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**TECHNIQUES FOR THE
COLLECTION AND REPORTING
OF DATA ON
COMMUNITY WATER SUPPLY**

Report of a WHO Scientific Group

WORLD HEALTH ORGANIZATION

GENEVA

1972

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AND REPORTING OF DATA ON COMMUNITY WATER SUPPLY

Geneva, 24-30 August 1971

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TECHNIQUES FOR THE COLLECTION AND REPORTING OF DATA ON COMMUNITY WATER SUPPLY

Report of a WHO Scientific Group

A WHO Scientific Group on Techniques for the Collection and Reporting of Data on Community Water Supply met in Geneva from 24 to 30 August 1971. Dr B. Dieterich, Director of the Division of Environmental Health, opened the meeting and welcomed the participants on behalf of the Director-General. He referred to the role of WHO in helping Member States to develop and maintain a healthy environment by improving urban and rural water supplies and the disposal of wastes. The national programmes that are to be formulated and implemented within the Second United Nations Development Decade, 1971-1980, will be hampered in many countries because the magnitude of the problems is not known and the basic information needed to solve them is lacking. The Scientific Group was the first to be convened by WHO specifically to study this subject. Its object was to recommend ways in which WHO might help to remedy this situation.

The composition of the group reflected the wide variety of experience needed to cover the many facets of a problem that, although it is most serious in the developing countries, concerns every country to some extent.

1. INTRODUCTION

The WHO Community Water Supply Programme, begun in 1959 in pursuance of a resolution adopted by the Twelfth World Health Assembly, aims to provide ample, continuous, and convenient supplies of safe water to all people. Subsequent Health Assemblies have noted and approved the assistance that the Organization has given to Member States to this end, and have called for accelerated efforts in view of the population growth, urbanization, and other factors that are aggravating the problem. WHO recognizes that nearly all environmental improvements require safe water, and has expressed concern that, in many parts of the world, supplies are increasing too slowly to satisfy the needs of the people within the foreseeable future.

As one measure to accelerate progress in this direction, targets were proposed for achievement by Member States during the United Nations Second Development Decade, 1971–1980, governments being urged to prepare national programmes, based on these targets, to provide water for their entire urban populations and for at least 20% of the rural population within this 10-year period. Experience in Latin America and in other areas where long-term programmes during the previous decade have led to a considerable improvement in the provision of water supplies suggests that the targets set could be attained elsewhere.

The formulation and implementation of many national programmes is hindered because lack of data on current water supply problems delays remedial measures.

In 1963, WHO published a study of urban water supply conditions and needs in 75 developing countries¹ the purpose of which was “to stimulate governments to collect the type of information that will provide the necessary background for the formulation of future programmes and policies”. A WHO Expert Committee on Community Water Supply, which met in 1968,² urged governments to initiate the recording of information for their own use and for the benefit of other countries.

Recognizing that data are more valuable if they are comparable, and that their collection, compilation, and presentation require special expertise, WHO appointed a Scientific Group to “study existing methods in use in various countries and recommend standard reporting techniques”. The present document reports the deliberations and recommendations of this group, and contains suggestions that may help governments to undertake or reorganize programmes for the collection and retrieval of information on community water supply.

In addition to recognizing the significance of safe water for a healthy environment, WHO stresses the importance of the sanitary disposal of wastes. Major health hazards may arise if a community water supply is established or extended without adequate provision for disposing of the resultant waste water. Although the present document deals specifically with the lack of data for community water supply, the procedures and principles discussed apply equally to the disposal of sewage and waste—a field in which data are even scarcer.

¹ Dieterich, B. H. & Henderson, J. M. (1963) *Urban water supply conditions and needs in seventy-five developing countries*, Geneva, World Health Organization (Public Health Papers, No. 23).

² *Wld Hlth Org. techn. Rep. Ser.*, 1969, No. 420, p. 21.

2. THE NEED FOR COLLECTING DATA, AND THEIR UTILIZATION

Up-to-date information on community water supply is lacking in most developing countries. As a result, governments and international agencies are hampered in their attempts to provide safe water supplies.

Few countries—whatever their economic status—collect, analyse, and report such data systematically and effectively. It often happens that a project is launched on the basis of inadequate information, collected at short notice for the occasion. Ignorance of physical, financial, or administrative questions may result in programmes that are over-ambitious and therefore wasteful, or that do not meet present or future requirements. Furthermore, it may cause delays in executing programmes.

Data on the following subjects are frequently lacking :

demography (population statistics, social information relating to existing and future water demands) ;

health (the endemicity of water-associated diseases and conditions likely to cause epidemics) ;

existing installations (the technical and financial soundness of present facilities) ;

new sources (the quality and quantity of possible new sources) ;

criteria (for the design and performance of installations) ;

costs (unit costs of constructing, administering, operating, and maintaining installations) ; and

benefits (to health, social welfare, and economic development—preferably in economic terms—resulting from new and improved water supplies).

As it is difficult and expensive to gather and process data, only information for which there is a foreseeable need should be collected. Moreover, although it is always desirable to have data to hand, their absence should not delay action at the operational level. However, data are necessary for planning and good management and allow comparisons to be made, especially if they are collected and presented in a uniform way.

The use of reliable data helps to achieve sound and economical community water supply schemes.

2.1 At various levels

Much basic information on community water supply is needed at various levels for developing, constructing, financing, managing, and operating supply systems that will meet technical, economic, and public health criteria.

The following is an illustrative but not exhaustive list of purposes for which these data are required.

Planning of :

- (a) national and provincial long-range water supply programmes ;
- (b) individual programmes for water supply ;
- (c) community water supply as part of the national programmes of economic development and public health ;
- (d) water utilization for all purposes.

Preparation of :

- (a) pre-investment, feasibility, and sector¹ studies ;
- (b) loan requests ;
- (c) criteria and designs ;
- (d) budgets ;
- (e) rate structures ;²
- (f) realistic goals and schedules ;
- (g) annual and other reports ;
- (h) training and research programmes ;

Measurement of :

- (a) potentiality of water sources, from the point of view of quantity and reliability ;
- (b) quality of water at its source and as delivered, with regard to contaminants and the efficiency of water treatment ;
- (c) public, commercial, and industrial requirements and consumption of water ;
- (d) progress towards attaining targets for community water supply, with reference to planning, design, financing, construction, management, operation and maintenance, and research ;
- (e) efficiency of management and operation ;
- (f) economic and social factors ;
- (g) manpower needs.

¹ In this context, " sector " means the water supply problem as a sector of a country's economy.

² That is, systems of collecting payment from water consumers.

Forecasting of :

- (a) the population to be served ;
- (b) *per capita* consumption of water ;
- (c) costs of construction and operation ;
- (d) international and national financing required ;
- (e) water shortages ;
- (f) introduction of new contaminants ;
- (g) salinity encroachment ;
- (h) conditions likely to cause epidemics ;
- (i) breakdown of existing treatment methods ;
- (j) research needs ;
- (k) training requirements.

Providing assistance in :

- (a) the management and administration of various agencies concerned with water supply ;
- (b) the operation and maintenance of water supply systems.

2.2 At the local level

At the local level particularly, information on community water supply is needed for planning, designing, and constructing installations ; management and supervision ; the procurement of funds ; public information ; and securing community interest.

The data must be adapted to the uses to which they are to be put, and at the local level these uses will include monitoring of progress and the consideration of further development.

Good management automatically produces reliable records. If these do not exist, the management has been inefficient. Once they have been analysed and condensed, these records should form the basis of annual reports, which should be published promptly and distributed to all concerned. In this way, the interest and support of the public can be sustained. Otherwise, the development of water supplies may not be effective and existing facilities may well deteriorate.

2.3 At the national and regional levels

Reliable data are required by those responsible for planning national water supply programmes, especially in water-deficient areas where there is competition for existing supplies.

Adequate data are essential for conducting sector studies, which are the first stage in identifying water supply problems, for promulgating national policies, drafting legislation, and establishing water supply priorities in relation to other national needs.

Pre-investment and feasibility studies as well as loan requests, are based almost entirely on an analysis of data on the projects under consideration. Reliable data facilitate these tasks and help to ensure that the projects are successful.

Data of this nature are needed not only for the formulation of national community water supply programmes and targets, but also for monitoring and evaluation. Furthermore, they facilitate the establishment of priorities for development and reconstruction.

National programmes require data :

- (a) on demography ;
- (b) about the quantity and quality of water resources ;
- (c) on financial matters, to enable budgets to be prepared and to justify the deployment of national financial resources ;
- (d) to facilitate approval for obtaining or providing loans ;
- (e) for calculating the proportion of external funds needed ;
- (f) on manpower needs ;
- (g) to establish training programmes ;
- (h) for undertaking programmes to prevent the pollution of water supplies ;
- (i) for research and development programmes.

Such data, when supported by health statistics, especially on water-associated diseases, may help to justify the need for water supply programmes and to evaluate the surveillance of water quality. Data on social and economic development are of value in measuring the costs and benefits of water supply schemes. Again, all these data will assist in securing public support for national water programmes.

The data derived from activities at the local level, once analysed, should be taken into account when legal provisions are formulated to ensure the efficiency of water supply programmes from the health, operational, and economic points of view.

Data obtained at the national level may be made available to international agencies, in order to assist their environmental and financial operations.

2.4 At the international level

International and bilateral agencies require data to enable them to support community water supply programmes and to evaluate their progress. The data must be presented in such a way as to allow inter-country comparisons of existing water supplies, so that the agencies can determine where the priorities for new programmes lie, and where further expansion would yield the greatest benefits. Governments, which will be the main sources of such data, must be able to show the relation between investments in water supplies and the health and prosperity of their populations.

Many developing countries experience difficulty in satisfying the requirements of international financing agencies for data to establish the viability and bankability of schemes submitted to them for assistance. Although these requirements often appear, at first sight, to be excessive, well run national and local water authorities are usually able to supply most of the information demanded. Even so, governments should bear the requirements of lending agencies in mind when setting priorities for their own data collection programmes.

International agencies provide financial and technical assistance with a view to ensuring the soundness of the projects formulated. There may also be a need for studies in depth which themselves involve the collection of data. Governments intending to undertake such studies are urged to seek the assistance that international agencies may be able to furnish as part of their research and development projects.

3. THE NEED FOR DATA ON COMMUNITY WATER SUPPLY

Data are required at all levels and for all phases of community water supply programmes. The Scientific Group concentrated its attention on the possible sources of information, the different phases of programmes for which data are needed, the types of data to be collected, and considerations in establishing priorities for data requirements.

3.1 Sources of data

The first step towards developing or improving a data collection programme is to locate and analyse the available information. The search should not stop with the more obvious sources, as relevant data may be found in unexpected places. The following agencies may supply pertinent information :

(a) The national planning agency and the planning departments of the institutions responsible for community water supply.

(b) The ministry or other agency responsible for environmental health ; the control of pollution and surveillance of water quality ; and urban and rural community water supply programmes.

(c) National, regional, state, and local water authorities ; semi-autonomous bodies or private companies supplying water.

(d) Financing institutions or lending agencies such as national and international banks ; bilateral and multilateral agencies ; national, state, or provincial subsidizing agencies ; and local financing organizations.

(e) Bilateral and multilateral technical assistance organizations.

(f) National, state, and local organizations for the management, administration, operation, and maintenance of water supply schemes.

(g) Governmental and private construction agencies.

(h) Housing agencies.

(i) Census bureaux.

(j) The agencies responsible for hydrological, meteorological, and geological surveys.

(k) Land surveyors.

(l) The government departments of industry, decentralization, relocation, and industrial development.

(m) Legal departments.

(n) Firms of consultants.

Individuals having unrecorded information should be urged to place their knowledge on record before it is lost. The accuracy of such data should be carefully checked.

As data are derived from many sources, it is suggested that a national reference centre on community water supply be established in each country. Its functions would be to maintain a list of existing and possible new sources of information ; to serve as a repository of data not maintained by agencies for their own purposes ; and to make available the data at its disposal. However, data are best maintained by the organizations that gather and use them.

3.2 Phases of a community water supply programme and types of data required for each phase

A community water supply programme proceeds in phases for each of which various types of data will be required. These phases are devoted to : (1) planning (which includes ascertaining problems, laying down national policies, preparing feasibility studies, establishing priorities, and drafting

legislation); (2) design; (3) financing; (4) construction; (5) management; (6) evaluation; and (7) research.

Data on the following subjects will have to be considered for each phase: (a) the population; (b) the health aspects of water supply; (c) the social and economic conditions; (d) sources of water and the quality and quantity of the water; (e) existing water supply systems (facilities, numbers served, financial aspects, potential for expansion, efficiency of operation and maintenance); (f) standards and criteria; (g) costs and benefits (with greater emphasis on the data required for calculating these items, making due allowance for imponderables, especially in the field of public health); and (h) manpower and training.

Information on current or planned research and on the extent of community participation may also be needed in some instances.

3.3 Priorities

No list of priorities will be applicable to all countries and situations. In each case, the national plan for community water supply, based on socio-economic factors, will govern the order of priority for data collection. In establishing priorities, consideration should be given to the degree of urgency and the available facilities. Furthermore, the order of priority will probably vary from one level to the other—e.g., some data will be of the first priority at the community level and only of the third or fourth at the national level, and *vice versa*.

Much information on the need for community water supply may be obtained from agencies outside the field—e.g., population statistics are supplied by the census bureau; statistics on morbidity, mortality, and water quality will come from the ministry of public health; information on groundwater may emanate from a different agency; and so on.

Priorities for data on community water supply may be affected by changing circumstances and need to be revised from time to time.

3.4 Minimum data required

A model report in tabular form, giving the minimum data that governments should have on hand from year to year is presented in Annex 1. This basic information will show, in terms of the population served and the cost of these services, what progress the community water supply programme has made during the year and is expected to make in the next 5 years.

4. COLLECTION, COMPILATION, AND REPORTING OF DATA ON COMMUNITY WATER SUPPLY

4.1 General considerations

The collection, analysis, and distribution of reliable data for community water supply programmes take time, thought, and money. They may even necessitate the recruitment of additional staff. However, if performed with sufficient care, data collection is worth while and will save money in the long run.

Much information on community water supply already exists in various forms and at innumerable locations in every country. Finding, collecting, collating, and analysing these data are formidable tasks the results of which will depend on the limitations of the data. First, all available information should be found and analysed. Apart from the more obvious sources (see Sources of data, page 11), certain agencies not directly concerned with water, as well as university departments and the reports of professional societies, may yield pertinent data.

Several considerations should be borne in mind in setting up or expanding a programme for the collection and compilation of data on community water supply. The basic consideration on which all the others depend is that, although uniformity in the collection and presentation of data is desirable, there is a limit to the degree of standardization that is practicable. Thus flexibility is encouraged in order to allow for professional judgement in all phases of the programme. Furthermore, the reliability of the data must be ensured by specially trained staff working under proper supervision. The purpose of the data should be specified and the data to be obtained should be enumerated and described in detail. Those most urgently needed should be collected first, the programme being expanded as required. To ensure comparability, similar types of data should be measured in the same way — e.g., by applying the same technique for a particular chemical analysis and by using the same units, preferably of the metric system. Furthermore, a uniform method should be used for analysing the data. There should be uniformity and continuity in the collection, compilation, and dissemination of the data, and the same reporting period should be used, preferably the calendar year.

If one agency or department is responsible for all phases and aspects of a community water supply programme, it is comparatively easy to allot responsibility for the collection and reporting of data. When, as in most countries, responsibility is divided among a number of bodies, it is more difficult to co-ordinate data collection. The solution of this problem will vary from country to country. In some, the planning office is the responsible body; in others, the central bureau of statistics. Frustrations

and misunderstandings may be avoided if the agencies in charge of collecting data also compile their own, or at least advise on how this should be done.

Where different agencies are responsible for different aspects of a national water supply programme, they should co-ordinate their activities so as to avoid duplication. Sometimes it is possible to require by law that specific data be obtained and made available. It may be necessary also to require that agencies in possession of water supply data—e.g., private water companies—furnish it to the official bodies responsible for water supplies.

In any collaborative programme for data collection, the participants, whether they be water engineers, managers, chemists, hydrologists, or plant operators, should be consulted on the type of data to be collected and the degree of detail required before the programme is put into operation or, in the case of existing programmes, revised substantially.

4.2 Methods of collecting data

The methods used for collecting data will depend on the type of data required and on their sources. If sampling is necessary, use of the appropriate statistical techniques should be considered. Expert advice should be obtained to determine the situations in which sampling is required and to establish the criteria for its use.

Field studies and research may prompt the collection of data. Voluntary assistance should be encouraged, but should be checked for accuracy. Surveys undertaken for other purposes may be made the occasion for obtaining information for water supply purposes—e.g., items may be added to a census questionnaire.

Adjacent countries with common water sources should be encouraged to co-ordinate the gathering of data of common interest and may agree to use these data for the common good—e.g., in a warning system against the pollution of rivers.

4.3 Compilation and reporting of data

As soon as a start has been made on the collection of data, compilation should begin. The compilation must be easily accessible and should not give rise to any risk of misinterpretation.

Reporting techniques will have to be studied so that the one most suitable for use in the developing countries can be selected, taking into consideration the size and complexity of their water supply programmes.

The same applies to the forms used for reporting data. The method of data storage and retrieval will determine how these forms are designed, and a decision should be taken on this point early in the programme so as to avoid the need for changes after large quantities of information have been collected, analysed, reported, and stored.

Forms and procedures for data reporting should be as simple as possible. Data that are not likely to be utilized within the foreseeable future should not be requested. Once it has been decided what information is needed at each level, and how frequently, reporting should be automatic and punctual.

The WHO International Reference Centre for Community Water Supply is already active in the compilation, storage, and dissemination of certain types of research data, particularly on the quality of drinking-water. The Centre acts through 28 collaborating institutions throughout the world within the framework of the WHO Community Water Supply Research and Development Programme, and it maintains a reference library at its headquarters in the Netherlands. The activities of the Centre may be extended in the future to cover other types of information related to water supplies.

The present summary of techniques for collecting and reporting data for community water supply programmes is not exhaustive, but it gives some indication of the benefits that can result from their use. No attempt has been made in this report to calculate the exact costs and benefits of the data collection programmes recommended here. However, since the world expenditure on community water supply over the next 10 years is estimated at \$9 100 million, data collection programmes likely to save an appreciable part of this cost would be amply justified.

5. CONCLUSIONS AND RECOMMENDATIONS

Up-to-date information on community water supply is lacking in most developing countries, at both the national and local levels. Few countries have programmes for the systematic collection, analysis, and reporting of such data. Thus the construction and evaluation of projects depends on data that are assembled on an ad hoc basis. The Scientific Group examined the need for data, the types of data required, possible sources of information, and methods of compiling, distributing, and utilizing data on community water supply. It made the following recommendations to assist countries in improving their water supply programmes through the use of more effective techniques in this field :

(1) The Group endorsed the recommendation of an earlier Expert Committee,¹ urging governments to start recording community water supply information, not only for their own use but also for that of other countries and of international agencies concerned with the development of community water supply programmes.

¹ *Wld Hlth Org. techn. Rep. Ser.*, 1969, No. 420, p. 21.

(2) Where existing resources of money and manpower may prevent many countries from undertaking immediately the collection of all desirable or necessary data, a partial data gathering programme should be initiated, starting with the collection of the most urgently needed information, and expanding the programme as facilities permit. As conditions vary from country to country, no general recommendation can be made regarding priorities.

(3) Deficiencies of essential data should be remedied as early as possible, but should not be used as a pretext for impeding progress towards the provision of water supplies.

(4) Since it is useless to collect data unless they are made available to those who need them, governments should encourage the prompt publication of information compiled by specialized departments or other agencies, and designate a national centre where both the data and their sources would be recorded for the information of potential users.

(5) Where different agencies are responsible for different aspects of a national water supply programme, they should be required to co-ordinate their activities in order to avoid duplication of the data collected. Agencies that are not directly concerned with water supply but possess data on this subject should make them available to the agencies responsible for water supplies. Furthermore, adjacent countries with common water systems should co-ordinate the gathering of data of common interest and use them for the common good—e.g., in warning of river pollution.

(6) Although uniformity in the collection and presentation of data is desirable for purposes of comparison, there is a limit to the degree of standardization that is practicable. Flexibility is necessary to allow for professional judgement in matters such as priorities and the avoidance of wasted effort through the collection of unnecessary information. Therefore governments should decide on the requirements of national water supply programmes, and should ensure uniformity of their data presentation as regards the design of forms and the use of units and definitions, bearing in mind the requirements of external lending agencies from which financial aid is likely to be sought. Intercountry uniformity in data presentation would be promoted by the use of the metric system and by using the calendar year as the basic reporting period.

(7) The collection, compilation, and presentation of data require staff trained for the purpose. Governments that intend to undertake or strengthen a programme for the collection of data on water supply should ensure the services of such staff, and if necessary expert assistance should be enlisted to complete their training.

(8) Data are needed at the local, regional, national, and international levels, and should be readily available from one level to another.

(9) At the local level, data are required for purposes such as planning (including design and construction); management and supervision; questions of finance; relations with interested bodies, consumers, and others; and securing community participation.

(10) The collection and recording of data are essential aids to, and responsibilities of, management. Data arising out of the management of the water supply system at the local level should be condensed, presented in the form of an annual report, and promptly published and distributed. Such reports show the efficiency and effectiveness of the system, help to sustain public interest, and stimulate the improvement of existing systems as well as the creation of new facilities.

(11) At the national level, data are used for the formulation of targets, programmes, and budgets; in preparing requests for loans; in monitoring and evaluating water supply programmes; in the surveillance of water quality to assure compliance with public health regulations; in demonstrating social and economic developments resulting from adequate water supply; in the co-ordination of regional activities; in promotional and public relations activities; in determining training needs; and in research on water supply.

(12) The data required by international agencies are of prime importance in enabling them to evaluate progress in community water supply and to identify situations where new or additional initiatives are desirable. Many developing countries find it difficult to satisfy the exacting requirements of international financing agencies for data to establish the viability and bankability of proposals submitted to them for assistance. Yet most of these data should be readily available to efficiently run national or local water authorities. Governments should bear the requirements of lending agencies in mind when setting priorities for their data collection programmes.

(13) A methodology should be developed for evaluating, in economic terms, the improvement in health and social development resulting from safe water supplies.

(14) Data should be collected as a basis for legislation dealing with health, operational, and economic aspects of community water supply.

The Group noted that WHO has been giving assistance to governments in the compilation of data, but believed that specific aspects of the question, such as the need for data to relate the economic and health benefits of community water supplies to the cost of installing and operating them, required more detailed consideration.

Annex 1

SPECIMEN REPORT FORM

I. BASIC WATER SUPPLY DATA ^a

Date of report

Total population in 19..... Urban : Rural :

	Urban		Rural		Total	
	House connexion	Easy access	House connexion	Easy access	House connexion	Easy access
Total No. persons (millions) served at time of collecting data						
No. persons (millions) who received improved services during reporting year						

II. CAPITAL INVESTMENT (millions of US\$) ^b

Expenditure for the financial year ending	Urban	Rural	Total
International loans ^c			
National funds (matching loans) ^d			
National funds (other) ^e			
Total			

III. PLANNING FOR THE NEXT FIVE YEARS

Period	Population to be served			Capital investment ^b			Capital financing ^b	
	Urban	Rural	Total	Urban	Rural	Total	National	International loans
19..... to 19.....								

^a Give data obtained as late as possible in the year, preferably after June.^b US dollar equivalent at current exchange rates.^c Amount spent during the year from international loans.^d Amount of national funds (i.e., from national, state, and local sources) spent during the year to match amount spent from international loans.^e Amount of national funds spent during the year on projects not benefiting from international loans. Do not include money expended on the operation or maintenance of water supply systems.

Annex 1 (continued)**IV. OPERATION AND MAINTENANCE *a, b***Costs for the financial year ending *a*

	Production	System	Treatment	Total
Cost per m ³				
Total cost				

Income for the financial year ending *a*

Tariffs	Other revenue	Grants or subsidies	Total

a US dollar equivalent at current exchange rates.*b* Operation and maintenance costs and financing should be tabulated annually for each system and then combined to obtain a national average for comparison.

N.B. In addition to the minimum basic data indicated in these tables, more detailed information will be required for technical, financial, and management purposes. A list of subjects on which data are required for community water supply activities is given in Annex 2.

Annex 2**LIST OF SUBJECTS ON WHICH DATA ARE REQUIRED
FOR COMMUNITY WATER SUPPLY ACTIVITIES****A. TECHNICAL****1. Demographic**

- (a) Population
- (b) Health aspects including the incidence of water-borne diseases
- (c) Social and economic conditions

2. Projections

- (a) Demographic changes
- (b) Changes in *per capita* consumption
- (c) Probable new sources of supply
- (d) Targets

3. Raw water resources

- (a) Quantity and type
- (b) Quality
- (c) Catchment area : geology and topography ; meteorology and hydrology

4. Selected water sources

- (a) Surface water
- (b) Groundwater

5. Treatment plant

- (a) Pumping and metering
- (b) Type of treatment
- (c) Fuel and chemicals : type, supply, source, and cost ; cost per unit volume treated

6. Distribution

- (a) Service reservoirs : type ; number, size, and location
- (b) Types of pipes (mains), joints, and fittings
- (c) Types of pumps, motors, and other equipment

7. **Design** : standards and criteria
8. **Construction**
 - (a) Current costs of labour, material, and plant
 - (b) Availability of labour and levels of skills
 - (c) Construction methods
9. **Pollution and environmental control**
10. **Legal implications**
 - (a) Land and water rights
 - (b) Water laws, regulations, and by-laws
 - (c) Compensation
11. **Research** : current and required
12. **Need for consultants, and their use**
 - (a) National consultants
 - (b) Consultants from abroad

B. ECONOMIC AND FINANCIAL

1. **Sources of finance**
2. **Present debts and interest rates on loans**
 - (a) Private
 - (b) Local
 - (c) National
 - (d) International
3. **Cost of existing works**
 - (a) *Per capita*
 - (b) Per unit volume of water produced
4. **Annual costs of operation**
 - (a) Maintenance
 - (b) Operational

5. Annual depreciation, sinking fund, and amortization**6. Regular financial reports****C. MANAGEMENT****1. Quantity of water**

- (a) Produced daily : maximum, minimum, mean
- (b) Reserves

2. Water sampling

- (a) Responsibility for supervision
- (b) Quality standards at all points in the system : physical ; chemical ; bacteriological, virological, radiological, and biological

3. Water use

- (a) Domestic
- (b) Industrial and commercial
- (c) Agricultural
- (d) Municipal, including fire fighting
- (e) Institutional, such as schools and hospitals
- (f) Leakage or loss : metering
- (g) Other purposes
- (h) *Per capita* consumption

4. Number and percentage of population served by

- (a) Service connexions
- (b) Public stand pipes, metered and unmetered
- (c) Stand pipe service for compounds¹ or individual houses
- (d) Number of metered premises
- (e) Number of unmetered premises

5. Personnel and training

- (a) Administrative
- (b) Professional
- (c) Skilled and sub-professional
- (d) Semi-skilled and general

¹ Term used in certain English-speaking developing countries to denote a clearly delimited cluster of dwellings.

6. Determination and review of operational costs financed by

- (a) Water charges
- (b) General taxes
- (c) Other sources

7. Internal and external audit**8. Future investments**

- (a) Improvements and extensions to existing works
 - (i) estimated cost
 - (ii) internal and external sources of funds
 - (iii) *per capita* cost
 - (iv) cost per unit volume
- (b) New projects
 - (i) estimated cost
 - (ii) probable source of internal and external funds, and methods of repayment
 - (iii) *per capita* cost of installation and of operation and maintenance
 - (iv) per unit volume cost of installation and of operation and maintenance
- (c) Cost-benefit analysis

9. Public participation

- (a) Attitudes
- (b) Co-operation : labour, materials, and land

10. Public relations

- (a) Consumers' complaints and their remedies
 - (b) Preparing for changes in service, water rates
 - (c) Emergencies
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