

IMPROVED MONITORING FOR SURFACE WATER QUALITY

The Development of a Manual of Best Practice



AUTORITÀ DI BACINO DEL FIUME PO



ENVIRONMENT AGENCY

1. INTRODUCTION

The purpose of this document is to increase awareness of a major collaboration programme to develop a Manual of Best Practice for water quality monitoring, currently being undertaken by the Environment Agency in the UK and the Po River Authority in Italy, two of the major regulatory authorities in Europe. The collaboration programme recognises the need for the development of efficient monitoring programmes to meet the requirements of EU and national legislation, as well as local operational needs. Expenditure on water quality monitoring across Europe is estimated to be in the region of 500 million ECUs each year, suggesting that cost savings or opportunities for better value for money through more efficient monitoring programmes could be potentially large.

The key components of the collaboration have included a review of current monitoring practice undertaken within each organisation and best practice elsewhere, leading to the identification of the most appropriate procedures to be adopted for particular monitoring requirements. These have been drawn together as a draft Manual of Best Practice which will be evaluated in selected catchments in the UK and Italy, as part of the ongoing work programme.

The development of a Manual of Best Practice, which will be available towards the end of 1996, is seen as an important contribution to the needs of Member States and in support of the role of the European Environment Agency in promoting best monitoring practice.



2. THE NEED FOR WATER QUALITY MONITORING

Water quality monitoring may be undertaken to obtain information to satisfy the following requirements:

- implementation of EU legislation;
- implementation of international agreements;
- implementation of national legislation;
- classification schemes; and
- supporting local water management activities.



2.1 European Union requirements for water quality monitoring

A number of EU Directives and Decisions have been adopted that require monitoring of rivers as part of their implementation.

These include:

- Surface Water for Abstraction Directive (75/440/EEC);
- Dangerous Substances Directive (76/464/EEC);
- Decisions on the Exchange of Information on the Quality of Surface Freshwaters (77/795/EEC and 86/574/EEC);
- Freshwater Fisheries Directive (78/659/EEC);
- Urban Waste Water Treatment Directive (91/271/EEC); and
- Nitrate from Agricultural Sources Directive (91/676/EEC).

These Directives and Decisions require monitoring for a variety of reasons, including: monitoring compliance with environmental quality standards, monitoring trends in surface water quality, and identifying areas susceptible to pollution. The extent to which the Directives are implemented varies between Member States depending on the characteristics and uses of the receiving waters and the nature of the inputs to these waters.



2.2 National requirements

In addition to the monitoring requirements arising from the implementation of EU legislation, monitoring is undertaken to satisfy national requirements resulting from the implementation of specific legislation or for the purposes of supporting more general water management activities at the operational level.

Italy

The basic legal framework for national water quality protection in Italy, including the elements relating to water quality monitoring, is set out by:

- Law 319/76 assigning only roles, responsibilities and powers;
- Inter-ministerial Committee Resolution of 4/2/77, relating to the protection of water from pollution, defining monitoring requirements including tasks to be undertaken for the identification of the water bodies to be monitored, sampling location, methods and sampling frequency for lakes and reservoirs, natural and artificial watercourses, estuaries and lagoons, coastal waters and groundwater;
- Law 183/89 defining the environmental protection activities to be performed within catchment areas and by relevant authorities. In this law the whole country is divided into catchment areas considered as ecosystems of national, or inter-regional, or regional importance. Article 9 of this law establishes the National Technical Services at the Prime Minister's Office to set up a national data system and integrated network for monitoring and surveillance providing information for public and private interests;
- Law 36/94 concerning the re-organisation of public services charged with water abstraction, supply and distribution for civil use, and wastewater treatment;
- Law 61/94 concerning the re-organisation of environmental controls and instituting the National Agency for Environmental Protection (ANPA) - in some regions the local Agencies are already operative - with responsibilities for; collecting and disseminating through public and educational programmes, all environmental information; setting limits for polluting agents; air, soil and water quality standards; sampling and survey rules; and establishing monitoring methods for the determination of the state of the environment and pollution control.

The national Government is empowered with supervision, and delegates to the Regions the operational design and establishment of monitoring activities in water bodies.

England and Wales

In England and Wales the legal framework for river monitoring is contained in the Water Resources Act 1991 and the Environment Act 1995. Various Sections and Schedules of these Acts require the Environment Agency to undertake monitoring as follows:

- The Agency is required to determine applications for consents to discharge and, although there is no explicit legal requirement on the Agency to monitor discharges to assess compliance with consent conditions, in practice this is the approach taken;
- Section 190 of the Water Resources Act requires that details of any Water Quality Objectives (WQOs) applied to protect certain uses of the aquatic environment must be maintained on a public register. River monitoring must be undertaken to gauge the degree of compliance with WQOs. In practice most WQOs have arisen from the introduction of European Union legislation.
- The Agency is required 'to monitor the extent of pollution in controlled waters'. This basic requirement has been assumed to mean that river monitoring must be done to gauge compliance with specific environmental quality standards, in order to protect the various uses of water.

Prior to the formation of the National Rivers Authority in 1989 (the predecessor to the Environment Agency which came into being on 1 April 1996), river monitoring for the purposes of water quality classification was undertaken by the ten former public Water Authorities. Although this monitoring was undertaken within the framework of the former National Water Council classification scheme, problems arose with the comparability of data between the ten Authorities, since their individual approaches to monitoring differed.

With the adoption of the Water Act 1989 (subsequently consolidated into the Water Resources Act 1991), the use-related and classification elements were separated into two new systems; statutory Water Quality Objectives (yet to be fully implemented) incorporating the use-related elements, and a General Quality Assessment (GQA) scheme for classification purposes.

The GQA scheme has been implemented in a consistent manner by the eight regions of the Environment Agency, enabling objective comparisons to be made of water quality across the country.



2.3 Local requirements

In addition to the monitoring requirements outlined above, monitoring is undertaken to satisfy the requirement for data to support regional and local water management activities.

Po River Basin

In Italy, responsibility for environmental protection has been largely devolved from the national level to each of the 20 Regional Administrations. Some, but not all, of these Regions have developed their own legislation and/or statutory programmes relating to river monitoring, taking into account the minimum requirements of the Resolution of 4/2/77. However, due to the different local approaches to water quality monitoring, there is to date no uniform monitoring approach.

The Po River Authority has made concerted steps towards assuming responsibility for the co-ordination of water management activities. On 1 July 1993, the Po River Authority's Institutional Committee approved a new project covering a monitoring system for surface water classification. At the same time the Authority signed a Memorandum of Understanding with other organisations responsible for water management in the catchment. These include the six Regions and the one autonomous Province covered by the Po catchment, the Parma office of the National Hydrographic Service, the Po Magistracy (having responsibility for flood control in the catchment), under the supervision of both the Ministry of Public Works and the Ministry of the Environment.

The Po River Authority has empowered a Commission to oversee the preliminary classification of the catchment's water quality. The Commission draws its membership from

the Authority, in particular its Technical Committee, as well as representatives from the other signatories to the Memorandum of Understanding.

The Resolution of 4/2/77 was also used to introduce a new National Environmental Information System (SINA). It is intended that SINA will promote the collection and dissemination of data on the environment, adopting procedures comparable on the national basis. The operation of this system is to be co-ordinated by the National Technical Services operating under the supervision of the Prime Minister's Office.

England and Wales

Local monitoring programmes are undertaken by the eight Environment Agency regions for local or regional water quality management purposes. The design of these types of monitoring programmes is undertaken at the local level, on a case-by-case basis. The range and extent of programmes vary but local monitoring can be divided into the following categories identified by the Environment Agency:

- discharge impact assessment and pre-consenting studies;
- development impact assessment;
- diffuse source impact assessment;
- trend detection and general quality characterisation;
- National and Regional Research & Development;
- post pollution incidents;
- real-time water quality management; and
- model development and validation.

Due to the diverse origins of the eight Environment Agency regions, approaches to monitoring relating to these categories differ.

In terms of expenditure, the most important categories are discharge impact assessment and pre-consenting studies; post-pollution incidents; and detection of trends and general quality characterisation.

2.4 Current scale of monitoring

A comparison of the current scale of river monitoring in the Po River Basin and England and Wales indicates that river monitoring is undertaken on a larger scale in England and Wales.

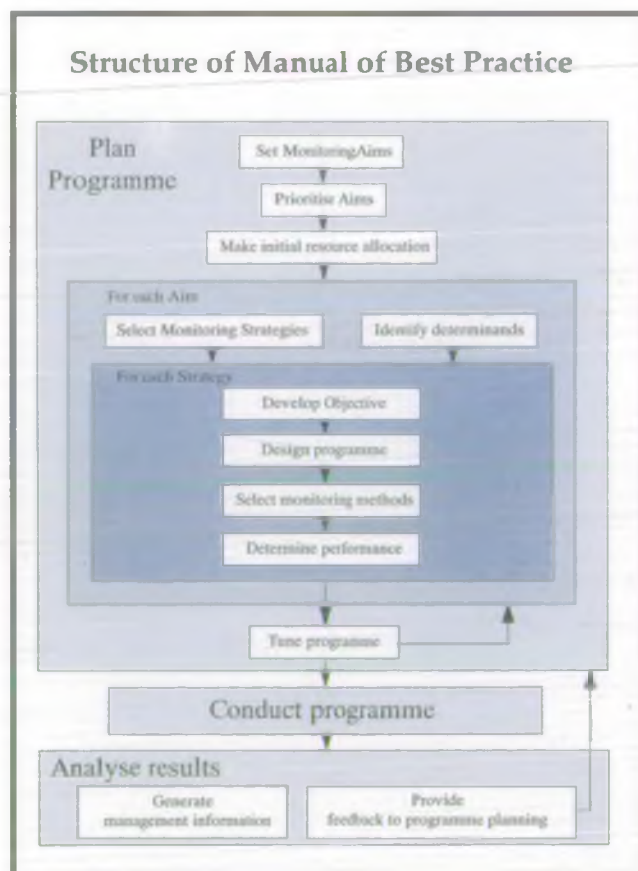
More monitoring sites, in terms of both average river length and catchment area, are currently operated in England and Wales (average 1 site/7 km) and a greater number of samples per year are taken at each monitoring site than in the Po River Basin (average 1 site/9 km). The higher density of monitoring sites in England and Wales reflects a larger population density and a more intensive use of rivers. A further explanation of a larger monitoring requirement is the adoption of the Environmental Quality

Standard approach to water management rather than the Uniform Emission Standard approach.

3. DEVELOPMENT OF A MANUAL OF BEST PRACTICE

The collaboration programme has resulted in detailed information being collected on current monitoring practices from the Environment Agency and the Po River Authority. This has included identifying the requirements of those involved in the design and interpretation of monitoring programmes and the range of tools and procedures used. This information has formed the basis of a draft Manual of Best Practice for water quality monitoring, which has now been produced for the two authorities by the UK Water Research Centre (under contract to the Environment Agency) and the Water Research Institute (IRSA) in Italy.

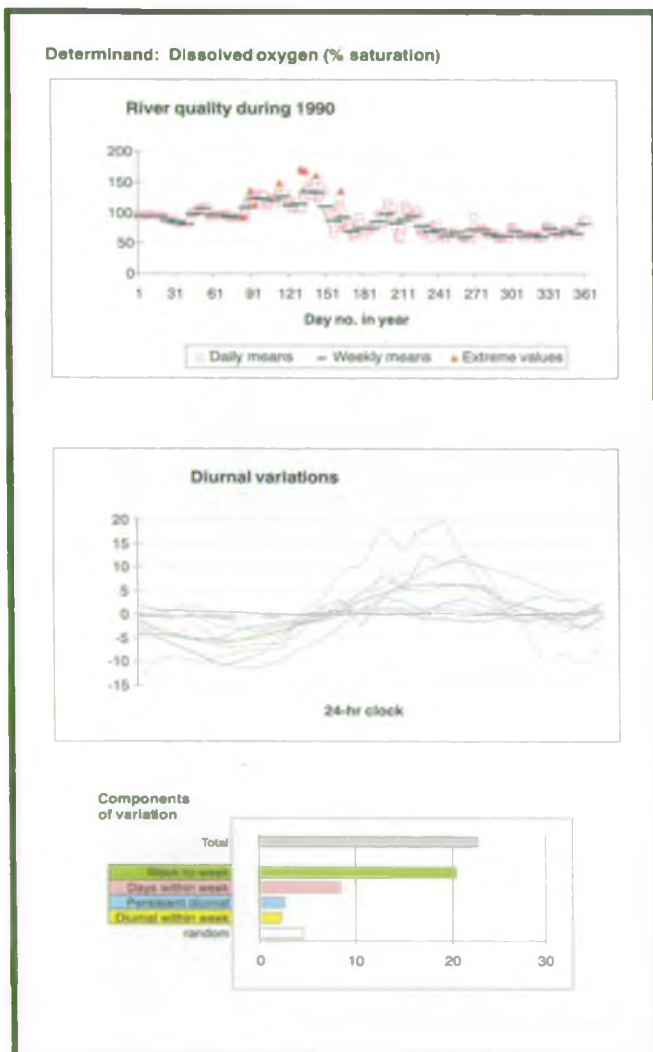
The Manual gives step-by-step guidance (see diagram) through all the stages of a monitoring programme. For a given monitoring objective, the user is guided through the processes of choosing an appropriate monitoring strategy, deciding what to measure and how and when to measure it, as well as how to analyse the resulting data and generate management information. The guidance covers the use of both chemical and biological monitoring methods,



for rivers, estuaries and coastal waters. The user will therefore be able to design a monitoring programme that will be most appropriate for the set of problems and circumstances encountered.

A key feature of the approach offered by the Manual of Best Practice is the ability to design a cost-effective monitoring programme within the constraints of the staff and other resources available.

In the ongoing collaboration programme, the draft Manual of Best Practice will be fully tested under operational conditions in a number of catchments in the UK and Italy. Case studies from these trials will be incorporated into the final version of the Manual as illustrative examples.



Prototype software output showing breakdown of variation from continuous monitoring data

4. A WIDER EUROPEAN CONTEXT

The European Environment Agency came into being in 1990, through an Order of the European Council, and became operational from its base in Copenhagen in 1993.

To achieve the aims of environmental protection and improvement laid down in the Treaty of Maastricht and by successive Community action programmes on the environment, the prime objective of the EEA is to provide the Community and Member States with objective, reliable and comparable information at the European level. This will allow governments to take the requisite measures to protect the environment, to assess the results of those measures and to ensure that the public is properly informed about the state of the environment.

The EEA functions through a network of data providers within each Member State with coordination and quality control being effected through European Topic Centres (ETCs) which are contracted directly to the EEA. The ETC on Inland Waters (ETC/IW) is a consortium led by the UK Water Research Centre. Its work programme for the EEA consists of a number of projects aimed at assessing how each country organises its monitoring programmes for surface and underground waters to meet its international and national obligations. A recently published review by the ETC/IW of the international legislative requirements for monitoring all surface waters has identified a number of barriers to harmonisation of monitoring arising at the sampling, analysis and reporting stages because of conflicts between Directives or because of imprecise specification within Directives. A widely accepted manual of best practice for surface water quality monitoring would clearly be beneficial in eliminating many of these barriers.

Based on its surveys, the ETC/IW has been asked to recommend a cost-effective, freshwater monitoring network for the whole of the EEA area. It would be ideal if all Member States could monitor to the same set of agreed principles in order to achieve the objective of providing high quality, representative, comparable, and reliable data relevant at the European level.

The ETC/IW would therefore be seeking out, developing and promoting examples of best practice that could be deployed throughout the EEA area. At present the area covered by the EEA extends from Iceland to the member states of the European Union but it is likely that the countries of Central and Eastern Europe (CEEC), including part of the former Soviet Union, will be integrated into the EEA starting in 1996. It is in this context that the Manual of Best Practice being developed jointly by the Environment Agency and Po River Authority will have a wider European significance.

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