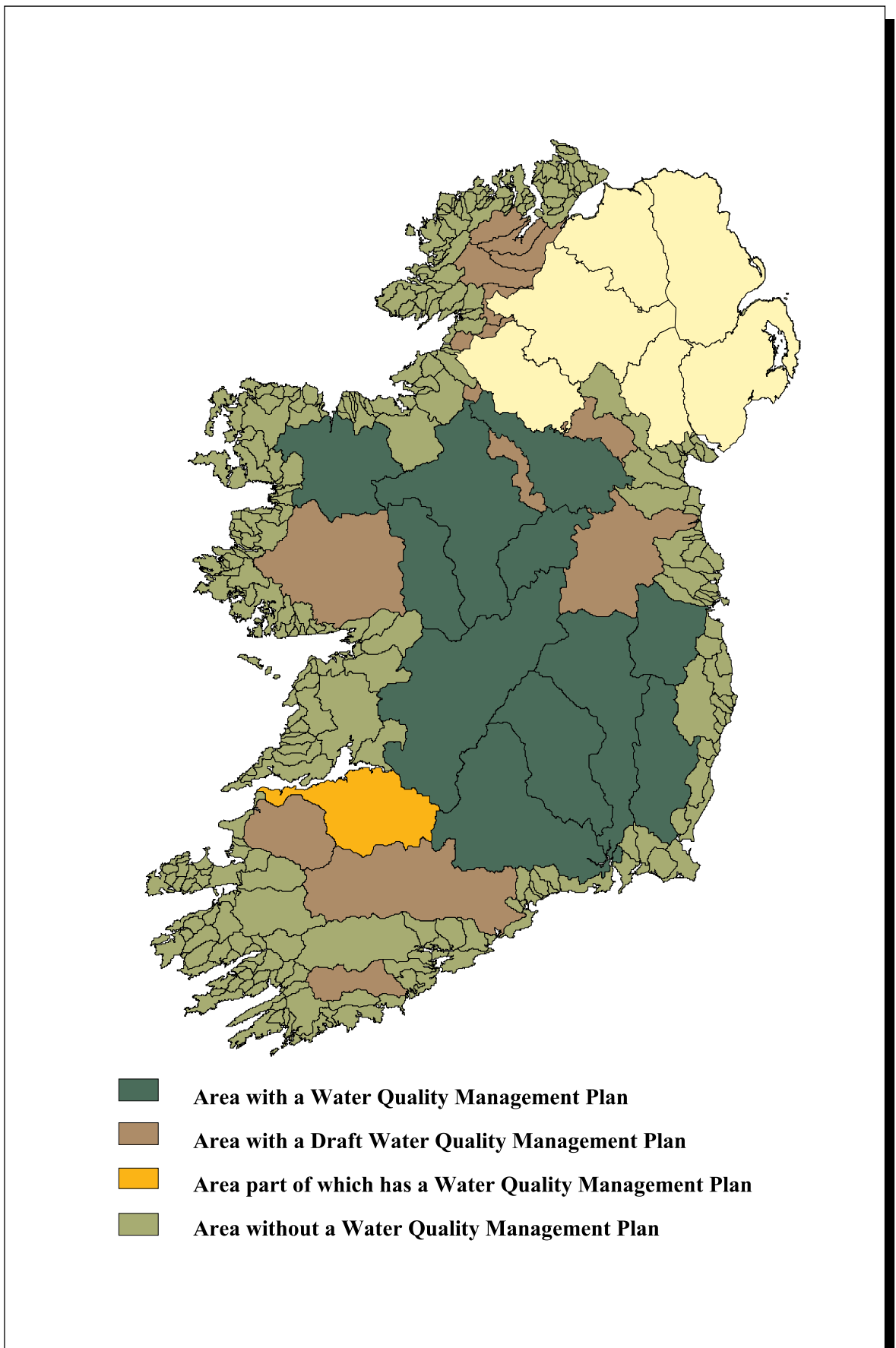


FIGURE 1 STATUS OF WATER QUALITY MANAGEMENT PLANS IN IRELAND

been found to a lesser extent within a much wider baseline of 12,700km of channel that has been surveyed since 1987. There is also evidence of a deterioration in the quality of Irish lakes (Bowman, et al, 1996).

It is now clear that eutrophication of freshwater is a major environmental problem in Ireland and that water quality management planning has not succeeded in preventing the associated deterioration in surface water quality. This is mainly due to the fact that the plans concentrated on point-source discharges, and did not, to any significant extent, address diffuse sources of pollution. Standards adopted in many of the plans related to the quality of the waters rather than the quality of emissions to these waters as provided for in the legislation. In addition, economic activities that result in changes in point source such as increased detergent usage have not been adequately addressed. There is also little evidence that water quality management plans have been subject to the necessary review and modifications required of a dynamic planning process even though revision was viewed as an integral part of the legislation adopted. The restriction of water quality management planning to the protection of surface waters has also meant that groundwater quality has not been afforded the same level of statutory protection. While groundwater protection schemes go some way to addressing this, it is clear that a more integrated approach to surface water and groundwater planning will lead to a higher level of environmental protection.

There have been several developments that affect water quality management planning since the publication of a review in 1991 (Toner, 1991) and it is timely to consider water quality management planning in the light of these developments. These include the introduction of new legislation, in particular, the Environmental Protection Agency Act, 1992 and the Waste Management Act, 1996, the establishment of the Environmental Protection Agency, the adoption of a National Sustainable Development Strategy, the development of national policy on the control of eutrophication, the introduction of statutory Environmental Quality Standards (EQS) for phosphorus, the proposal by the EPA for a broad-spectrum assignment of Environmental Quality Objectives (EQO) and EQS for all waters throughout the State and the general move towards a more integrated catchment-based approach to water quality management planning which is evident in some of the more recent plans and strategies. A number of EU directives

including the Urban Waste Water Treatment Directive, the Directive for the Protection of Waters from Pollution by Nitrates and the Integrated Pollution Prevention and Control directive have been introduced.

There has been a move towards protection of groundwater sources and aquifers as a whole through the development of county based protection schemes. However, groundwater protection is probably best considered within the context of integrated surface water and groundwater planning. Furthermore, the EU Water Framework Directive when adopted is likely to have a major impact on water quality management planning and practice in Ireland. This impact needs to be considered prior to implementation of the directive, and in particular the integration of groundwater protection schemes and water quality management plans must be considered.

In addition to changes in the institutional and legal framework, there has been a general trend at national level towards the use of an environmental management systems approach to environmental protection which operates on the basic principle of continual improvement. This improvement loop consists of analysing the existing state of the "system", formulating measures to improve it, implementing these measures, analysing their efficacy and reformulating the measures to continue the improvement. This loop of "plan, implement and review", as illustrated in Figure 2, is central to all modern environmental management systems and will become increasingly relevant to water quality management planning.

Other recent developments include improvements in the technical tools and techniques available to practitioners of water quality management planning. Developments in modelling and geographical information systems in particular, provide the facility to adopt a more integrated approach to catchment evaluation and planning. These tools together with the application of advanced environmental assessment and management techniques are becoming increasingly important when using water quality management planning as a dynamic tool for environmental protection and are reviewed here in the context of their relevance to water quality management planning.

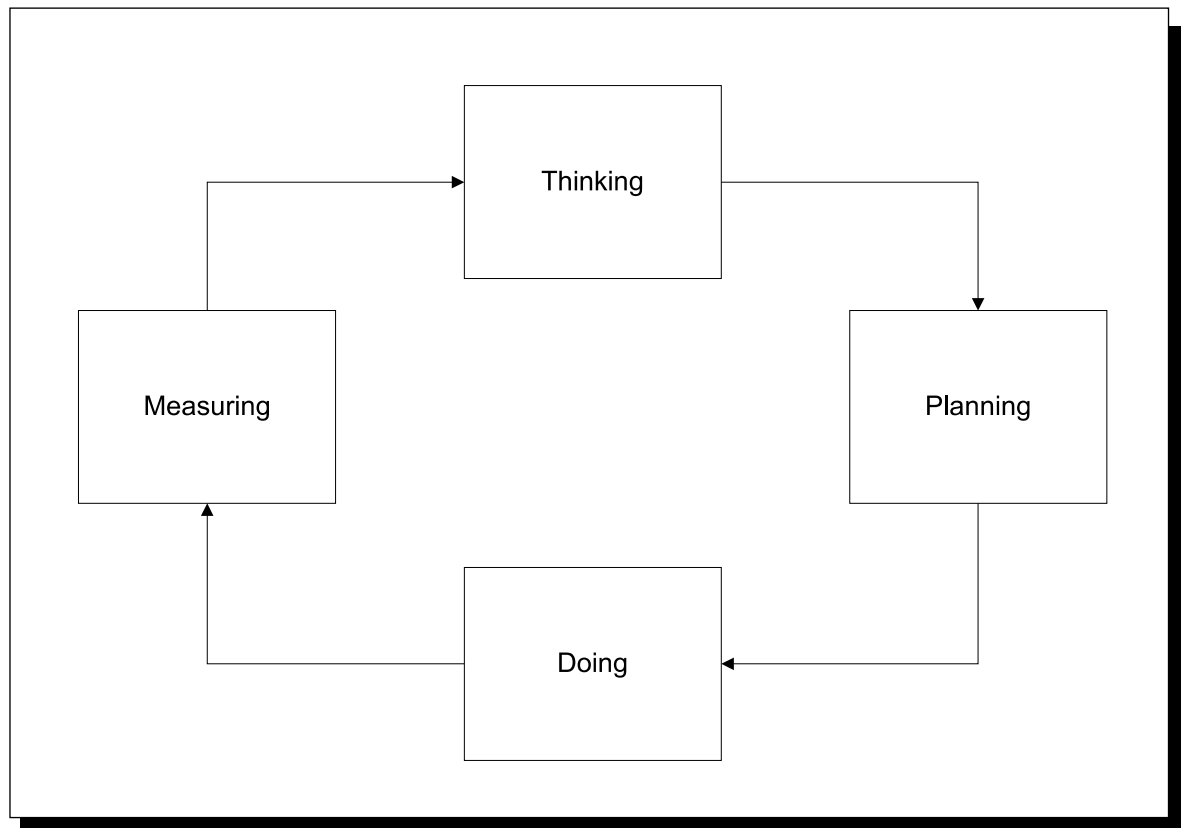


FIGURE 2 TOTAL QUALITY MANAGEMENT (TQM) SYSTEM

2. LEGAL AND POLICY FRAMEWORK

2.1 LEGAL INSTRUMENTS

This section reviews the legal provisions governing the creation, review and revision of water quality management plans, requirements for public consultation, integration of licensing procedures with the plans and integration of the plans with other statutory plans.

2.1.1 LOCAL GOVERNMENT (WATER POLLUTION) ACT, 1977 AND LOCAL GOVERNMENT (WATER POLLUTION) (AMENDMENT) ACT, 1990

Section 15 of the Local Government (Water Pollution) Act, 1977 provides for the creation of water quality management plans in the Republic of Ireland. The creation of the plans under the Act is a reserved function of the elected representatives making up the local authority itself and cannot be conferred on any official of the authority.

Section 15 states that a local authority may or shall if so directed by the Minister make a water quality management plan for any water situated in its functional area or which adjoin that area but may include the sea only to the extent that the Minister, after consultation with the Minister for the Marine and Natural Resources, approves. The Minister can require plans by two or more local authorities to be co-ordinated. The section also allows for periodic revision and requires furnishing of copies of the plan to various regulatory bodies. Making a plan is mandatory if the Minister directs its creation.

The main provision of the section is that plans shall

“contain such objectives for the prevention and abatement of pollution of the waters the subject of the plan and such other provisions as appear to the local authority to be necessary”

One proviso is that a plan cannot contain any requirement that is inconsistent with quality standards for waters, trade effluents and sewage effluents or standards in relation to methods of treatment of such effluents made by the Minister under Section 26 of the Act.

Local authorities are bound to have regard to water quality management plans when considering any application for a discharge licence under the Local Government (Water Pollution) Act, 1977. Local authorities are not however required to have regard to water quality management plans when considering any application for a review of a discharge licence under Sections 7 and 17 of the Local Government (Water Pollution) Act, 1977. The review of water quality management plans does not effect any existing discharge licences and need not be taken into account on their review.

Public notice of the preparation of a proposed plan by a newspaper notice is required. The notice must detail where and when a proposed plan will be available for inspection and that representations can be made which must be considered by the local authority. More specific requirements on the making of notices and the provision of copies of the plan are contained in Part VI of the Local Government (Water Pollution) Regulations, 1978.

Section 15 of the Local Government (Water Pollution) Act, 1977 was amended by the Local Government (Water Pollution)(Amendment) Act, 1990. The amendment provided for the creation of a plan between two or more local authorities, allowed local authorities to revise or replace plans made and updated the list of regulatory bodies to whom copies of the plan were to be supplied.

However the most noteworthy issue in the legislation in relation to the formulation of water quality management plans is the absence of legal stipulation as to their content and structure. This is at variance, for instance, with the more prescriptive requirements for waste management plans and environmental impact statements contained within more recent legislation

2.1.2 ENVIRONMENTAL PROTECTION AGENCY ACT, 1992

The Environmental Protection Agency Act contains a number of sections which relate to water quality management planning.

The Minister for the Environment and Local Government may require the Agency to prepare a

water quality management plan under the provisions of Section 100 of the Act which extends, by order, powers under the Local Government (Water Pollution) Act, 1977 to the Agency in lieu of the local or sanitary authority. Alternatively the Minister may provide that the Agency make a water quality management plan under Section 102 of the Act. An order under this section may provide for modification of Section 15 of the Local Government (Water Pollution) Act, 1977.

Section 75 of the Act requires that the Agency specify and publish quality objectives which the Agency considers reasonable for the purpose of environmental protection. Any such quality objective must be taken into account by the Minister, any other Minister and any other public authority in the formulation of policy, in the setting of standards or in the exercise of any of their functions concerning environmental protection. Local authorities would have to have regard to any quality objectives defined and published by the Agency in the formulation of a water quality management plan.

The Agency must have regard, under Section 83(2)(a), amongst other things, to any water quality management plan when considering an application for an IPC licence or review of an IPC licence or revised IPC licence.

Under Section 103 of the Act, the Agency may at any time and shall when requested by the Minister, make recommendations to the Minister in relation to the prescribing of quality standards under Section 26 of the Local Government (Water Pollution) Act, 1977. The Minister must have regard to any recommendations made by the Agency when making regulations under Section 26 of the Local Government (Water Pollution) Act, 1977.

Of obvious relevance to water quality management planning are Sections 59-61 of the Act and the Environmental Protection Agency Act, 1992 (Urban Wastewater Treatment) Regulations, 1994 which specify requirements in relation to urban wastewater treatment in Ireland and provide a comprehensive framework for actions to deal with the pollution threat of urban waste water to rivers, lakes, estuaries and coastal waters.

2.1.3 WASTE MANAGEMENT ACT, 1996

The Waste Management Act contains a number of

sections which relate to water quality management planning. It requires that in making or reviewing a waste management plan, a local authority or authorities must have regard to the proper planning and development of its or their functional area or areas and shall have regard to the provisions of any water quality management plans in force in relation to the areas covered by the waste management plan. When considering an application for a waste licence or waste licence review, the Agency must have regard to any existing water quality management plan.

While not directly related to water quality management planning, Section 66 which deals with Nutrient Management Planning will significantly affect the operation of water quality management plans. This section amends the Local Government (Water Pollution) (Amendment) Act, 1990 by introducing a legal framework for Nutrient Management Planning to Ireland. This means that local authorities now have the power to require preparation of a Nutrient Management Plan where the authority considers it necessary for the purposes of preventing, eliminating or minimising the entry of polluting matter to waters. This has great significance for water quality management planning as it provides local authorities with a very specific legal instrument for controlling non-point source pollution of waters.

The Local Government (Water Pollution) (Nutrient Management Planning Consultation) Regulations, 1998 prescribe the EPA as the body to be consulted before a local authority exercises its power to require the preparation of Nutrient Management Plans.

2.1.4 LOCAL GOVERNMENT (WATER POLLUTION) ACT, 1977 (WATER QUALITY STANDARDS FOR PHOSPHORUS) REGULATIONS, 1998 (S.I. 258 OF 1998)

The Regulations require that water quality be maintained or improved by reference to quality rating/trophic status or phosphorus concentrations. Where water quality is deemed unpolluted (rivers) or satisfactory (lakes) the regulations require that the existing biological quality of rivers and lakes be maintained at the same level as assigned by the Agency during the period 1995-1997. The biological quality is based on the trophic status (level of enrichment) for lakes and the Q value system for rivers.

Where quality has been found to be unsatisfactory, the regulations require that the water be improved by the 31 December 2007 at the latest for waters surveyed in the period 1995-1997 and within a maximum timeframe of ten years for waters surveyed after 1997. The degree of improvement required is based on the existing quality and standards prescribed by the regulation are reproduced in Appendix A.

A six year extension to the period allowed to reach compliance for a certain water body is permissible; if the relevant local authority (or as the case may be, the Agency) is satisfied that one or more of the following circumstances exist in relation to that body:

- water quality is severely affected by human activity making compliance within the specified period impractical or entailing excessive cost;
- BATNEEC is being used to treat any significant direct discharge;
- appropriate steps are being pursued in respect of other sources of pollution.

Local authorities are required to submit a report to the EPA by 31 July 1999 setting out measures to be taken meet the prescribed standards. This is to be followed up by a report to the Agency on the implementation of these measures by 31 July 2000 and every two years thereafter until 2008. The EPA must publish progress reports including such recommendations as it considers appropriate by 31 March 2001 and every two years thereafter until 2009.

2.1.5 EXISTING EUROPEAN LEGISLATION

European directives and regulations and their adoption into domestic legislation, international treaties and conventions to which Ireland is a signatory have impacted on the development of plans. Of particular relevance are the water-use directives and their implementation in Irish law as regulations under the European Communities Act, 1972. A summary of the relevant EU directives and associated regulations is given in Appendix B.

2.2 POLICY INSTRUMENTS AND DISCUSSION DOCUMENTS

The future development of water quality management planning is likely to be significantly

affected by national policy instruments which point towards a more integrated approach to environmental management. In addition to policy instruments there are discussion documents which are consultative documents prepared to provide information to the policy making process. Policy instruments and discussion documents of note include:-

- Sustainable Development, a Strategy for Ireland (Department of the Environment, 1997a);
- Managing Irelands Rivers and Lakes - A Catchment Based Strategy Against Eutrophication (Department of the Environment, 1997b);
- Coastal Zone Management, a Draft Policy for Ireland, A Discussion Document (Department of the Environment and Local Government, Department of the Marine and Natural Resources, Department of Arts, Heritage, Gaeltacht and the Islands, 1997); and
- Environmental Quality Objectives and Environmental Quality Standards, The Aquatic Environment, A Discussion Document (Environmental Protection Agency, 1997).

2.2.1 SUSTAINABLE DEVELOPMENT, A STRATEGY FOR IRELAND

The National Sustainable Development Strategy was launched by the then Minister for the Environment in 1997. The principal purpose of the strategy is to provide a comprehensive framework which provides for sustainable development in Ireland. The strategy has implications for water quality management planning as water resources are identified as a key natural resource requiring protection for the use of future generations. The strategy also copperfastens the concept of integrating environmental concerns into all aspects of government policy, economic activity and societal activity so that protection of our environment is given a higher priority when decisions with a potential to affect its quality are being made.

Specific initiatives of relevance to water quality management planning include an integrated catchment management initiative to reverse deteriorating trends in selected catchments and the development by the Agency of an updated methodology for the preparation of water quality

management plans to be used in reviewing all water quality management plans over the next five to ten years.

2.2.2 MANAGING IRELAND'S RIVERS AND LAKES - A CATCHMENT BASED STRATEGY AGAINST EUTROPHICATION

The Catchment Based Strategy against Eutrophication launched in May 1997 by the then Minister for the Environment, sets out national policy for the improvement of surface water quality in Ireland. The strategy deals specifically with eutrophication and has obvious implications for water quality management planning. This strategy draws together the various legal and policy strands of relevance to the control of eutrophication in freshwater and will be of central importance to the implementation of water quality management plans in the next decade. Within the strategy, the catchment based approach is identified as the ideal mechanism for water quality management. It adopts an integrated approach to dealing with the problem of eutrophication by identifying the various statutory powers available to public authorities to implement the various measures proposed and by proposing that, at organisational level, there be a more integrated approach between authorities in promoting water quality management and an increased co-ordinating role for regional authorities, as appropriate. It also identified significant contributors to eutrophication, these being urban waste water discharges, farming and industrial emissions.

In the case of rivers, the overall objective laid down in the strategy is to eliminate seriously, moderately and slightly polluted stretches, i.e. to attain ultimately a Quality Rating of 4 (unpolluted status/Class A) or higher, under the Agency's biological quality classification system. For lakes, the objective is to eliminate hypertrophic and eutrophic conditions so as to achieve at least mesotrophic status (satisfactory conditions). Where lakes were previously oligotrophic the aim will be to restore them to that condition (satisfactory/highest quality). These objectives are intended to ensure river and lake conditions suitable for water quality sensitive species such as salmon and trout.

The strategy proposes a time frame of 10 years for the achievement of interim quality standards for rivers, clear water lakes and other lakes. The standards will involve:-

- elimination of seriously polluted river stretches;
- incremental improvements in river channel currently slightly polluted or moderately polluted; and
- restoration of lakes which are eutrophic to satisfactory conditions and improvement of lakes which are presently hypertrophic.

The strategy requires that where diffuse sources are implicated, it will be a matter for local authorities to clearly identify sources within each catchment and take steps to ensure that effective measures be taken to eliminate the pollution risk. The use of statutory powers under the Waste Management Act to require the preparation of nutrient management plans was raised as a possible tool for carrying this out. The standards for phosphorus in surface waters, as prescribed in the Local Government (Water Pollution) Act, 1977 (Water Quality Standards for Phosphorus) Regulations, 1998 were proposed by the strategy.

2.2.3 COASTAL ZONE MANAGEMENT, A DRAFT POLICY FOR IRELAND, DISCUSSION DOCUMENT

This document assesses the requirements for integrated coastal zone management (ICZM). The concept of ICZM is similar to water quality management planning and is defined in the document as:

“A continuous process of administration which seeks through more efficient and holistic management:-

- ***to establish and maintain the sustainable use and development of the resources of the coastal zone so as to improve the quality of life and of human communities dependant on these resources;***
- ***to maintain the biological diversity and productivity of coastal ecosystems and to improve the quality of the coastal environment.”***

Based on the diverse legislative and administrative bodies involved in Coastal Zone Management, the draft policy proposes a system of thirteen coastal cells with various options for administrative bodies which could more

effectively assist in the management of the coastal cells. These include Interdepartmental Committees between the relevant government departments, an Interdepartmental Unit, an Independent Unit with independent resources directed by a committee appointed by relevant Ministers or an Agency or Authority with responsibility for coastal cells. It was the recommendation of the consultants who prepared the draft policy that coastal zone management be introduced in a phased manner with a progressive change in the type of administrative control as required from interdepartmental committee to independent unit or agency.

The document does not however deal with the implications of the draft EU Water Framework Directive that includes coastal waters within its administrative units (river basin districts). This directive is likely to have significant effects on the size of these coastal cells and the administrative framework for coastal zones.

2.2.4 ENVIRONMENTAL QUALITY OBJECTIVES AND ENVIRONMENTAL QUALITY STANDARDS, THE AQUATIC ENVIRONMENT, A DISCUSSION DOCUMENT

Section 75 of the Environmental Protection Agency Act, 1992 relates to the specification of environmental quality objectives (EQOs) by the Agency. The Section requires that the Agency specify and publish quality objectives which the Agency considers reasonable for the purpose of environmental protection. The document sets out the Agency's position on the definition of EQOs and EQSs. EQOs describe the intended use (or beneficial use) of an environmental medium or media; the use to which the medium is to be put defines the quality that is required to be maintained. For example, water uses include bathing, fishing, recreational use and abstraction for drinking water. The EQO is then met through the application of EQSs. EQSs are media-specific standards for chemical, physical or biological parameters required to be met for an intended use. To ensure that the standards are met, inputs to the medium must be controlled through the assignment of emission limit values to point-source discharges and the management of non-point discharges.

In the document, the Agency proposes that EQOs should be assigned on a national basis throughout the State and its territorial waters as appropriate.

This course of action is recommended both as a basic element of environmental protection and as a way to prevent further diminution of present overall satisfactory quality. Such a broad spectrum assignment of EQOs would be matched by the setting of appropriate EQSs. It is proposed that the general, fishery EQO for all freshwater in the State with associated salmonid EQS or, in certain cases, the cyprinid (coarse) EQS, i.e., that the waters be capable of supporting salmonid species or cyprinid species, respectively. The majority of waters in the State would be required to meet the stricter salmonid fishery EQS.

The scope of the discussion document may alter in line with the draft EU Water Framework Directive which requires good ecological status for waters which includes not only good chemical water status but also requires good biological water status.

The document proposes a list of EQSs for a variety of parameters in relation to the aquatic environment which are to met to satisfy the EQOs. Following a period of consultation, the Agency will consider publishing quality objectives for the aquatic environment. Once published, the Minister, any other Minister of the Government and other public authority is obliged to take account of any quality objective published by the agency in the formulation of policy, in the setting of standards or in the exercise of their functions concerning environmental protection. All public authorities will have to have regard to any EQSs set by the Minister when making, revising or reviewing water quality management plans.



3. IMPLICATIONS OF DEVELOPMENTS IN NATIONAL SITUATION AND THE DRAFT EU WATER FRAMEWORK DIRECTIVE

3.1 DEVELOPMENTS IN NATIONAL SITUATION

Recent developments in national policy show a definite move towards the revitalisation of water quality management planning. All existing plans are to be reviewed in the next ten years and their revised objectives will most likely include compliance with the interim quality standards contained in "Managing Ireland's Rivers and Lakes - A Catchment based Strategy Against Eutrophication" (Department of the Environment and Local Government, 1997). The reviewed plans will also have to comply with the provisions of the Local Government (Water Pollution) Act, 1977 (Water Quality Standards for Phosphorus) Regulations, 1998. In addition plans are likely to take account of the requirements of "good ecological status" under the draft EU Water Framework Directive (see below).

The National Lakes, Rivers, Estuarine and Groundwater Monitoring Programmes are presently being prepared by the Agency in consultation with other organisations. As these programmes will provide information for the review of water quality management plans and formulation of river basin management plans, they should be analysed to show they satisfy the information requirements of these plans. This assessment will be carried out before the revised programmes are adopted. Similarly, the monitoring and management programmes being co-ordinated by the Department of the Environment and Local Government should be assessed as to their coverage of the informational requirements of River Basin Management Plans.

3.2 DRAFT EU WATER FRAMEWORK DIRECTIVE

There is presently a draft EU Water Framework Directive proposed by the European Commission. The directive, when adopted, will have major implications for water quality management planning in Ireland. It is expected that the directive will form the framework for future catchment management systems. Its overall objective is to establish a framework for the protection and improvement of surface waters,

estuaries, coastal waters and groundwater with the aim of achieving "good water status". The scope of the directive is very far reaching with rivers, lakes, estuaries and coastal zones being included together with the associated groundwater.

Member states will be required to identify individual river basins and assign them to River Basin Districts. A District is defined as an area of land and sea, made up of one or more neighbouring river basins, together with their associated groundwater and coastal waters. These River Basin Districts will be the primary administrative units for the purposes of water management. In Ireland the existing catchment sizes are relatively small and it is likely that many will be amalgamated together to produce River Basin Districts which are of a suitable size for reporting to Europe. Initial indications from the Department of the Environment and Local Government are that Ireland will be divided into two, three or four river basin districts.

A Competent Authority must be designated for each River Basin District to ensure the application of the requirements of the directive. The Commission suggests that this can be achieved through the co-ordination of administrative efforts rather than by the imposition of a single agency or authority. However, it is likely this will depend upon the traditions of the relevant member states. It is not yet clear how River Basin Districts will be administered in Ireland.

The requirements of the proposed directive are:-

- an assessment of the characteristics of the river basin district covering geography, geology, hydrology, demography, land use and economic activity;
- assessment of human impacts covering point and diffuse pollution, estimates of water abstractions and an analysis of other anthropogenic factors e.g. habitat damage;
- monitoring of the status of surface and ground waters;
- the establishment of programmes of measures to achieve the objective of the Directive;

- an economic analysis with recovery of costs for water use covering: abstraction/distribution of fresh water, collection/discharge of waste water, environmental/resource costs and benefits, and long-term forecasts of supply/demand;
- register of all significant bodies of water used, or which may be used in the future, for potable water supply;
- register listing all areas designated as requiring special protection under specific Community, national, or local legislation;
- summarising of all of the above in a river basin management plan;
- public consultation on that Plan;
- a feedback mechanism to inform authorities and the Commission of the particular problems that may arise;
- action to combat accidental pollution;
- simplified reporting procedures;
- a procedure for the development of co-ordinated strategies for dealing with pollution by individual pollutants or groups of pollutants.

Each Competent Authority must publish a river basin management plan for each River Basin District. These Plans will define the framework for achieving the objectives of the Directive and provide for reporting to the Commission. The main “objective” of the Directive is to ensure that all surface, coastal waters and groundwater achieve good water status within a specified period. “Good water status” is defined within a classification system contained within the draft directive (Annex V). The classification system takes account of biological, physico-chemical and hydromorphological characteristics dependant on the type of waterbody.

Although the time frame for the implementation of the various provisions of the draft directive are still subject to change the draft contains specific periods by which various tasks under the directive will have to be completed. The periods are relative to the date of publication of the directive in the Official Journal of the European Communities. Within 3 years, the directive must

be incorporated into national law and the competent authorities designated. Within three years and six months, the member states will have to provide the Commission with relevant details in relation to the competent authorities. Within 5 years, the member states must have carried out their analysis of the basin characteristics, review of human activities, established a register of protected areas and carried out an economic analysis of water and its use within the basins. Within 7 years, monitoring programmes must be in place for the monitoring of water status. The programme of measures to achieve the objectives of each river basin management plan must be established within 10 years and operational within 13 years. The river basin management plan itself must be produced within ten years. The plans are liable for review by year 16 and every six years thereafter. The plans will go through a public consultation stage where the draft plan will be available for one year for public review and comment prior to the publication of the finalised plan.

In the proposed directive, river basin management plans can be supplemented by the production of more detailed programmes and management plans to deal with specific aspects of water management which may include catchment, estuarine and coastal management plans. Existing water quality management plans and groundwater protection plans will need to be integrated into river basin management plans so that unnecessary duplication of effort is avoided. As with the administration of River Basin Districts, it is not yet clear how this will be achieved in Ireland. However, it is essential that the limited resources available to conduct comprehensive water quality management planning are applied in an efficient and cost effective manner.

3.3 LIKELY IMPACT ON NATIONAL SITUATION

The implementation of the draft framework directive will likely occur concurrently with the review of water quality management plans and the preparation of both will be related. Clearly the two processes should be amalgamated as much as possible to avoid wasting of resources. The relationship between them could be as simple as the water quality management plan providing information for the preparation of the river basin management plan or could consist of a strategic river basin management plan which forms the framework for the revision of the water quality

management plan. This would be analogous to the relationship between Strategic Environmental Assessment and project Environmental Impact Assessment. If this were to be the working model, river basin management plans would have to be prepared in advance of the revision of water quality management plans. However, the time frames for the implementation of the draft EU Water Framework Directive and review of water quality management plans make it more likely that the water quality management plans will be reviewed as the river basin management plans are formulated. There is likely to be feedback from one process to the other as they are closely related. However the level of inter-relatedness of the processes is dependant on the bodies responsible for their co-ordination.

It should be noted that implementation of the framework directive may require new legislation and the Commission is currently developing implementation guidelines for the draft directive.



4. ADVANCES IN ENVIRONMENTAL MANAGEMENT TECHNIQUES AND TECHNICAL TOOLS

The tools and techniques available to the water quality management planning practitioner are continually improving. These can be considered under three main headings:

Environmental Management Tools which include:

- Environmental Management Systems;
- Farm Environmental Resource Planning and Nutrient Management Planning;
- Riparian Management;
- Strategic Environmental Assessment;
- Risk Assessment;
- Groundwater Protection Scheme and Responses;
- Environmental Indicators.

Data Compilation and Analysis Tools which include:

- Geographical Information Systems and Computer Assisted Cartography;
- Computer Modelling;
- Satellite Imagery;
- Remote Sensing;
- Data Logging Monitoring Systems;
- Global Positioning Systems.

Associated Environmental Systems which include:

- Planning and Environmental Impact Assessment;
- Integrated Licensing Systems;
- Effluent Discharge Licensing;
- Environmental Designations.

In this section the various tools and techniques are

reviewed in the context of their relevance to water quality management planning.

4.1 ENVIRONMENTAL MANAGEMENT TOOLS

4.1.1 ENVIRONMENTAL MANAGEMENT SYSTEMS

In simple terms, an Environmental Management System can be defined as that part of the overall management system which deals with environmental issues relating to an area or organization. There are a number of accredited systems such as ISO 14000, EMAS and BS7750. While there are various differences in the systems design and output between the standard systems the basic concept is the same. Figure 3 below illustrates the common principles underpinning an environmental management system.

On an operational level the environmental management system consists of initial review, formulation of targets and objectives, assigning responsibility for attaining targets and formulating an environmental management programme. The environmental management programme is often described as the engine for continuous improvement but the direction and attainment of the targets is often due to periodic auditing to assess achievement of the targets or significant milestones in the achievement of targets. These audits can then provide additional information for the fine tuning of the system to maximise efficiency in reaching the targets.

One of the findings of the assessment of existing plans was that the recommendations contained in them had not been completely implemented (Section 5.3). While the reason for this is not clear, the absence of an auditing mechanism within many of the plans to assess implementation makes the attainment of its objectives more difficult. An environmental management systems approach can provide water quality management plans with the degree of flexibility necessary to deal with new information and changes in the physical and economic environment thereby ensuring that the plan maintains its relevance to the existing situation during the operational phase of the plan.

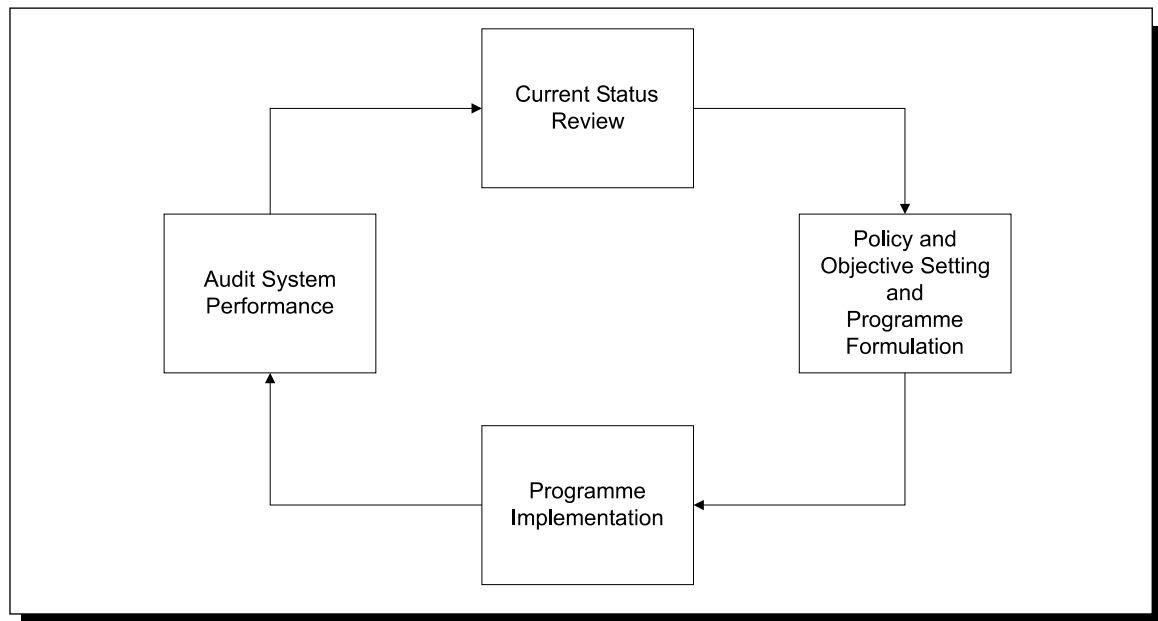


FIGURE 3 GENERALISED ENVIRONMENTAL MANAGEMENT SYSTEM

4.1.2 FARM ENVIRONMENTAL RESOURCE PLANNING AND NUTRIENT MANAGEMENT PLANNING

Farm environmental resource planning and nutrient management planning are two of the main tools for the control of farm emissions. These tools operate in association with codes of good agricultural practice which provides general guidance on prevention of water pollution from agricultural sources. The first Code of Practice for the Control of Farm Pollution was published in 1977 and was later updated in 1985. There is also a Code of Practice to Protect Waters from Pollution by Nitrates published jointly by the Departments of the Environment and for Agriculture, Food and Forestry in 1996. These codes of practice provide recommendations in relation to the storage, application methods and rates of organic fertilisers which complement the use of farm environmental resource planning and nutrient management planning.

Farm environmental resource planning provides for the management/control of production, collection and storage of manures and organic by-products in a manner that minimises the risk of pollution. The plans address such issues as the minimisation of production of manures and farm effluents together with their proper collection and storage. These plans do not however take account of the nutrient content of the materials to be spread on land or of the nutrient status of soils in the landspreading area. The safe collection,

isolation from rainwater and storage of manures and farm effluents are necessary for the protection of waters from acute agricultural pollution. It should also be noted that a significant percentage of nutrient releases from farms can come directly from the farmyard.

Nutrient management planning is the logical extension of this resource planning and does take into account the soil and materials nutrient characteristics. It gives an area by area assessment of the amounts of manures, effluents or inorganic fertilisers which should be applied to each area based on soil type and nutrient status. It should also be noted that nutrient management plans can be required by a local authority under section 21A of the Local Government (Water Pollution)(Amendment) Act, 1990 as amended by Section 66 of the Waste Management Act, 1996.

Since the late 1980's assessment and application of farm yard management has been on-going (parallel to farm surveys and farm pollution control schemes) while nutrient management planning has been developing since the early 1990's and is being applied through the REPS and the monitoring and management schemes for Loughs Derg, Ree and Leane and the Rivers Liffey, Boyne and Suir. Nutrient management planning is advocated in the Department of the Environment and Local Government's Catchment Based Strategy Against Eutrophication "Managing Ireland's Rivers and Lakes" and the statutory provisions contained in Section 66 of the Waste Management Act, 1996. Nutrient

management planning should clearly be a feature of future Water Quality Management Plans.

4.1.3 RIPARIAN MANAGEMENT

A riparian zone is a strip of land along a river corridor. They are sometimes termed vegetated buffer zones indicating their importance in lessening the impact of adjacent land use on water quality. Their management basically consists of the maintenance of a 10-30m wide strip of native vegetation, particularly deciduous trees, along the riverbank. Riparian zones can mediate the effects of land use through changes in their vegetation and are areas where land management strategies can be initially focused to facilitate catchment management. The benefits of good riparian zone management include reduction in bank erosion and sedimentation, wildlife conservation, increased recreation value and improvements in water quality and the extent of such zones only accounts for a relatively small proportion of the catchments in which they are sited.

Riparian zone management has not been utilised as a tool in water quality management planning but it has been used as a habitat protection measure by the fisheries boards. With EU structural funds provided under the Tourist Angling Measure and the goodwill of local farmers, narrow riparian zones have been constructed along stretches of a number of rivers (including the Moy) to protect the channel from bank erosion. While these riparian zones are normally only three meters wide they do provide the instream habitat a good level of protection. It should also be noted that funding for riparian zones can be obtained through the REPS scheme under Supplementary Measure 4.

4.1.4 STRATEGIC ENVIRONMENTAL ASSESSMENT

Strategic environmental assessment is the consideration of environmental impacts at the various tiers of decision making: policies, plans and programmes. The assessment of environmental impact at these strategic levels provides a more complete framework for environmental protection and can protect against piecemeal development and introduces environmental assessment into the physical planning process earlier.

Its application in water quality management planning could relate to the relationship between river basin management proposed under the draft

framework directive and water quality management plans. Alternatively it could relate to closer ties between the water quality and the physical planning systems to provide for the earlier appraisal of development programmes in relation to impacts on water quality.

4.1.5 RISK ASSESSMENT

The basic methodology of an environmental risk assessment involves a stepwise process. The first step is essentially scoping of the assessment which is followed by hazard identification. Hazard identification involves establishing the agents that could possibly harm the receptor of interest e.g. the underlying groundwater or local population. Once the hazards have been identified the potential for exposure of the environment to the hazard and the effects it would have if exposure occurred are assessed. Based on this information the risk is estimated and the risk assessment formulated.

Risk assessment has been used in the decision making process of a number of environmental issues. For instance this is the approach that is used in the assessing the environmental risks posed by GMOs, chemicals and specific industrial plants. A European Environment Agency Manual on environmental risk assessment states that risk based approaches to environmental problems are being used extensively. The approach has been adopted by the EPA through requiring firewater retention assessments and ground/groundwater contamination assessments as conditions of integrated licences. More significantly, the revised groundwater protection scheme as described below is based on a risk assessment of the potential for groundwater contamination based on hazard posed by certain types of land use and the geological and hydrogeological characteristics of the area covered by the scheme.

When viewed in context with the provision in Article 13.3 of the Draft EU Water Framework Directive for *“measures to prevent leakage of pollutants from technical installations and to prevent and/or reduce the impact of accidental pollution incidents”* the applicability of this method of assessment to water quality management planning becomes apparent. On a practical level, risk assessment of existing facilities (such as factories, dairies and farm complexes) to ensure that they do not pose a significant risk to the maintenance of water quality should form a part of the initial preparation of a water quality management plan or a work task

during the operational phase of the plan.

4.1.6 GROUNDWATER PROTECTION SCHEME AND RESPONSES

A groundwater protection scheme is a system that brings together land surface zoning and groundwater protection responses. It provides a framework to assist in decision making on the location and nature of developments and activities with a view to protecting groundwater using a risk assessment based approach. Its purpose, like that of water quality management plans, is to maintain the quantity and quality of groundwater and in some cases improve it.

The two main components to the new scheme are land surface zoning and protection response for potentially polluting activities. A diagram of the scheme is shown in Figure 4.

The land surface zoning aspect contains a series of maps including bedrock and subsoil geology, depth to bedrock and well locations. These maps are then integrated to form aquifer maps and vulnerability maps. The final map is termed a groundwater protection zone (resource) map which can form the basis for land use planning. It delineates land area in terms of the groundwater vulnerability to pollution and their groundwater potential. Associated with the scheme is the creation of source protection zones. These zones are usually developed for local authority supplies and provide detailed information on the

groundwater flow type and vulnerability. The zones are subdivided into the inner and outer protection zones with respect to the travel time of the groundwater and the vulnerability of the area.

Groundwater protection responses indicate the acceptability of specific land uses such as landfills, wastewater treatment plants and landspreading of organic wastes within an area or particular measures to be taken in relation to these uses. It should be noted that underlying these schemes is the application of risk assessment to the potential for contamination to groundwaters from various land uses.

4.1.7 ENVIRONMENTAL INDICATORS

Environmental indicators can be defined as key statistics which represent or summarise a significant aspect of the state of the environment and related human activities. They focus on trends in environmental change, the stresses causing them and the societal response to minimise the impacts. The characteristics of good indicators are that they are policy relevant, analytically sound and can be measured. In relation to environmental management, indicators are needed:

- to provide a means of linking environmental impacts to socio-economic activities and to enable policy makers to evaluate the magnitude of environmental problems;

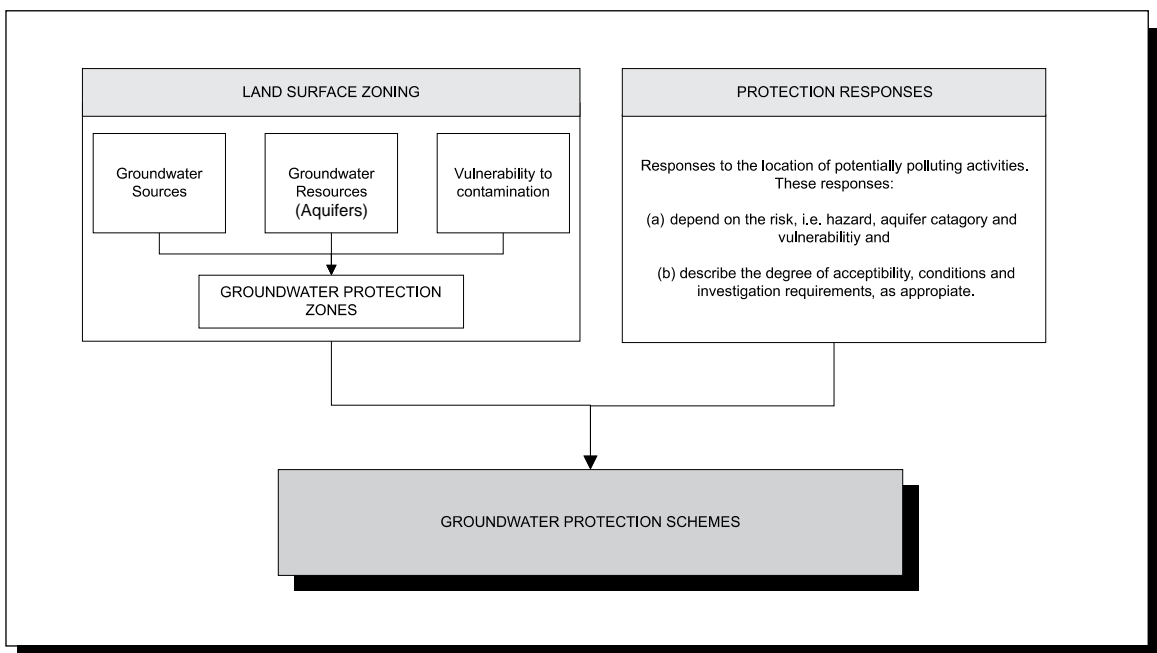


FIGURE 4 COMPONENTS OF GROUNDWATER PROTECTION SCHEMES

- to support priority setting by identifying key factors that cause pressure on the environment;
- to monitor the effects of responses to these pressures
- to provide information to both decision makers and the public on the State of the environment, how it is changing, why these changes have been brought about and on proposed actions and policies to improve the environment.

One of the most widely accepted frameworks for the organisation of environmental indicators is the Driving force-Pressure-State-Impact-Response (DPSIR) framework, developed initially by the OECD (as the PSR framework) and adapted by organisations such as the European Environment Agency.

Indicators for driving forces describe the developments in society and the corresponding changes in life styles, overall levels of consumption and production patterns (e.g. population change within a catchment). Pressure indicators describe developments in release of substances (emissions), physical and biological agents, the use of resources and the use of land (e.g. phosphate emissions from catchment sewage treatment works). State indicators give a description of the environment (physical, biological and chemical) in a certain area (e.g. concentration of phosphorus in lakes). Impact indicators describe changes in the quality and quantity of natural resources due to pressure on the environment (e.g. number of fish kills). Society responds to these changes through environmental, general economic and sectoral policies which can be described by response indicators (e.g. percentage of population serviced by tertiary sewage treatment).

Additional indicators used in assessing sustainable development are efficiency indicators and performance indicators. Efficiency indicators directly relate environmental pressures to human activities. These indicators provide insight into the efficiency of products and processes (e.g. phosphate usage/ ha grassland). The relevance of efficiency indicators is that they reflect whether or not society is improving the quality of its products and processes in terms of resources, emissions and waste per unit output. Performance indicators compare the situation as it is with the situation as it should be, were the environment managed in a sustainable manner. These also tend to be the indicators that are most comprehensible to the

general public. They measure the “distance(s)” between the current environmental situation and the established environmental quality objective or target (e.g. percentage of river sampling stations with water quality capable of supporting salmonids).

4.2 TECHNICAL TOOLS

4.2.1 GEOGRAPHICAL INFORMATION SYSTEMS AND COMPUTER ASSISTED CARTOGRAPHY

A Geographical Information System (GIS) is a tool that allows for the processing of spatial data into information. The system is sometimes described as consisting of four subsystems;

- a data input subsystem that collects and pre-processes spatial data from various sources;
- a data storage and retrieval subsystem that organises the spatial data in a manner that allows retrieval, updating and editing;
- a data manipulation and analysis subsystem that performs tasks on the data including aggregation, classification for further analysis and performs modelling functions;
- a reporting subsystem that displays all or part of the database in tabular, graphic, or map form.

The data manipulation and analysis subsystem is the most powerful tool in water quality and land use planning. It can analyse the interaction between various sets of geographical data to produce graphic information. This could be as simple as finding all the treatment plants which are within a certain distance from the coast or as complex as determining the vulnerability of aquifers from depth to bedrock data, subsoil type data and karst features data.

Computer assisted cartography (CAC) is similar to GIS with one major difference: the information is not georeferenced. This digital information can be georeferenced and input into a GIS but there can be significant work in achieving this integration.

Use of GIS has become widespread in water quality management planning and land use planning. Both the Erne and Foyle WQM Strategy used a GIS system for data handling and

thematic mapping. GIS systems have also been developed for the Tolka water quality management plan and the Boyne water quality management plan. The monitoring and management programme for Lough Derg and Lough Ree (Shannon Catchment) is using a GIS to form the basis of its operation. This project is also collecting water quality data using the input module of the Inland Waters Database developed by the EPA. As the programme area includes portions of ten local authorities' functional areas this will mean standardisation of data collection between these ten county councils. Other monitoring and management programmes commencing operation are the Boyne, Suir and Liffey catchments and Lough Leane. All of these programmes will use GIS. However no arrangement has been formulated in relation to data collection system standardisation as yet.

GIS have been developed for the Lough Gill STRIDE project in County Sligo and are in use by a number of the county councils for control of services and environmental information. The Geological Survey of Ireland (GSI) is also using CAC for its source protection programmes and aquifer vulnerability mapping operations. Similarly the STRIDE programme for the vulnerability mapping of Mayo, Galway and Roscommon was produced using digital mapping technology. The GSI is presently working on counties Meath, Wicklow and Tipperary South Riding, Waterford, Offaly, Laois and Clare and has previously carried out a similar survey for Wexford. However, while digital this information is not all georeferenced and will require manipulation before integration with other environmental data sets.

4.2.2 COMPUTER MODELLING

Computer modelling has been widely used as a tool for determining the effects of human activity on the receiving environment. In water quality management planning the role of computer models has been predominantly in relation to estuaries. This is because the hydrodynamics of estuaries are complex and this makes the assessment of inputs into the system difficult. Computer models help in:

- assessing the fate and impact of discharges;
- examining potential ways of improving water quality;

- setting realistic EQOs;
- developing a management strategy and assessing new developments.

Estuarine models are normally temporally dynamic. In general, models are either one, two or three dimensional. The decision as to which of the above is most applicable to a study area is generally made on the basis of the geometry of the areas. One dimensional or width averaged two dimensional models are generally applied to rivers and depth averaged two dimensional models are applied to coastal regions. Three dimensional models apply where there are large influences from both depth and width dimensions like large lakes or deep ocean waters.

Computer modelling has been in use in water quality management planning in Ireland from the 1980s. Models include the riverine dissolved oxygen model developed by Martin McGarrigle and the models for the Barrow, Suir and Nore estuary and the Shannon estuary developed in the early eighties. These models were limited by the computer technology of the time. The Barrow, Suir and Nore estuary model was programmed in FORTRAN and did not have any graphical user interface (GUI). Similarly the original Shannon estuary model did not have a GUI but it has since been upgraded in 1992 by MCS International. The Shannon Oil Spill model was developed after the water quality model and was developed with a Windows™ interface with access to the modelling system to vary environmental conditions such as wind speed and direction. One of the major problems with the model was that it was not designed to run on a PC and required that the run data be sent via modem to a more powerful system for operation. The most recently developed estuarine model is the Cork Harbour model again developed by MCS International. This PC based model contains both oil spill and water quality modelling capabilities. Development is ongoing for a model for Lough Conn in Mayo which is being used to assess the effects of phosphorus loading to the lake (pers. comm. McGarrigle M.). The Dublin Bay Water Quality Management Plan also entailed the creation of a model of the bay.

It should be noted that models are based on a digital representation of a certain area. However these areas are not georeferenced and cannot be directly linked to a GIS to allow comparison with information on water use and land use contained

within the GIS. The ongoing research project on the Slaney estuary will have an integrated modelling and geographical information system. Models are currently under development both for Wexford Harbour and Cork Harbour. These models will have the capacity to be linked to a GIS.

4.2.3 SATELLITE IMAGERY

Most notable in relation to satellite imagery is the CORINE land cover information which was obtained from Satellite imagery in 1989/1990. The information collected by the CORINE programme not only included land cover information but also allows for slope to be determined for the land. This information was included in the GIS system developed for the Foyle catchment.

While CORINE is the most highly utilised satellite derived information more recent satellite imagery of Ireland is available and the resolution of the imagery is improving together with its the associated land cover information. The level of use of this technology in water quality management planning and river basin management planning in the future remains to be determined. However an update of the CORINE data set will be required to reflect the changes in land cover in Ireland in the past 8 years especially in relation to forestry.

4.2.4 REMOTE SENSING

Remote sensing is similar to satellite imagery. The normal operation is the taking of video footage and spectrophotometric readings from an aircraft and processing these images and readings afterwards to provide data on rivers, the trophic status of lakes and land use/cover information.

The power of this technique is the collection of data over a large geographical area in a short time. A remote sensing project funded by the EPA Research and Development programme has improved an existing system that can survey the chlorophyll levels and lake vegetation in over 100 lakes in one day. This technology will be used in the Agency's Lakes monitoring programme and can provide information for the purposes of water quality management planning. It should also be noted that remote sensing using high resolution satellite imagery will likely become more useful in water quality management planning. Remote sensing of algal and vegetation cover was used in studies carried out as part of the preparation of the in Dublin Bay water quality management plan.

4.2.5 DATA LOGGING SYSTEMS

Data logging systems have been used widely in Ireland for measuring flow and quality parameters for raw water and effluents from waste water treatment plants. The use of these systems in ambient water quality monitoring has however been limited. The most notable use of this technology in ambient water monitoring is the surveying of diurnal dissolved oxygen at a number of locations within Ireland by the Agency. This system is termed "the eutrophication effects monitoring system" as an enhanced temporal variability of dissolved oxygen is indicative of eutrophication. The information provided by these data logs is being used for the calibration of dissolved oxygen modelling in specific rivers. It is expected that these systems will become more widely used in the future in Ireland as has occurred in the UK.

4.2.6 GLOBAL POSITIONING SYSTEMS

Global Positioning Systems (GPS) are useful tools in locating and georeferencing of a sampling point or area. The systems operate based on locating the operator by triangulation in relation to a number of satellites. This technology has been used by the Agency for a number of purposes. Notable among its environmental uses in Ireland was the georeferenced bathymetric mapping of 100 lakes. If the integration of environmental geographical data sets is to be achieved the georeferencing of environment applicable data set will required.

GPS is widely used in the EPA hydrometric, groundwater quality monitoring and estuarine and coastal water quality monitoring projects for reference of stations and navigation of routes. It has also been used in an informal manner by the Licensing and Control Division for collection of information on the location of IPC licensed facilities and the land spreading areas for organic wastes from them. The Environmental Management and Planning monitoring team is also using GPS for the referencing of the location of waste management facilities.

4.3 ASSOCIATED REGULATORY ENVIRONMENTAL TECHNIQUES

4.3.1 PLANNING AND ENVIRONMENTAL IMPACT ASSESSMENT

Physical planning in Ireland is governing through the planning system as set out in the Local Government (Planning and Development) Acts, 1963 to 1993 and associated regulations. The legislation allows for the creation of statutory development plans. These development plans provide the framework for dealing with applications for planning permission from people who wish to undertake development. The plan identifies preferred areas for development, areas sensitive to development and types of development permitted in those areas.

The local authorities are the competent authorities for dealing with planning applications in their functional areas. The majority of developments are subject to planning control. Developments not requiring planning permission include local authority developments and certain state developments which relate to security matters. Planning applications are assessed by the planning authority to decide whether they conform with the Development Plan and how they affect the proper planning and development and the amenities of an area.

The importance of the physical planning system in relation to water quality management planning is that proper planning must take account of the environmental consequences of development. Inappropriate developments which can have a detrimental effect on the aquatic environment can be refused planning permission. However, local planning authorities are precluded from considering environmental factors where facilities require either IPC licences or waste licences from the Agency.

Environmental impact assessment (EIA) is the process of predicting and evaluating the impacts of a development on the environment in advance, the conclusions to be used as a tool in decision making. EIA involves:

- reviewing the existing state of the environment and the characteristics of the proposed action;
- predicting the state of the future environment with and without the action (the difference between the two being the Impact); and

- considering methods for reducing and eliminating any negative impacts.

The use of EIA is widespread through out the European Union due to a number of directives requiring EIA to be carried out for certain potential projects. In Ireland, EIA is closely linked with physical and land use planning with the power to require EIAs and resulting statements (EIS's) residing in the main with the local authority planners.

As EIA is a tool used to assess future development its relevance to the water quality management planning practitioner may not be immediately obvious; however during the operational phase of a plan new developments should be assessed as to their impact on the aquatic environment and an assessment made of their potential effect on the achievement of the objectives of the plan. Linking of physical development and the management of water quality in this manner is in keeping with the aspirations of the National Sustainable Development Strategy.

4.3.2 INTEGRATED LICENSING SYSTEMS

Prior to the establishment of the Agency in 1993, the local authorities had the primary responsibility for environmental protection. They also issued pollution control licenses to potentially polluting activities. With the establishment of the Agency, responsibility for licensing was split between the Agency and the local authorities. The Agency is now responsible for integrated licensing of large or complex activities with significant polluting potential. Local authorities will continue to be responsible for licensing those activities not mentioned in the first schedule to the Environmental Protection Agency Act, 1992. The Agency is also the licensing authority for larger waste management facilities under the waste licensing system introduced under the Waste Management Act, 1996

Under IPC and the Waste licensing regimes, only one license is issued to a facility to cover all aspects of air, water, waste and noise emissions. The license takes account of the effect the activity has on the environment as a whole. This has advantages over the former system in that it allows for an assessment to be made of the overall effect of the activity on the environment and limits the transfer of pollution from one environmental medium to another.

The IPC licensing function of the Agency

commenced in May 1994. The phasing-in period for IPC licensing of these new activities extended from May 1994 to September 1996. Due to the numbers involved a much longer phasing-in period has been required for the IPC licensing of established activities. The Waste licensing system commenced operation in May 1997 and from that date all new activities require a license prior to commencement. Various existing waste management facilities are being phased with applications to date being received in relation to the larger landfills and hazardous waste treatment facilities.

The emissions standards set in IPC and Waste licences must have regard to any existing water quality management plan.

The information which arises from fulfilling licence conditions (especially monitoring data and bund integrity assessments) is of relevance to the preparation and implementation of water quality management plans. More importantly, the enforcement of the licence conditions limit the effects of discharges and other operations on waters.

4.3.3 EFFLUENT DISCHARGE LICENSING

Local authorities have the power to issue and review water discharge licenses under the licensing system created by the Local Government Water Pollution Act, 1977 to activities other than those licensed by the EPA. Any industry which emits a process effluent must possess a licence to discharge this effluent either to waters or to sewer. Such a licence normally contain provisions in relation to the volume of effluent to be discharged, its rate of discharge and its pollution potential as BOD or COD and the concentrations of various chemical species within the effluent. They also contain conditions as to the monitoring of emissions and in certain cases conditions relating to proper storage on-site and emergency provisions.

For water quality management planning, the licensing and control of discharges within the catchment is of major importance. While implementation of discharge licensing system is the responsibility of each local authority the information that the system gives rise to is of relevance to the water quality management practitioner.

4.3.4 ENVIRONMENTAL DESIGNATIONS

An evaluation of environmental designations was published in 1997 by the Heritage Council (Hickey 1997). Environmental designations fall into a number of categories: water designations, nature conservation designations and amenity designations.

4.3.4.1 WATER DESIGNATIONS

Probably the most important designations in relation to water quality management planning are designations in relation to waters. These include designations such as salmonid water, sensitive area for urban wastewater and sensitive areas for fisheries and forestry.

Ireland is required by the EU Freshwater Fish Directive to designate waters as salmonid. The Freshwater Fish Directive was implemented in Ireland through European Communities (Quality of Salmonid Waters) Regulation, 1988 (S.I. No. 293 of 1988). To date 22 rivers have been designated as salmonid. This directive sets out the sampling programmes and the methods of analysis and inspection which must be complied with in relation to these waters.

Similar to the freshwater fish directive, Ireland is required to designate waters as sensitive areas for urban wastewater under the Urban Waste Water Treatment Directive as implemented by Environmental Protection Agency Act, 1992 (Urban Wastewater Treatment) Regulations, 1994. Sensitive area for urban wastewater are designated based on criteria laid down in the directive. Designation as a sensitive area sets more stringent time frames for the introduction of nutrient removal from larger urban areas (Population Equivalent >10,000). Member states must review the identification of sensitive waters at intervals of no more than four year

Sensitive Areas for Fisheries and Forestry is a non-statutory designation which relates to waters where there is a potential for significant effect on water quality due to forestry developments based on the following criteria:

- the aquatic zone must be part of a recognised salmonid fishery and be a spawning, nursery or angling area;
- the geology must give rise to acid sensitive waters;

- in water samples taken between 1 February and 31 May, pH readings must be 5.5 or less, or water hardness must be less than 12mg calcium carbonate per litre or alkalinity less than 10 mg calcium carbonate per litre.

While there is no statutory basis for this designation, the forestry service has published guidelines in order to minimise physical and chemical effects on water quality of forestry plantations. The guidelines include consultation with fisheries boards and measures to reduce the impact of work related to silviculture. Grant aiding of afforestation projects is contingent upon adherence to these guidelines.

These designations provide the water quality management practitioner with a framework in which some decisions have been predefined. The requirements in relation to the Urban Waste Water Regulations, for example, set the timeframe for certain actions in relation to sensitive waters. Similarly, designation as salmonid waters defines the minimum level of monitoring for certain waters. The special areas for Fisheries and Forestry are an attempt to deal with one of the major areas of concern in water quality management: the interactions between water use and land use.

4.3.4.2 NATURE CONSERVATION DESIGNATIONS

Nature designations include Natural Heritage Areas (proposed) (pNHA), Special Protection Areas (SPAs) and Special Areas of Conservation (SACs), together with a host of other designations. The network of pNHA designations will form the basis of the protection of a range of natural habitats occurring in Ireland including oligotrophic lakes and pristine riverine catchments such as the Owenduff catchment, Co. Mayo.

SPA sites relate specifically to the protection of bird species which require habitat conservation due to their rarity or vulnerability to habitat change. Under the Birds Directive as implemented in Ireland under the Conservation of Wild Birds Regulations, 1985 (S.I. 291 of 1985) and various amendments, the designation of sites which qualify as SPAs in accordance with the designation criteria as defined in the Birds Directive (i.e. a site supporting a specific number of individual species) is mandatory for EEC member states.

The objective of the Habitats Directive is to maintain biodiversity (i.e. the variety of different habitat types and their associated plants and animals) throughout the EU Member States. The main provision which will allow the achievement of this objective is the requirement for designation by Member States of a network of SACs. The designation of these areas will enable Member States to protect the best examples of natural habitats in their own national territory and ultimately in the EU. A number of "priority habitats and species" are listed within the Habitats Directive which are targeted for special attention. In simple terms the proposed SAC network includes the best of the proposed NHAs incorporating some 400 sites nationally. The protection which afforded to SACs under the European Communities (Natural Habitats) Regulations, 1997 (S.I. 94 of 1997) is more strict than any previous Irish nature conservation measure apart from the protection afforded to National Nature Reserves and National Parks. The consultation process in relation to these sites is presently ongoing.

The importance of nature designations to water quality management planning is two fold, firstly certain aquatic habitats are proposed for designation which will provide an increased measure of protection from development and secondly the designation of terrestrial habitats should result in associative protection of water courses in their environs.

4.3.4.3 AMENITY DESIGNATIONS

Amenity designations include area of special control in development plans and special amenity area orders. "Area of special control" is used as a generic term covering amenity zoning by local authorities. In general, more stringent planning controls are applied in these areas. Special amenity area orders allow planning authorities to strictly control certain developments without the need for compensation and to control certain developments normally exempted. Similar to nature conservation designations, amenity designations should also provide water courses in their environs with some degree of protection.

5. CURRENT STATUS AND IMPLEMENTATION OF WATER QUALITY MANAGEMENT PLANNING IN IRELAND

5.1 INTRODUCTION

The various plans, strategies and programmes of relevance to water quality management planning are reviewed in this section, with particular emphasis on their implementation and relative success in achieving stated objectives. Groundwater protection schemes are included as they fall within the wider scope of integrated surface and groundwater planning.

A review of water quality management planning in Ireland was published in 1991 (Toner, 1991). This dealt comprehensively with the practice of water quality management planning in Ireland at that time. It set out the general issues involved such as information and data requirements for preparing the plan and the role of policy decisions in implementing the plan. The setting of water quality standards, the general and specific controls required for point and non-point waste sources and the need to decide on the priorities of a remedial programme for polluted reaches identified during the development of the plan were also considered. It emphasised the point that water quality management plans should not be considered “once-off” endeavours and noted the importance of periodic review of plans.

The review went on to describe the methodology used to develop water quality management plans by An Foras Forbartha(AFF) (McCumiskey, 1982). The methodology took on board the main provisions of the technical guidance published earlier by the Department of the Environment (DoE, 1978) along with the provisions of the various European use-related water directives and other relevant documentation. All of the initial plans prepared in Ireland in the 1980's were drafted by AFF with some of the later plans prepared directly by local authorities. At the time of the review, plans completed or in hand covered most of the major river systems in the State. A comprehensive description of the AFF method is contained in Appendix C.

The review included a number of recommendations regarding the future development of water quality management planning for Irish rivers. These included:

- recommendations for extension of coverage including a recommendation that smaller rivers might be more appropriately dealt with as groups of adjacent small catchments;
- a recommendation for the inclusion in the water quality management planning process of certain estuarine and coastal waters;
- recommendations for the control of eutrophication and the control of non-point sources of pollution, in particular those of agricultural origin;
- a further assessment of the critical flow conditions to be used in calculating the waste assimilation capacity from biodegradable wastes in rivers;
- a further assessment of water quality standards; and
- recommendations regarding the future monitoring of water quality.

Some of these recommendations have been taken on board in water quality management plans and strategies drafted since the review.

More recently, a review of water quality management planning in 1992 (Stapleton, 1993) concluded that plans must be responsive to change and that they should provide a framework within which decisions can be made in an evolving situation with clearly defined responsibilities for the ongoing supervision, implementation and review of the plans.

5.2 PLANS

5.2.1 WATER QUALITY MANAGEMENT PLANS

A listing of adopted plans, plans at draft stage and cross-border water quality strategies is provided in Appendix D. These plans cover most of the major catchments in the country as shown in Figure 1. The catchments where plans have not been drawn up are mostly along the western seaboard.

Fifteen water quality management plans have been adopted since the enactment of the Local Government (Water Pollution) Act, 1977. Eleven of these were formulated by either the Water Resources Division of AFF or by its successor, the Environmental Research Unit. These plans covered the following catchments: the Barrow, Nore, Suir, upper Shannon, lower Shannon, Slaney (including the estuary) and Cavan county, and the following estuaries: the Barrow, Nore and Suir estuary, the Shannon estuary and Dublin Bay. The remaining four were prepared by or on behalf of local authorities. These plans covered the Deel and Moy catchments, Bantry Bay and Dungarvan Harbour. The EQS adopted by each of the plans are detailed in Appendix E.

5.2.1.1 PLANS ~~PREPARED~~ BY AN FORAS FORBARTHA (1984-1992)

The overall objective of the eleven plans prepared by AFF was to assure an acceptable quality of water for specific uses in the future thereby:

- safeguarding public health;
- catering for the abstraction of water for domestic, industrial and agricultural purposes;
- catering for the needs of fishing;
- catering for the needs of relevant water based amenities and recreational requirements.

The achievement of these objectives was mediated by two specific targets; the identification of control measures necessary in relation to the satisfactory treatment and disposal of existing and future sewage and industrial discharges; and the identification of the priorities for investment in public and private waste water treatment facilities.

Each plan was formulated using available information on the characteristics of the area covered by the plan, current water uses and water quality. It included a definition of the area covered by the plan, the setting of an EQO(s), associated EQSs and flow criterion under which the EQSs apply. The plans also defined a general policy in relation to effluent control which included primary treatment of all significant discharges, balancing of effluent flow and the combined treatment, where possible, of domestic and industrial effluents.

The plans prioritised the areas requiring

restoration. In the case of riverine plans priority was given to polluted sections of the main channel. The polluted reaches of the tributaries were then ranked based on the degree of pollution and the length of channel affected. In estuaries, the priorities were set based on the areas most seriously polluted. Computer based modelling of the complex hydrodynamic conditions was used to obtain information on the likely impact of discharges.

Based on this priority setting, an Action Programme was developed which set out the standard of effluent treatment to be provided for specific discharges. The implementation of these capital projects were considered as short term remedial measures. The plans also contained a "Programme for Further Action" which detailed additional information which should be collected to aid the implementation of the plans.

The water quality management plan prepared for Dublin Bay was a significant departure from the other AFF plans. Its scope was much wider as were its main objective. These objectives were:

- to prevent and abate pollution and so to safeguard public health and to protect and enhance the environment of the plan area;
- to ensure an acceptable quality of water for various beneficial uses of the plan area and in particular for recreational uses;
- to ensure that the ecological balance of the area is not adversely affected and in particular to protect areas of importance for wildlife conservation;
- to provide a framework for management including monitoring and for conflict resolution and so to facilitate balanced urban, industrial and port development, and to help ensure that the environmental dimensions an integrated part of development and related policies;
- to ensure that the available finances for pollution control are used in the most effective manner, and to increase the effectiveness of actions to protect the environment;
- to assess the options of the major sewage discharge at Ringsend, and the options in relation to other discharges to the bay and estuary and the make appropriate recommendations.

Based on the collected information and legislative requirements, a programme of proposed actions was formulated including recommendations in relation to sewage discharges, cooling water discharge, spillage, dredge spoil and sewage sludge disposal, development of amenity facilities and future management and monitoring together with provision of better public information. The organisational structure proposed in the plan consisted of two committees:

- a management committee, to assess the effectiveness of measures and to advise local authority on new actions required to further the objectives of the plan
- and a co-ordinating committee which was to facilitate co-ordinated actions by the different local authorities, preparation of annual reports on implementation, liaison with outside bodies, preparation of amendments to the plan, preparation and co-ordination of annual programmes of monitoring and research.

The plan stated that it was not its intention to be a blueprint setting out all actions required to protect the bay but to provide a framework on the basis of which future decisions can be determined. Certain initial actions were proposed but the plan stressed that the future action would have to be made using the most up-to-date guidelines.

5.2.1.2 DEEL WATER QUALITY MANAGEMENT PLAN (1990)

The Deel plan was prepared using the AFF scheme but was modified to include farm surveying to identify the extent of problems arising from farm wastes. The plan did not contain estimates of dry weather flow or 95%ile flow but did contain some advances in the development of water quality management plans. The most notable inclusion in the plan was a listing of the standard conditions applied to farming developments for the control of agricultural wastes. This attempt to assess and deal with non point-source pollution was a broadening of the scope of water quality management planning in Ireland.

5.2.1.3 MOY WATER QUALITY MANAGEMENT PLAN (1987)

The Moy plan adopted a different flow criterion to other plans. The flow criterion used by AFF was the flow equalled or exceeded 95% of the time. The Moy plan applied its EQS at 1.6 times the dry

weather flow (with the lowest measured flow taken as the dry weather flow). This was found to be more acceptable to the fisheries board than the 95%ile flow (pers. comm. Norton R. Mayo Co. Council). The plan contains a limited analysis of the effects of on-going physical and economic development and makes recommendations on some measures that could be taken to mitigate their effect.

5.2.1.4 DUNGARVAN HARBOUR WATER QUALITY MANAGEMENT PLAN (1994)

Dungarvan Harbour water quality management plan is based on a computerised model of the harbour. A list of management options for achieving its objectives was compiled and the computer model then used to predict the benefit arising out of any particular management option. This allowed the planner to determine the importance of different factors in the attainment of the priority objectives.

5.2.2 DRAFT PLANS

A significant number of draft water quality management plans have been prepared for other catchments by the relevant local authorities which have not yet been adopted. These include the Corrib catchment and the Boyne, Bandon, Feale, Finn, Tolka, Leannan, Munster Blackwater and Swilly rivers. There is no evidence that any of these plans were formally adopted by the relevant county councils and only a few of the more recently developed draft plans were available were reviewed for this document.

5.2.2.1 BLACKWATER DRAFT WATER QUALITY MANAGEMENT PLAN (1989)

The Munster Blackwater draft plan (Cork County Council, 1989) was prepared by Cork County Council on behalf of itself, Waterford County Council and Kerry County Council as 80% of the main channel flows through County Cork. This plan is based on the AFF scheme but has a more highly developed analysis of water usage and, more importantly, of land use which is an addition to the earlier plans. It also included the requirement for a catchment status report for each year of the plan's operation. In addition, one of the report's recommendations was that the present level of surveying of existing and potential sources of agricultural pollution was to be increased with a rigorous follow-up programme of

repeated prosecutions, where required, to eliminate the problem.

5.2.2.2 TOLKA DRAFT WATER QUALITY MANAGEMENT PLAN (1995)

The Tolka water quality management plan (Dublin Corporation, 1995) is unique in Irish water quality management plans in that it deals with a catchment with a high percentage of urban land use. It is based on an environmental management systems approach to water quality management planning. The plan contains a management strategy which reviews the plans objectives and proposes policies for satisfying the stated objectives.

The creation of a steering group from the three relevant local authorities was proposed to facilitate the achievement of the plan's objectives. The plan also contained what were termed "Priority Objectives" which included a pollution control plan to prevent localised agricultural pollution in the Meath section of the catchment and a listing of sites for wildlife conservation. One of the plan's most important recommendations was that no further development occur in the Dunboyne area until its wastewater treatment services were upgraded. This recommendation indicates a move from water management to integrated catchment management where the development of the catchment is assessed as to its effect on the receiving water environment. The plan contains provision for the continuation of the monitoring programme and maintenance of a GIS to facilitate the achievement of its objectives.

The broadening of scope within this draft plan to include non point sources of pollution, habitat conservation and the creation of a link between water quality management planning and development planning shows a more holistic approach to water quality management planning than had previously been exhibited.

5.2.2.3 BOYNE DRAFT WATER QUALITY MANAGEMENT PLAN (1997)

The Boyne draft plan (1997) has as its objectives the maintenance of water quality for the usual beneficial uses. Its scope has been broadened to include the laying down of criteria for future development but it does suffer from similar information gaps as were apparent in the earlier plans referred to above. One notable element of the draft plan is a comprehensive review of land

use in the catchment.

The plan contains an estimation of the phosphate budget for the catchment. This budget determined that approximately 30% of the available phosphorus was from waste water treatment plants while the remaining 70% was from general run off. Although it had addressed the phosphorus budget for the catchment in the technical information, the plan does not investigate options for controlling phosphorus runoff beyond stating that there was insufficient information on runoff rates and sources and that farm surveys and septic tank surveys are required.

The proposed implementation of the plan was reasonable with specific measures being outlined including a GIS data management system and system manager, resources to implement the water quality monitoring programme and specific technical resources to carry out the specialist surveys including farmyards and septic tanks. It did not, however, design any system for the strategic use of this information within decision making processes as was recommended in some of the earlier plans referred to above.

5.2.2.4 SWILLY DRAFT WATER QUALITY MANAGEMENT PLAN

There is a draft water quality management plan for the Swilly catchment was published in 1997 (pers. comm. Casey D. Donegal County Council). This draft plan is similar to the Erne and Foyle strategies. It does not, however, have the inherent implementation difficulties resulting from the lack of cross jurisdictional institutional structures.

5.2.3 WATER QUALITY CATCHMENT MANAGEMENT STRATEGIES

Work on catchment management has recently been undertaken in the cross border area, partly funded by the EU INTERREG initiative. Catchment based water quality management strategies have been developed covering the Foyle and Erne catchments. The term strategy has been used to denote the difference between cross border schemes and water quality management plans which have a statutory status in the Republic of Ireland. It should be noted that although these two strategies are unlikely to be adopted as water quality management plans, they may very well serve as a basis for water quality management plans which may be adopted by the relevant local authorities. It should also be noted that EU funding has ended.

5.2.3.1 FOYLE WATER QUALITY MANAGEMENT STRATEGY (1995)

The Foyle Water Quality Catchment Management Strategy (Department of the Environment and Local Government and Environment and Heritage Service, Department of the Environment for Northern Ireland, 1995) contains many common elements with the earlier water quality management plans referred to above. These include a general description of the catchment, resource use, review of catchment state and quality targets. It did not however contain estimates of dry weather flow or 95%ile flow. New or at least more comprehensively dealt with elements were a review of the administrative system in the catchment, a list of water classification systems for freshwater, estuarine and coastal waters, firm target designation and listing of management options. The management options determined the work areas to be addressed to achieve the designated targets. It did not however investigate the cost and resource implications of attaining the stated targets. It was also one of the first water management plans that utilised a GIS.

5.2.3.2 ERNE WATER QUALITY MANAGEMENT STRATEGY (1996)

The Erne water quality management strategy (Department of the Environment and Local Government and Environment and Heritage Service, Department of the Environment for Northern Ireland, 1996) contains the common elements of a water quality management plan but has a more systems based approach to water resource management. The objectives of the plan have a wider scope than the earlier plans and include:

- providing a framework for catchment development in a balanced and sustainable manner;
- ensuring that monitoring and information systems are adequate and sufficient to support decision making; and
- ensuring that financing of pollution control programmes is based on efficient and effective strategies.

The strategy is holistic with catchment uses being assessed including the land use and cultural heritage. The strategy also places a higher priority

on public consultation. On a more technical level, the planners proposed objectives for the plan based on both biological and physico chemical EQSs. Another change from previous practice is the inclusion of a flow EQS. This was intended to ensure sufficient flow in the river to protect the existing ecosystem. The Strategy also assessed the phosphorus budget for the catchment.

However, the regulatory framework for these strategies is more complex as the catchments are cross jurisdictional and are unlikely to be adopted as water quality management plans under the Local Government (Water Pollution) Act. In addition, the EU structural funding for these projects has ended and the level of monitoring has been significantly reduced.

5.2.4 CATCHMENT MONITORING AND MANAGEMENT SYSTEMS

Implementation of the provisions of the Directive concerning urban waste water treatment in a number of river and lake catchments is being co-financed at a rate of 80% to 85% by the Cohesion Fund of the European Union. While by far the greatest proportion of the capital investment in these catchments is being directed towards improvement of sewerage systems and upgrading or urban waste water treatment plants, in each of those projects funding has been approved for the setting up of Monitoring and Management Systems. The setting up of these systems is an integral part of each catchment based project. The objectives are to provide the necessary infrastructural systems, including laboratory facilities and GIS based information systems to enable the local authorities to assess the impacts of the investment in sewerage systems on water quality and to establish the impacts from other point and diffuse sources of pollution in the catchments. In each case a three year consultancy project is being co-financed by the Cohesion Fund. At the end of each three year project arrangements will have to be made by the local authorities and other interested agencies to maintain the Monitoring and Management Systems.

The Lough Derg and Lough Ree Monitoring and Management System with a budget of £2.3 million over three years has commenced. The Department of the Environment and Local Government has contracted for the development and implementation of similar programmes for the Suir, Boyne and Liffey river catchments. There is also a similar programme has commenced for

Lough Leane, Killarney, Co. Kerry with a budget of £0.8 million. While there are no plans to initiate any other such projects in the short term, it is hoped that over the period of the next National Development Plan, 2000 to 2006, this approach can be extended to other important river and lake catchments.

The Lough Derg Lough Ree Monitoring and Management system is operating within a two element management structure. It consists of a project steering group made up of representatives of two lead county councils, Clare and Roscommon, a representative of the Department of the Environment and Local Government, a representative of the EPA and the project co-ordinator. In conjunction with the project steering group there is an operational management group made up of representatives from: the nine county councils associated with the Lough Ree and Lough Derg catchment, the Central and Shannon Regional Fisheries Boards, Teagasc, the Department of the Environment and Local Government, Bord na Mona and the EPA. The project has established a laboratory for physico-chemical analysis in Roscommon and a GIS management system which will be distributed to the relevant bodies later this year. The results generated by the project laboratory and data generated by the various organisations involved in the project will be handled in a data management centre to be established in the near future. In addition to the water based analysis being carried out, the project incorporates three agricultural mini-catchments where nutrient loss from the rural catchment can be characterised. This work is being carried out by Teagasc under contract to the project (pers. comm. Duggan P. Project Co-ordinator).

While these projects do not have a statutory basis, they will equip the local authorities concerned with a GIS based management system in which on-going monitoring results will provide the basis for rapid response to changing circumstances. They will also facilitate the up-dating of water quality management plans as necessary. The Monitoring and Management Systems can be readily integrated into any new proposals for water quality management planning in Ireland.

5.2.5 GROUNDWATER PROTECTION SCHEMES

Groundwater protection schemes based on a scheme developed by the Geological Survey of Ireland (GSI) in the early 1980s have been used

for a number of years by a number of local authorities (Offaly, Wexford, North Cork, Galway and Louth).

In the 1990s, a revised groundwater protection scheme (as described in Section 4.1.6) has been used to prepare a number of groundwater protection scheme including those for counties Limerick, Waterford, Tipperary, Meath, Wicklow and Offaly. It should be noted that these schemes are on a county not a catchment basis. While this approach has its drawbacks, the production of these schemes on a county basis does allow for their inclusion within the planning process. The groundwater protection scheme for County Limerick is referred to in the draft Development Plan thereby linking the protection of the county's aquifers to its physical planning. Specific source protection plans have been developed by the Geological Survey of Ireland to protect individual public supply sources.

In 1998 a document entitled "A Strategy for the Protection of Groundwater" was finalised and is due for publication in mid 1999. This document prepared by the Department of the Environment and Local Government, EPA and GSI outlines the strategy for the development of groundwater protection schemes. The strategy forms a framework within which future groundwater protection schemes can be developed. To ensure consistency, it is envisaged that the same land surface zoning aspects will be applied within each local authority area. This will also facilitate groundwater protection on a catchment basis.

The level of available geological and hydrogeological information on which to base a groundwater protection scheme varies from area to area. It will not be possible to produce comprehensive groundwater protection schemes for every local authority area in the short term as adequate geological information, particularly on subsoils, is not available for a significant proportion of the country. However, interim measures as outlined in the Strategy for the Protection of Groundwater may be adopted to protect groundwater reflecting the precautionary principle for environmental protection.

5.2.6 DEVELOPMENTS IN WATER QUALITY MANAGEMENT PLANNING

The developments in the field of water quality management planning and associated systems and schemes are summarised in Table 1.

TABLE 1 SUMMARY OF SIGNIFICANT DEVELOPMENTS IN WATER QUALITY MANAGEMENT PLAN PREPARATION SINCE ORIGINAL AN FORAS FORBARTHA SYSTEM

| Plan | Significant Developments |
|--|---|
| Moy | Application of a different flow criteria in relation to EQS |
| | Assessment of physical and economic development and measures to mitigate their effects |
| Deel | Attempt to assess and deal with non point source pollution |
| | Inclusion of standard conditions applied to farming developments for the control of agricultural wastes |
| Dublin Bay | Wider scope to include wildlife conservation |
| | Proposal of management committees to implement the plan |
| Dungarvan Harbour | Assessment of management options using a computer model |
| Blackwater | Land Use Assessment |
| | Annual Status Reporting |
| | Increased farm surveying with rigorous follow up |
| Tolka | Utilisation of Geographical Information System |
| | Assessment of the resources needed to provide for the continuation of the monitoring programme and maintain the GIS |
| | Structured approach to policy setting |
| | Linking land use/development planning with water quality management planning |
| Foyle | Review of administrative and institutional structure |
| | Firm Target designation |
| | Comprehensive land use assessment |
| | Listing of Management Options |
| Erne | Broad scope including provision of a framework for catchment development |
| | Application of biological EQS |
| | Increased public consultation |
| | Phosphorus Budgeting to assess the inputs for point and diffuse sources |
| Boyne | Outline of technical resources needed to carry out farm and septic tank surveys |
| Lough Derg /Lough Ree | Introduction of a Catchment Co-ordinator |
| | Assessment of diffuse run off through subcatchment studies |
| Limerick groundwater protection Scheme | Specific groundwater protection responses indicating the acceptability of specific land uses within an area based on the relative importance of the groundwater resource and its vulnerability to contamination |

5.3 IMPLEMENTATION OF WATER QUALITY MANAGEMENT PLANS

The plans drawn up by AFF called for a review of their "general position" at regular intervals not exceeding 5 years. These reviews were to assess the efficacy of the control measures previously introduced and the refinement of the methodology of waste assimilative capacity allocation through taking account of updated information regarding existing and projected waste loads and where necessary, making modifications in the plan strategy over the following review period.

While some of the plans have been in place for a number of years it does not appear that any of these plans have been subjected to this type of review. In addition, no revised plans have been made for the waters covered by existing adopted plans. Implementation is also hampered by the time lag between preparation of draft plans and their adoption. The time periods involved between the monitoring of sites, the assessment of the data for the purposes of the plan and the time taken before its formal adoption means that a number of years pass before plans become operational. Recent draft plans that remain to be adopted include the Munster Blackwater plan, which was published in draft form in 1989 and the Tolka plan dating from 1995.

The primary means for assessing the implementation of water quality management plans is assessing changes in water quality in the areas covered by the plans. Implementation can also be assessed by determining the extent to which recommended capital expenditure projects have been carried out.

The results of a review of the implementation of capital expenditure projects are presented in Appendix F. In summary, about half of the capital expenditure projects proposed in the plans have been carried out within the set timeframe. As point source reduction was the main approach advocated in the plans, it is clear that the plans have not been implemented to the extent envisioned at the time the plans were adopted.

Reviews of water quality in Ireland indicate a continuing trend towards increasing levels of slightly and moderately polluted river channel across Ireland. The main purpose of water quality management planning is to ensure that the quality of waters covered by the plan is maintained so that existing and future beneficial uses are protected. On a national level, there has been a marked

reduction in the length of seriously polluted channel from at least 6% in 1971 (original surveys covered only 2700km and are not directly comparable with the more recent extended surveys) to 1% in 1994. However, the relative success of water quality management planning is called into question by the continuing deterioration in the quality of freshwaters (EPA, 1996). Long term trends based on some 2,900 km of river channel, which have been surveyed periodically since 1971, have shown a continuing decline in the length of unpolluted water channel from 84% in 1971 to just 57% in 1994 with the most striking trends being a five-fold increase in the extent of slight pollution and a three fold increase in moderate pollution. These trends have been found to a lesser extent within a much wider baseline of 12,700km of channel that has been surveyed since 1987. There is also evidence of a deterioration in the quality of Irish lakes (Bowman, et al, 1996).

Table 2 contains a comparison of the relative quality of water in the various water resource regions in Ireland for the period 1987-1994. It is apparent that water resource regions such as the South Eastern region and the Shannon region which have been heavily planned now have high levels of slightly to moderately polluted river channel. This strongly suggests that water quality management planning has failed to adequately protect the quality of waters covered by the plans.

TABLE 2: REVIEW OF WATER QUALITY CHANGES IN WATER RESOURCE REGIONS BETWEEN 1987 AND 1994

| Region | Survey Period | Length Surveyed (Km) | Unpolluted | Slightly Polluted | Moderately Polluted | Seriously Polluted |
|--------------------------|---------------|----------------------|---------------|-------------------|---------------------|--------------------|
| Eastern Region | 87-90 | 1316.5 | 61 | 19.5 | 15.5 | 4 |
| Eastern Region | 91-94 | 1392 | 45.5 | 27.7 | 24.5 | 2.3 |
| <i>Percentage Change</i> | | | -15.5% | +8.2% | +9.0% | -1.7% |
| South Eastern Region | 87-90 | 2495.5 | 68% | 17.5% | 13.5% | 1% |
| South Eastern Region | 91-94 | 2546.5 | 64.7% | 22% | 12.8% | 0.4% |
| <i>Percentage Change</i> | | | -3.3% | +4.5% | -0.7% | -0.6% |
| Southern Region | 87-90 | 2088 | 87 | 9 | 3.5 | <0.1 |
| Southern Region | 91-94 | 2219.5 | 86.9 | 8.9 | 4.2 | 0.0 |
| <i>Percentage Change</i> | | | -0.1% | -0.1% | +0.7% | 0% |
| Mid Western Region | 87-90 | 987 | 65 | 18 | 16 | 1 |
| Mid Western Region | 91-94 | 1092 | 65 | 16 | 18.2 | 0.8 |
| <i>Percentage Change</i> | | | 0% | -2.0% | +2.2% | -0.2% |
| Shannon Region | 87-90 | 2080.5 | 83% | 7% | 9% | 1% |
| Shannon Region | 91-94 | 2228 | 67.1 | 21.8% | 10.5% | 0.6% |
| <i>Percentage Change</i> | | | -15.9% | +14.8% | +1.5% | -0.4% |
| Western Region | 87-90 | 1778 | 87 | 9 | 4 | 0.3 |
| Western Region | 91-94 | 1791 | 79.8 | 13.7 | 6.4 | 0.2 |
| <i>Percentage Change</i> | | | -7.2% | +4.7% | +2.4% | -0.1% |
| North Western Region 1* | 87-90 | 538.5 | 46.5 | 22 | 31.5 | - |
| North Western Region 1 | 91-94 | 552 | 56 | 22.6 | 21.5 | 0.0 |
| <i>Percentage Change</i> | | | +9.5% | +0.6% | -10% | 0% |
| North Western Region 2 | 87-90 | 1406 | 94 | 3 | 2.5 | 0.5 |
| North Western Region 2 | 91-94 | 1376 | 90.4 | 3.5 | 5.6 | 0.5 |
| <i>Percentage Change</i> | | | -3.6% | +0.5% | +3.1% | 0% |

*North Western region 1 (Cavan- Monaghan)

North Western region 2 (Donegal Sligo)

The reduction of seriously polluted channel is an indication of the partial success of implementation of the capital expenditure projects recommended by the plans. However, based on these assessments, it is clear that the scope of the adopted plans is not wide enough to ensure the maintenance of water quality within the catchment. Future plans will have to address diffuse sources of pollution if they are to have the desired effect: that is to ensure that the quality of waters covered by the plan is maintained so that existing and future uses are protected. There is also need for full implementation of point source abatement recommendations.

There is a need to progress from reliance on static Water Quality Management Plans to the development of dynamic Water Quality

Management and Monitoring Systems. While there is a statutory obligation on local authorities to adopt Water Quality Management Plans it is necessary to back these up with GIS based management and monitoring systems which can provide management with a continuous flow of monitoring information and the technology to analyse this information. This will facilitate assessment of progress in implementation of plans and revision of the plans in response to changed circumstances.



6. CONCLUSIONS AND RECOMMENDATIONS FOR A FRAMEWORK FOR FUTURE WATER QUALITY MANAGEMENT PLANNING IN IRELAND

6.1 CONCLUSIONS

Review of the available information gives rise to the following conclusions:

- The scope of the early plans was not sufficiently broad to protect surface waters from diffuse pollution.
- Groundwaters are not sufficiently protected by existing plans
- Implementation of the plans has not been consistent.
- There has been no systematic review of plans as envisaged in the legislation and in the plans themselves.
- A number of plans have been prepared but have not been adopted. There has also been a significant lag period between the preparation of a plan and its formal adoption.
- Given the continuing deterioration in the quality of freshwaters in Ireland, water quality management planning has not adequately protected the quality of waters covered by the plans.
- The requirements of the proposed Directive establishing a framework for Community action in the field of water policy will require the revision or creation of water quality management plans.
- Catchment Management and Monitoring Systems provide a basis for progressing from reliance on static plans to providing a dynamic support base for the implementation and review of such plans. They are management oriented and, through the GIS based monitoring system, facilitate more intensive assessment of pollution inputs from agricultural operations and development of Nutrient Management Planning. They do not however, have any statutory status and local authorities when carrying out associated statutory functions such as the preparation of waste management plans or the licensing of discharges are not required to have regard them.

6.2 RECOMMENDATIONS

Recommendations to make water quality management planning more effective are:

- An updated methodology for the preparation of plans should be developed. The method should include the information tools and format to be followed in the presentation of plans. This method must take account of changes in the legislative/institutional framework and technical advances in water quality management planning practice.
- At a national level, water quality management planning should be carried out within the framework of river basin management planning. To facilitate information flow, the assessment of water quality will need to make use of the water quality classification system created by the draft EU Water Framework Directive.
- Preparation of new or revised plans should adopt an environmental management systems approach. Particular attention should be paid to the mechanism for assessing progress in attaining the objectives of a plan. Measures adopted to tackle specific problems should be audited as to their efficacy so that where necessary additional action can be taken to ensure that the plan reaches its objectives.
- Updated plans should have a broader scope incorporating groundwaters and surface waters in the catchment.
- Physical development and water quality management planning should be carried out in such a way that common issues are dealt with in an integrated manner.
- Catchment Monitoring and Management Systems being developed should be used as a basis for the updating of statutory water quality management plans.



7. REFERENCES AND FURTHER READING LIST

An Foras Forbartha (1980) *The Shannon Estuary, a Model for Water Quality Management. Volume 2. Main Report.* An Foras Forbartha, Dublin.

An Foras Forbartha (1981) *Draft Water Quality Management Plan for the River Barrow Catchment Volume 1. Main Report.* An Foras Forbartha, Dublin.

An Foras Forbartha (1981) *Draft Water Quality Management Plan for the River Suir Catchment, Volumes 1, 2, 3 and 4.* An Foras Forbartha, Dublin.

An Foras Forbartha (1984) *Draft Water Quality Management Plan for the County Cavan Volume 1, Main Report.*, An Foras Forbartha, Dublin.

Cavan County Council (1996), *The River Erne Catchment, Proposals for a water quality management strategy, Volume 1, Summary.* An Foras Forbartha, Dublin.

Cork County Council(1989) *Draft water quality management plan for the River Blackwater Catchment.* An Foras Forbartha, Dublin.

DeMers Michael N. (1997) *Fundamentals of Geographical Information Systems.* John Wiley and Sons, Inc. New York.

Department of the Environment and Local Government, Department of the Marine and Natural Resources, and Department of Arts, Heritage, Gaeltacht and the islands (1997), *Coastal Zone Management, A Draft policy for Ireland, Discussion Document.*

Department of the Environment Northern Ireland and Department of the Environment and Local Government, (1995) *Proposals for a Water Quality Strategy for the Foyle Catchment and Lough Foyle.*

Department of the Environment and Local Government(1997) *Sustainable Development, A Strategy for Ireland.*

Department of the Environment and Local Government (1997) *Managing Ireland's Rivers and Lakes - A Catchment based Strategy Against Eutrophication.*

Dublin Corporation, Dublin County Council, Kildare County Council, Wicklow County Council, Meath County Council(1992) *Water Quality Management Plan for the Liffey Catchment.*

Environmental Protection Agency Act, 1992 (No.7 of 1992)

European Environment Agency (1998) *Environmental Risk Assessment Approaches, Experience and Information Sources, Environmental Issues Series No. 4.*

EPA (1996), *State of the Environment Report.*

EPA (1996), *Water quality in Ireland 1991-1994.*

EPA (1997) *Environmental Quality Objects and Environmental Quality Standards, The Aquatic Environment, A Discussion Document.*

EPA (1998) *Environmental Research Programme, a summary of work in progress.*

Foody Giles M. and Curran Paul (1994) *Environmental Remote Sensing From Regional to Global Scales.* John Wiley and Sons, Inc. New York.

- Heathcote Isobel W., (1998) *Integrated Watershed Management*.
- Hickey D. (1997) *Evaluation of Environmental Designations in Ireland*, The Heritage Council.
- Laois County Council, Offaly County Council, Kildare County Council, Carlow County Council, Kilkenny County Council, Wicklow County Council, Wexford County Council (1985) *Water Quality Management Plan for the Barrow Catchment*.
- Limerick County Council (1990) *Water Quality Management Plan for the River Deel*.
- McCumiskey L.M.(1982) *Water Quality Management Plans What is required*, *Irish Journal of Environmental Science*, Vol.1 No. 2.
- McCumiskey L.M. Environmental Research Unit (1991) *Water in Ireland, A Review of Water Resources, Water Supplies and Sewerage Services*.
- Meath County Council (1997) *River Boyne Water Quality Management Plan, The Plan*.
- Mitchell Bruce (1990) *Integrated Water Management* Belhaven Press, London and New York.
- Midland Regional Development Organisation (1986) *Draft Water Quality Management Plan for the Upper Shannon Catchment Volume 5 Water Quality*.
- Stapleton L. (1993), *Water Quality Management Plans in Proc. of Inland Waters of Ireland Conf, Royal Dublin Society Seminar Proceedings, No. 5 (Ed. Mollan C.)*.
- Technical Committee on Effluent and Water Quality Standards (1978), *Memorandum No. 1, Water Quality Guidelines*.
- Tipperary (NR) County Council, Tipperary (SR) County Council, Kilkenny County Council, Waterford County Council, Waterford Corporation (1983) *Water Quality Management Plan for the Suir Catchment*.
- Toner P.F. (1991), *Irish Rivers, Biology and Management*, Royal Irish Academy. (Ed. Steer M.).
- United Nations Environmental Programme, Water Supply and Sanitation Collaborative Council and World Health Organisation (1997) *Water Pollution Control*.
- Waste Management Act, 1996 (No.10 of 1996).
- Waterford County Council (1994) *Dungarvan Harbour Draft Water Quality Management Plan, Executive Summary*.

8. USER COMMENT FORM

NOTE: Completed comments to be forwarded to:

The Environmental Management and Planning Division, Environmental Protection Agency, PO Box 3000,
Johnstown Castle Estate, Co. Wexford.

Document Title: **Water Quality Management Planning in Ireland**

CONTENTS:

STYLE:

INFORMATION:

SUGGESTIONS:

NAME.....

ORGANISATION.....

ADDRESS.....

.....

DATE

PHONE

FAX.....



APPENDIX A

QUALITY STANDARDS FOR RIVERS AND LAKES PRESCRIBED BY THE LOCAL GOVERNMENT (WATER POLLUTION) ACT, 1977 (WATER QUALITY STANDARDS FOR PHOSPHORUS) REGULATIONS, 1998 (S.I. 258 OF 1998)

**THIRD SCHEDULE TO
LOCAL GOVERNMENT (WATER POLLUTION) ACT, 1977 (WATER QUALITY STANDARDS
FOR PHOSPHORUS) REGULATIONS, 1998
PART I
QUALITY STANDARDS FOR RIVERS**

| Column 1 | Column 2 | Column 3 |
|--|--|---|
| Existing Biological Quality (Q) Rating/Q Index | Minimum Target Biological Quality (Q) Rating/Q Index | Molybdate-Reactive Phosphate Median Concentration* (ug P/L) |
| Unpolluted | | |
| 5 | 5 | 15 |
| 4-5 | 4 - 5 | 20 |
| 4 | 4 | 30 |
| Slightly Polluted | | |
| 3-4 | 4 | 30 |
| Moderately Polluted | | |
| 3 | 3 - 4 | 50 |
| 2-3 | 3 | 70 |
| Seriously Polluted | | |
| ≤ 2 | 3 | 70 |

*Median concentration to be determined using as a minimum ten samples taken at intervals of four weeks or longer in any twelve consecutive month period. Where the requisite number of samples has not been taken within such period, the median concentration shall be determined from sampling conducted over such period, being a period not exceeding twenty four months, as required to obtain a minimum of fifteen samples taken at intervals of four weeks or longer.

**THIRD SCHEDULE TO
LOCAL GOVERNMENT (WATER POLLUTION) ACT, 1977 (WATER QUALITY STANDARDS
FOR PHOSPHORUS) REGULATIONS, 1998
PART II
QUALITY STANDARDS FOR LAKES**

| Column 1 | Column 2 | Column 3 |
|-------------------------|-------------------------------|--|
| Existing Trophic Status | Minimum Target Trophic Status | Total Phosphorus Average Concentration* (ug P/L) |
| Satisfactory | Ultra-Oligotrophic | ≤ 5 |
| Ultra-Oligotrophic | | |
| Oligotrophic | Oligotrophic | $>5 \leq 10$ |
| Mesotrophic | Mesotrophic | $>10 \leq 20$ |
| Unsatisfactory | Mesotrophic | $>10 \leq 20$ |
| Eutrophic | | |
| Hypertrophic | Eutrophic | $>20 \leq 50$ |

*average concentration to be determined using as a minimum ten samples taken at intervals of four weeks or longer in any twelve consecutive month period. Where the requisite number of samples has not been taken within such period, the average concentration shall be determined from sampling conducted over such period being a period not exceeding twenty four months, as required to obtain a minimum of fifteen samples taken at intervals of four weeks or longer.

APPENDIX B

RELEVANT EUROPEAN LEGISLATION AND ASSOCIATED IRISH REGULATIONS

USE RELATED STANDARDS**Council Directive 76/160/EEC of 8 December 1975 concerning the quality of bathing water.****[O.J., L 31, 5 February 1976]**

Regulations in relation to the directive were originally made in 1988. These were replaced by the European Communities (Quality of Bathing Waters) Regulations, 1992 (S.I. No.155 of 1992). The 1992 regulations prescribe bathing EQSs and the bathing areas to which they apply, together with the sampling programmes, arrangements for the display of results and the methods of analysis and inspection to be used by local authorities to determine compliance with the standard in relation to 94 bathing areas. European Communities (Quality of Bathing Waters) (Amendment) Regulations, 1994 (S.I. No. 145 of 1994) added 22 bathing areas to the 94 bathing areas listed in the First Schedule of the 1992 regulations. European Communities (Quality of Bathing Waters) (Amendment) Regulations, 1996 again added another 8 bathing areas, bringing the total number of bathing areas covered by the Regulations to 124. Another change brought on by the 1996 regulations was that local authorities are now required to submit results of their bathing water sampling programmes to the Environmental Protection Agency instead of to the Minister, in such manner as directed by the Agency. The Quality of Bathing Waters (Amendment) Regulations, 1998 further amended the list of bathing waters with a total of 130 areas being listed.

Council Directive 79/923/EEC of 30 October 1979 on the quality required by shellfish waters.**[O.J., L 281, 10 November 1979]**

The Directive was implemented in Ireland through the European Communities (Quality of Shellfish Waters) Regulations, 1994 (S.I. No.200 of 1994). These regulations prescribe quality standards for shellfish waters and designate the waters to which they apply, together with sampling and analysis procedures to be used to determine compliance with the standards.

Council Directive 78/659/EEC of 18 July 1978 on the quality of freshwater needing protection in order to support fish life.**[O.J., L 221, 14 August 1978]**

The Freshwater Fish Directive was implemented in Ireland through European Communities (Quality of Salmonid Waters) Regulation, 1988 (S.I. No. 293 of 1988). This directive is, in practical terms, the most important of all directives in relation to water quality management planning in that its quality requirements together with the sampling programmes and the methods of analysis and inspection have been applied widely in water quality management planning. This is due to the fact that if the EQS for Salmonid water are maintained/achieved, the water will be of sufficient quality to serve most other beneficial uses including use as a source of raw water for public supply.

Council Directive 75/440/EEC of 16 June 1975 concerning the quality of surface water intended for the abstraction of drinking water in the Member States.**[O.J., L 194, 25 July 1975]****Council Directive 79/869/EEC of 9 October 1979 concerning the methods of measurement and frequencies of sampling and analysis of surface water intended for the abstraction of drinking water in the Member States.****[O.J., L 271, 29 October 1979]**

The Surface Water Directive and Methods of Analysis and Frequency of Sampling Directive were implemented in Ireland through the European Communities (Quality of Surface Water intended for the Abstraction of Drinking Water) Regulations, 1989 (S.I. No. 294 of 1989). The regulations categorise surface waters from which water for public supply will be taken as A1, A2 or A3, depending on quality standards for 39 parameters. Depending on its categorisation the water is designated as requiring a specified degree of treatment before use as drinking water. These regulations also prescribe quality standards and methods and frequencies of analysis for surface fresh water used or intended for use in the abstraction of drinking water.

POLLUTION CONTROL STANDARDS**Council Directive 76/464/EEC of 4 May 1976 on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community.**

[O.J., L 129, 18 May 1976]

EC Dangerous Substances Directive was a framework directive. Its scope included inland surface waters, territorial waters, internal coastal waters and groundwater. The directive required the elimination of pollution of these waters by dangerous substances and their families listed in Annex I of the directive and the reduction of pollution by the dangerous substances and their families listed in the Annex II of the directive. The specific chemicals to which the directive refers have been set down in a number of daughter directives. These daughter directives were implemented in Ireland through a series of Regulations listed below:-

| Regulations under Local Government (Water Pollution) Act, 1977 and 1990 | Statutory Instrument No. | Daughter Directive |
|--|---------------------------------|---------------------------|
| (Control of Cadmium Discharges), Regulations, 1986 | (S.I. No. 294 of 1985) | 83/513/EEC |
| (Control of HCH and Mercury Discharges), Regulations, 1986 | (S.I. No. 55 of 1986) | 84/491/EEC and 84/156/EEC |
| (Control of Aldrin, Dieldrin, Endrin, Isodrin, HCB, HCBd and CHCL ₃ Discharges) Regulations, 1993 | (S.I. No. 348 of 1993) | 86/280/EEC |
| (Control of Carbon Tetrachloride, DDT and Pentachlorophenol Discharges) Regulations 1994 | (S.I. No. 43 of 1994) | 88/280/EEC |
| (Control of EDC, TRI, PER and TCB Discharges) Regulations, 1994 | (S.I. No. 245 of 1994) | 90/415/EEC |

In addition to the daughter directives there was also “**A Communication from the Commission to the council on Dangerous substances which might be included in List I of Council Directive 76/464/EEC [O.J. C176 14 July 1982].**” This contained a list of 129 substances which are for the purposes of regulation considered as List II substances in relation to the dangerous substances directive. The directive was supplanted in relation to groundwaters by the groundwater directive (Council Directive 80/68/EEC).

Council Directive 80/68/EEC of 17 December 1979 on the protection of ground water against pollution caused by certain dangerous substances.

[O.J., L 20, 26 January 1980]

The Groundwater Directive was implemented in Ireland by Part V of the Local Government (Water Pollution) Regulations, 1992 (S.I. No. 271 of 1992). Similar to the Dangerous Substances Directive the member states were to prevent the discharges of list I materials and limit the emission of list II materials. The groundwater directive relates directly to the classes of chemicals listed in its annexes unlike the dangerous substances directive which relates specifically to the substances listed in its daughter directives.

Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources.

[O.J., L 375, 31 December 1991]

The Nitrates Directive concerns actions to protect waters against pollution caused by nitrates from diffuse agricultural sources. A code of Good Agricultural Practice has been drawn up in partial fulfilment of the

requirements of the directive. The member states are also charged with the designation of vulnerable zones. Action programmes to manage these zones were required together with monitoring programmes to assess the action programme's effectiveness.

Council Directive 91/271/EEC of 21 May 1991 concerning urban wastewater treatment, [O.J., L135, 30 May 1991]

The directive was implemented by the Environmental Protection Agency Act, 1992 (Urban Waste Water Treatment) Regulations, 1994 (S.I. No.419 of 1994). These regulations prescribe requirements in relation to the provision of collecting systems and treatment standards and other requirements for urban waste water treatment plants, generally and in sensitive areas. The regulations identify 10 water bodies as sensitive areas. They also provide for monitoring procedures in relation to treatment plants and make provision for pre-treatment requirements in relation to industrial waste water entering collecting systems and urban waste water treatment plants. The Directive specifically refers to actions to be taken with regard to excessive levels of nutrients in fresh waters with regard to both eutrophication and drinking water abstraction. The directive lays down limits on nutrients associated with WWT works dealing with population equivalent of over 10,000 which must be met by 31 December 1998, where discharges are made to identified sensitive areas. Appropriate industrial sectors are also included in the terms of the directive.

Council Directive (96/91/EC) of 24 September 1996 concerning integrated pollution prevention and control [O.J. L257, 10 October 1996]

The Integrated Pollution Prevention and Control directive has yet to be implemented in Irish Law. However, its main provisions are covered by Part IV of the EPA Act, 1992. The purpose of the directive is to set up an integrated licensing system for different categories of industries which covers the totality of the emissions from the industry.

ENVIRONMENTAL ASSESSMENT

Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment.

The EIA Directive was implemented by the European Communities (Environmental Impact Assessment) Regulations, 1989 (S.I. No.349 of 1989) with some amendment through the European Communities (Environmental Impact Assessment)(Amendment) Regulations, 1994 (S.I. 84 of 1994) and European Communities (Environmental Impact Assessment) (Amendment) Regulations, 1998 (S.I. 351 of 1998). The directive requires the assessment of the effects of certain projects on the environment and the reporting of the assessment in a Environmental Impact Statement. The statement must include a description of the development and existing environment, a review of the likely impacts of the development, measures to mitigate these impacts and a non technical summary.

ECOSYSTEM PROTECTION STANDARDS

Council Directive (92/43/EEC) of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora

The Habitats Directive was implemented by the European Communities (Natural Habitats) Regulations, 1997 (S.I. No.94 of 1997). Each member state must identify the habitat types and species on a European Community level that require conservation through designation of special areas of conservation (SACs). Areas designated as SACs are protected from unnecessary development. Each Member state must set up a network of SACs and if necessary create action programmes to maintain them.

Council Directive (79/409/EEC) on the conservation of Wild Birds

The directive was implemented by the Conservation of Wild Birds Regulations (S.I. 291 of 1985). The directive requires each member state to designate Special Protection Areas (SPAs) to protect those birds species which require habitat conservation.

APPENDIX C

**AN FORAS FORBARTHA METHODOLOGY AND FORMAT FOR
PREPARATION OF WATER QUALITY MANAGEMENT PLANS**

Water quality management plans in Ireland have predominantly been prepared using a methodology formulated by An Foras Forbartha (McCumiskey 1981). A diagrammatic representation of the system is shown in Figure 5. The method was based on the concept of EQO/EQS with reference to a number of sources most notably European use related water quality directives and Memorandum No.1, Water Quality Guidelines published by the Department of the Environment.

The overall objective of the plan would be to ensure a future acceptable quality of water for specific uses at the time and place where it was needed. To achieve this objective the plan would have to ensure the quality of the catchment's waters were maintained in a satisfactory condition and where necessary improved, thereby safeguarding public health and catering for water abstraction, fisheries maintenance and relevant water based amenities and recreational requirements.

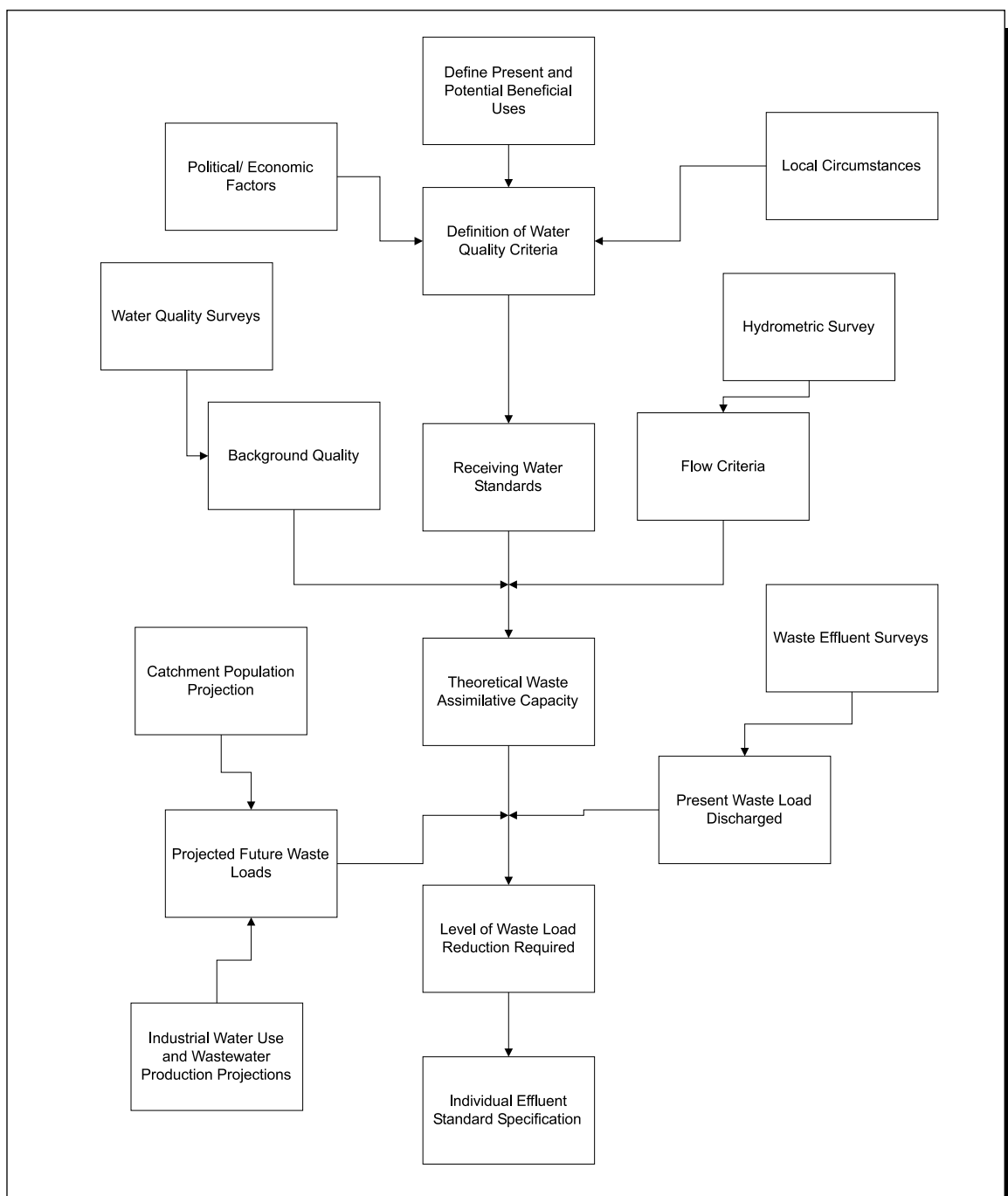


FIGURE 5 MECHANICS OF A CONVENTIONAL WATER QUALITY MANAGEMENT PLAN

The coverage of the plan, in the case of a catchment, would consist of the main river channel and all significant tributaries. Smaller streams would be omitted on practical grounds; however consultation with fisheries authorities was recommended before omitting them in case they constituted spawning grounds for salmonids. A fourteen step procedure was proposed for preparing a water quality management plan. These steps are contained in the Table 3.

TABLE 3 PROCEDURE FOR THE PREPARATION OF WATER QUALITY MANAGEMENT PLANS

- | | |
|-------|--|
| I. | Identify existing and future beneficial water uses to be protected. |
| II. | Compile all available data on water quality and water resources within the catchment. |
| III. | Examine the data in (ii) above and determine the characteristic elements which mainly determine water quality at selected control sections along the main river channel and its tributaries. |
| IV. | Select the receiving water standards deemed necessary to support the various beneficial uses. In doing this reference should be made to data and information from various international sources including the EPA (US), EEC directives and Memorandum No.1 and the general water quality conditions pertaining in the catchment. |
| V. | Compute estimates of the Waste Assimilative Capacity (WAC) of the river and tributaries at key locations. |
| VI. | Compute population projections for the catchment (20 years). |
| VII. | Compute estimates of the existing generated waste water loads |
| VIII. | Compute projections of the generated waste water loads for the period covered by the plan. |
| IX. | Identify all existing and future abstractions. |
| X. | Estimate the water quality conditions likely to arise at key locations in the catchment as a result of existing and projected waste water loads. Identify level of waste load reduction required. |
| XI. | Review all possible options in relation to the treatment of existing and projected waste loads prior to discharge and determine the reserve capacity of the river at the selected key locations in relating to these options. |
| XII. | Select the appropriate treatment options for existing waste discharges (public and private) so that the receiving water standards can be met and a suitable reserve capacity for future developments maintained. |
| XIII. | Determine the main priorities for capital investment in both public and private waste water treatment facilities. |
| XIV. | Outline the general procedures that should be adopted for the laying down of effluent emission standards for future waste water discharges. |

A possible procedure for effluent emission standard was proposed which meant that before any licence was issued the proposed discharge was assessed in relation to the available waste assimilative capacity. A diagrammatic representation of the procedure is given in Figure 6.

Water Quality Criteria and Water Quality Standards were defined as EQO and EQS are defined today. Specific recommendations were made in relation to five parameters. The parameters apply at 95%ile flow although the 99.9%ile value for dissolved oxygen was usually applicable for all flows. The recommendations are contained in Table 4.

TABLE 4 EQS PROPOSED BY AN FORAS FORBARTHA FOR FRESHWATER REACHES OF CATCHMENTS

| | |
|---------------------------|--|
| Dissolved Oxygen | >40% saturation for 99.9% of time values (=4 mg ^l ⁻¹) >60% saturation for 95% of time values (=6 mg ^l ⁻¹) >80% saturation for 50% of time values (=9 mg ^l ⁻¹) |
| Biochemical Oxygen Demand | 95 percentile value of 5 mg ^l ⁻¹ 50 percentile value of 3 mg ^l ⁻¹ |
| Ammonia | 95 percentile value of 0.02 mg ^l ⁻¹ N for un-ionised ammonia 95 percentile value of 0.5 mg ^l ⁻¹ N for total ammonia |
| Oxidised Nitrogen | 95 percentile value of 11 mg ^l ⁻¹ N |
| Orthophosphate | 95 percentile value of 0.2 mg ^l ⁻¹ P 50 percentile value of 0.1 mg ^l ⁻¹ P |

Source: McCumiskey 1981

The underlying philosophy of the EQO/EQS concept is that a waterbody has the potential to process pollutants up to some defined limit without causing harm to the environment or significant degradation of water quality. Waste Assimilative Capacity (WAC) was defined based solely on the available BOD capacity at a certain point based on the background concentration at ninety five percentile flow. The WAC was defined as:-

$$WAC = (C_{max} - C_{back}) * 95\%ile\ flow * 86.4kg\ BOD/day$$

C_{max} = Maximum permitted concentration (4mg^l⁻¹)

C_{back} = Background or upstream BOD

95%ile flow = Flow equalled or exceeded 95 % of the time

(86.4 is a correction factor for the different units and converts the load to a daily value)

In relation to estuaries, McCumiskeys paper recommends a continually updated computer model of the estuary to deal with the added uncertainties within the flow patterns of an estuary.

The problems identified in the paper relate predominantly to the requirements of the biota using the system and the lack of holistic information on the existing situation. The proposed solution of these problems was a continuing course of research including a minimum frequency of sampling at key stations of approximately 25 times a year with shorter diurnal surveys to assess the dissolved oxygen regime in important reaches. Additional research was also proposed in relation to levels of toxic contamination of waters and modelling of the river system.

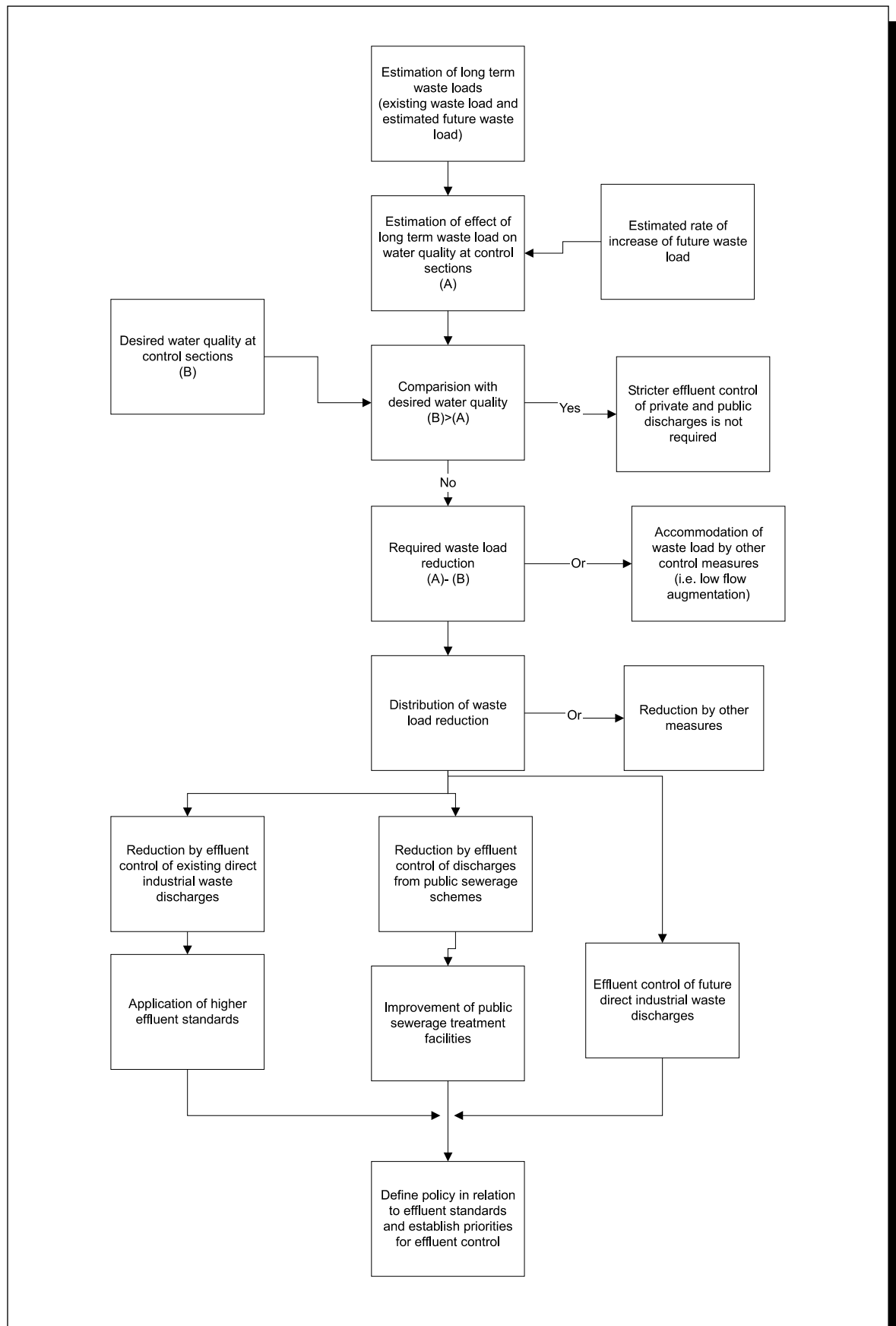


FIGURE 6: METHOD PROPOSED BY AN FORAS FORBARTHA FOR THE SETTING OF EMISSION STANDARDS FOR POINT SOURCES WITHIN A PLANNED CATCHMENT

The formulation of plans prepared by AFF was carried out in a defined manner. Data and information was collected, collated and analysed to produce a draft document in five volumes entitled

| | |
|-------------|---|
| Volume I: | Main Report; |
| Volume II: | Summary of Water Resources; |
| Volume III: | Abstraction and Discharges; |
| Volume IV: | Beneficial Uses and Water Quality Criteria; |
| Volume V: | Water Quality in the Catchment. |

Volume I was a summary of the information contained in Volume II through V together with a draft water quality management plan. The draft plan consisted inter alia, of the formal listing of the EQSs to be adopted, identification of reaches requiring improvement, the formulation of an action plan including the prioritisation of capital expenditure projects and a programme for further action which detailed the additional research required to complement the data utilised in the production of the plan. The draft plan becomes a plan when adopted by the relevant local authority or authorities, as the case may be, with the making, revision or replacing of plans being a reserved function.

Volume II contained data on precipitation, hydrometric data and hydrological data. A description of the catchment including the geology and hydrogeology. The resource was assessed as average flow, low flow and 95 percentile flow. It also included a programme of further investigation of the hydrological aspects of the catchment.

Volume III drew on the information collected from detailed surveys of abstractions and discharges over 5m³ per day. The listing detailed sewerage and industrial plants with best estimates of the levels of emissions and abstractions based on either meter readings or engineering estimates based on population served and infiltration rate. The surveys dealt with both surface and groundwater and were well organised. The listing of effluent discharges was dealt with in more detail than the abstractions.

Volume IV was the assessment of the beneficial uses and selection of water quality criteria was carried out under the classification of abstractions, fisheries and other uses. In relation to the assessment of beneficial uses, the assessment of fisheries was the most developed and included a financial evaluation of the fisheries and detailed the major fishing locations and spawning areas in the freshwater reaches. The standards were derived from these criteria and were required, with the exception of the minimum limit for dissolved oxygen and the limits for potentially toxic substances, to be met at flows equal to or greater than the 95 percentile flow. The latter limits were required to be met at all flows, including the dry weather flow.

Volume V contained an explanation of the assessment schemes in use for determining water quality and presented the results of biological and physico-chemical surveys. The survey information was based on the national monitoring programme of the time and in some cases the biological monitoring was a number of years old at the time of assessment for the water quality management plan.



APPENDIX D

LIST OF WATER QUALITY MANAGEMENT PLANS, STRATEGIES AND CATCHMENT MANAGEMENT SYSTEMS

ADOPTED WATER QUALITY MANAGEMENT PLANS

| River/Estuary | Local Authorities | Adoption Date | Preparator |
|----------------------------|---|----------------------|---|
| Bantry Bay | Cork County Council | Oct. 1989 | |
| Barrow | Carlow County Council Kildare County Council Kilkenny County Council Laois County Council Offaly County Council Wexford County Council Wicklow County Council | April 1988 | AFF |
| Barrow, Nore, Suir Estuary | Carlow County Council Kilkenny County Council Tipperary SR County Council Wexford County Council Waterford County Council | June 1992 | AFF |
| Deel | Limerick County Council | July 1990 | Limerick County Council |
| Dublin Bay | Dublin Corporation Dublin County Council Dun Laoghaire Corporation | Dec. 1993 | Environmental Research Unit |
| Dungarvan Harbour | Waterford County Council Dungarvan Urban District Council | Dec. 1994 | Waterford County Council E.G. Pettitts Engineers |
| Moy | Mayo County Council Sligo County Council | Oct. 1987 | County Councils |
| Nore | Carlow County Council Kilkenny County Council Tipperary NR & SR County Councils | Oct. 1987 | AFF |
| Shannon Estuary | Clare County Council Kerry County Council Limerick County Council | June 1988 | AFF |
| Cavan County | Cavan County Council | Dec. 1988 | AFF |
| Shannon (Lower) | Tipperary NR County Council Limerick Corporation Limerick County Council Clare County Council Galway County Council | Oct. 1992 | AFF |

| River/Estuary | Local Authorities | Adoption Date | Preparator |
|------------------------------|--|----------------------|-------------------|
| Shannon (Upper) | Galway County Council Leitrim County Council Longford County Council Offaly County Council Roscommon County Council Tipperary NR County Council Westmeath County Council | Oct. 1991 | AFF |
| Slaney including the estuary | Carlow County Council Wexford County Council Wicklow County Council | June 1988 | AFF |
| Suir | Kilkenny County Council Waterford County Council Waterford Corporation Tipperary NR County Council Tipperary SR County Council | Sept. 1984 | AFF |
| Liffey | Dublin Corporation, Fingal County Council, South Dublin County Council, Kildare County Council, Meath County Council, Wicklow County Council | 1997 | AFF/ERU |

DRAFT PLANS/STRATEGIES WHICH HAVE NOT BEEN ADOPTED

| Catchment | Draft Publication Date | Preparator |
|---|-------------------------------|--|
| Blackwater (Cork) Water Quality Management Plan | Feb. 1989 | Cork County Council |
| Boyne Water Quality Management Plan | Nov. 1997 | Meath County Council/ M.C. O'Sullivan & Co. |
| Erne Water Quality Catchment Management Strategy | Dec. 1996 | Department of the Environment and Local Government and Department of the Environment for Northern Ireland, |
| Foyle Water Quality Catchment Management Strategy | Oct. 1995 | Department of the Environment and Local Government and, Department of the Environment for Northern Ireland |
| Tolka (Dublin) Water Quality Management Plan | Mar. 1995 | Dublin Corporation/ M.C. O'Sullivan & Co. |

CATCHMENT MANAGEMENT SYSTEMS COMMENCING OPERATION

| Catchment | Commenced | County Councils |
|--------------------------|------------------|--|
| Boyne | 1998 | Meath County Council Cavan County Council Kildare County Council Louth County Council Offaly County Council Westmeath County Council Drogheda Corporation |
| Liffey | 1998 | Kildare County Council Fingal County Council South Dublin County Council Dublin Corporation Wicklow County Council Meath County Council |
| Lough Derg and Lough Ree | 1997 | Galway County Council Leitrim County Council Longford County Council Offaly County Council Roscommon County Council Tipperary NR County Council Westmeath County Council Cavan County Council Clare County Council |
| Lough Leane | 1998 | Kerry County Council |
| Suir | 1998 | Tipperary (NR) County Council Tipperary (SR) County Council Kilkenny County Council Waterford County Council Waterford Corporation Limerick County Council Cork County Council |



APPENDIX E

SUMMARY OF ENVIRONMENTAL QUALITY STANDARDS CONTAINED IN REVIEWED WATER QUALITY MANAGEMENT PLANS

| SUMMARY OF ENVIRONMENT QUALITY STANDARDS CONTAINED IN REVIEWED WATER QUALITY MANAGEMENT PLANS, DRAFT PLANS AND STRATEGIES | | | | | | | | | | | | | | |
|---|--------|------|-------|-------|--------------|-----------------|-----------------|---------------------|--------|-------|-------|------------|--------------------|------|
| | Barrow | Deel | Moy* | Nore | Cavan County | Shannon (Lower) | Shannon (Upper) | Slaney inc. estuary | Liffey | Suir | Boyne | Blackwater | Foyle ^s | Erne |
| Adopted | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | No | Yes | No | No | No | No |
| Catchment Area (km ²) | 3,068 | 480 | 2,084 | 2,461 | 1,930 | 2943 | 8,900 | 1,860 | 1,122 | 3,484 | 2,694 | 3,327 | 925 | 2200 |
| Percentage of Republic's land | 4.4% | 0.7% | 3.0% | 3.5% | 2.7% | 4.2% | 12.7% | 2.6% | 1.6% | 5.0% | 3.8% | 4.7% | 1.3% | 3.1% |
| 99.9%ile DO limit | 4 | 4 | | 4 | 4(2)** | 4 | 4 | 4 | 4 | 4 | - | 4 | | |
| 95 %ile DO limit | 6 | 6 | 6 | 6 | 5(3) | 6 | 6 | 6 | 6 | 6 | - | 6 | | |
| 50 %ile DO limit | 9 | 9 | 9 | 9 | 8(6) | 9 | 9 | 9 | 9 | 9 | - | 9 | | |
| 95 %ile BOD Limit | 5 | 4 | 4 | 5 | 5(6) | 5 | 5 | 4 | 5 | 5 | - | 3 | | |
| 50 %ile BOD Limit | 3 | 2.5 | | 3 | 3(4) | 3 | 3 | 2.5 | 3 | 3 | - | - | | |
| 95%ile of unionised ammonia limit | 0.02 | 0.02 | 0.02 | 0.02 | - | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | - | 0.02 | | |
| 95%ile of total ammonia limit | 0.5 | 0.5 | | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | - | - | | |
| 50%ile of total ammonia limit | - | - | - | - | 0.2 | 0.2 | 0.2 | - | 0.2 | - | - | - | | |
| 99.9%ile Oxidised N limit | - | - | - | - | 11 | 11 | 11 | - | 11 | - | - | 23 | | |
| 95%ile Oxidised N limit | 11 | 11 | 11 | 11 | 5 | 5 | 5 | - | 5 | - | - | 11 | | |
| 50%ile Oxidised N limit | - | - | - | 3 | 3 | 3 | - | 3 | - | - | - | - | | |
| 95%ile Ortho P limit | 0.2 | 0.25 | 0.25 | 0.2 | 0.1 | 0.1 | 0.15 | 0.2 | 0.10 | 0.2 | - | 0.2 | | |

| | Barrow | Deel | Moy * | Nore | Cavan County | Shannon (Lower) | Shannon (Upper) | Slaney inc. estuary | Liffey | Suir | Boyne | Blackwater | Foyle [§] | Erne |
|--|--------|------|-------------------------|------|--------------|-----------------|-----------------|---------------------|--------|------|-------|------------|--------------------|------|
| 50%ile Ortho P Limit | 0.1 | 0.1 | 0.1 | 0.1 | 0.05 | 0.05 | 0.05 | 0.1 | 0.05 | 0.1 | - | 0.1 | | |
| Max. mean Total P conc. for lake water | | | | | 0.05 (0.08) | 0.025 | 0.025 | | 0.035 | | | | | |
| pH | | | 6.4-8.5 | | | | | | | | | | | |
| Suspended Solids | | | <20 (average in floods) | | | | | | | | | | | |
| 95%ile Nitrite | | | 0.005 | | | | | | | | | | | |
| 95%ile residual chlorine | | | 0.005mgL as HOCL | | | | | | | | | | | |
| 95%ile dissolved zinc | | | 0.3 | | | | | | | | | | | |
| 95%ile total copper | | | 0.04 | | | | | | | | | | | |

* the flow criterion for the application of the EQS is 95%ile flow for all plans with the exception of the Moy plan which apply at 1.6 the Dry Weather Flow. ** () indicate EQS for cyprinid waters *** [] indicate EQS for coastal waters § The Foyle strategy assigns quality targets for the reaches with the catchment and assesses management options to attain them.

APPENDIX F

**ASSESSMENT OF THE IMPLEMENTATION OF CAPITAL
EXPENDITURE FOR PROVISION OF URBAN WASTE WATER
TREATMENT RECOMMENDED BY ADOPTED WATER QUALITY
MANAGEMENT PLANS**

COMPLETION OF CAPITAL EXPENDITURE FOR PROVISION OF URBAN WASTE WATER TREATMENT RECOMMENDED BY PLANS *

| Plan | Level of treatment recommended | Location | Implementation |
|---------------|--------------------------------|--------------|----------------|
| Suir | Secondary | Templemore | ✗ |
| | Secondary | Thurles | ✓ |
| | Primary | Clonmel | ✗ |
| Barrow | Secondary | Carlow | ✓ |
| | Secondary | Portarlinton | ✓ |
| | Secondary | Mountmellick | ✓ |
| | Tertiary | Portlaoise | ✗ |
| | Tertiary | Kildare | ✗ |
| | Secondary | Stradbally | ✗ |
| | Secondary | Daingean | ✗ |
| Moy | Secondary | Balla | ✓ |
| | Secondary | Kiltimagh | ✗ |
| | Tertiary | Swinford | ✓ |
| | Tertiary | Castlebar | ✗ |
| | Primary | Foxford | ✓ |
| | Unspecified Improvement | Tubbercurry, | ? |
| | Unspecified Improvement | Knock | ? |
| | Unspecified Improvement | Crossmolina | ? |
| Nore | Tertiary | Kilkenny | ✗ |
| | Secondary | Mountrath | ✓ |
| | Secondary | Abbeyleix | ✓ |
| | Tertiary | Rathdowney | ✗ |
| | Secondary | Castlecomer | ✓ |
| Lower Shannon | Secondary | Cappawhite | ✗ |
| | Secondary | Doon | ✓ |
| | Secondary | Castleroy | ✓ |
| | Secondary | Scarriff | ✗ |
| | Secondary | Killaloe | ✓ |
| | Secondary | Portumna | ✗ |

| Plan | Level of treatment | Location | Implementation |
|---------------|--------------------|----------------|----------------|
| | recommended | | |
| Upper Shannon | Secondary | Ballinasloe | ✓ |
| | Secondary | Ballaghderreen | ✓ |
| | Secondary | Ballyjamesduff | ✓ |
| | Tertiary | Athlone | ✓ |
| | Secondary | Oldcastle | ✓ |
| | Secondary | Cloghan | ✓ |
| | Secondary | Granard | ✓ |
| | Secondary | Roscommon | ✓ |
| | Secondary | Lanesboro | × |
| | Secondary | Ballymahon | × |
| | Secondary | Clara | × |
| | Secondary | Kilcormac | ✓ |
| | Secondary | Ferbane | × |
| | Secondary | Banagher | × |
| | Secondary | Birr | ✓ |
| | Tertiary | Roscrea | × |
| Slaney | Secondary | Enniscorthy | ✓ |
| | Secondary | Tinahely | × |
| | Secondary | Tullow | ✓ |
| | Secondary | Wexford | × |
| | Secondary | Ferns | × |
| | Primary | Rathvilly | ✓ |
| | Primary | Bunclody | ✓ |
| | Primary | Camolin | ✓ |

* This table omits the Liffey plan as it was adopted in 1997

× Indicates not implemented to date

✓ Indicates implemented

? Indicates information on status of implementation unavailable at time of survey