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## THE BLUE PLAN (first phase)

### SURVEY ON "FRESH WATER IN THE MEDITERRANEAN BASIN"

Terms of reference

Document prepared by Mr. R. AMBROGGI, Consultant  
United Nations Environment Programme (UNEP)

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CONTENTS

	<u>Page</u>
INTRODUCTION	1
OBJECTIVES AND GEOGRAPHICAL COVERAGE	1
THE SURVEY PROGRAMME	2
Preliminary comments	2
Basic data	3
<u>Present situation</u>	3
Sources of information	3
The historical background	4
Stock-taking of the natural potential	4
Inventory of available technologies	5
Relationships with (or effects on) other elements of the environment	5
Relationships with (or effects on) the components of development	5
Sensitive areas and imbalances	7
Present trends	7
Identification of gaps in knowledge	7
<u>Priority action</u>	7
Comments	7
Information on fresh water in the Mediterranean	8
Training of water resources management specialists	8
New and available technologies	8
ORGANIZATION AND BUDGET	8
Organization	8
Budget	9
ANNEXES	
Annex 1: Form A - Water balance: potential renewable water resources	
Annex 2: Form B - Mobilizable water resources	
Annex 3: Form C - Water withdrawals	
Map of the fresh water catchment area in the Mediterranean (to be provided later).	

SURVEY ON FRESH WATER IN THE MEDITERRANEAN BASIN

INTRODUCTION

1. The Blue Plan is a very important element in the social and economic chapter of the Mediterranean Action Plan (MAP), which contains two other chapters - legal and scientific.
2. The Blue Plan Project, which has been in preparation since October 1975, was discussed and formulated during and after two meetings of experts from Mediterranean coastal States, the United Nations, the specialized agencies and other organizations (Geneva, January 1976, and Paris, May 1976). It was then submitted to the Intergovernmental Meeting of Mediterranean Coastal States held at Split (Yugoslavia) in February 1977, at which it was adopted by all the Governments represented. These Governments also recommended the initiation of the Priority Action Programme as soon as possible, and identified water and soil as priority areas.
3. The first of the three phases of the Blue Plan consists of exploratory work on the present situation with a view to obtaining an over-all picture of trends in the evolution of natural environments as they are affected by the various components of development. This exploratory work will take the form of surveys on a set of topics which are related to one another by interdisciplinary links.
4. Fresh water in the Mediterranean Basin is one of the main topics to be covered in these surveys, which will probably take about one year to complete. The present terms of reference have been prepared on the basis of a preliminary document, by a working group of experts from coastal States (Aix-en-Provence, 21-22 November 1977).

OBJECTIVES AND GEOGRAPHICAL COVERAGE

5. Long-term objective

To identify the risks and constraints which might affect the availability of fresh water (in terms both of quantity and quality) in the light of developments envisaged, and also to cover other aspects of the problem.

6. Immediate objectives

Considering water as an element of the environment and a factor of development:

- (i) to analyse the present situation of fresh water in its relationship with the sea, in the light of the historical background and from the standpoint of on-going processes, sensitive areas, imbalances and development trends;
- (ii) to identify priority measures.

Geographical coverage

7. For the purposes of the Blue Plan, the Mediterranean Basin comprises the Mediterranean Sea (excluding the Sea of Marmora and the Black Sea) and its islands and littoral. The countries concerned with the Blue Plan are the 18 coastal States.

8. For the purposes of the "fresh water" survey, there will be two different limits for the geographical coverage, depending on the objectives to be achieved:

- the natural limit of the catchment areas; and
- a conventional boundary line defined by States.

9. The natural limit of the surface and underground catchment areas includes the maximum geographical area of the Mediterranean basin (hereinafter called the Basin), with the exception of the part of the Nile basin downstream from the Aswan Dam (see attached map). The Basin so delimited covers an area of 4.5 million km<sup>2</sup>, including 2 million km<sup>2</sup> of continental area. Surface and underground flows into or out of the Basin will be taken into account.

10. The conventional boundary line will be fixed by each State in accordance with criteria of its choice. It may, for example, include a Mediterranean zone identified in accordance with climatic, economic or socio-cultural criteria or by major water uses.

11. Within the conventional boundary line, restricted zones or "pockets" may be identified in cases where there is a concentration of development constraints. Such zones may include, for example, all or part of the littoral, depending on the country concerned.

12. In short, the geographical coverage will embrace three different types of zone:

- maximum zone (natural limit of the catchment areas);
- intermediate zone (conventional boundary line fixed by States); and
- restricted zone (areas in which constraints are concentrated).

## THE SURVEY PROGRAMME

### Preliminary comments

13. The terms of reference for the surveys establish a system of analysis designed for prospective thinking; and they all have a common basis, which is the essential link in this first phase of exploratory work (paragraph 3). However, in spite of this common basis, elements of the environment and components of development will be dealt with in different ways. These elements and components are the topics of the surveys; and as each topic has its own particular characteristics, the details of the work involved have to be adapted as necessary. This is why there will be a separate survey for each topic. 1/

14. The rule to be followed in preparing the survey is not to deal with every single aspect of a topic, as would be done in a monograph, but rather to select the data and information that are essential for prospective analysis. The procedure involved, which is similar to that followed in a study, will therefore be convergent, i.e. it will

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1/ The topics selected (17) are: water, soil, air, marine flora and fauna, flora and fauna of Mediterranean coastal areas; mineral and energy resources (sea-bed, littoral), industrialization, urbanization and tourism, agriculture, fisheries and aquaculture, shipping, soft technologies, training and information, transfer of technology, demography (standards of living, quality of life, health); and the social and cultural environment.

consist merely of assembling the information needed to answer the questions raised (paras. 19 to 25). Only global data relating to countries and large areas will be taken into account. The experts will therefore have to exercise their judgement and make the wisest possible choices.

15. The fresh water of the Mediterranean Basin is the mainland water existing in the geographical area of the Basin (para. 9). It will be considered as an element of the natural environment, whether it exists in the solid, liquid or gaseous state, or as precipitation, run-off or evaporation, or in rivers, deltas, lagoons and salt pans, natural and artificial lakes or surface and underground reservoirs. It will be considered also as a component and factor of development from the standpoint of its different uses and consumption purposes, i.e. irrigation, household and drinking, sanitation, industry, hydro-electric power, navigation, leisure activities and fishing, animal reserves and flood and low-water control. It will, lastly, be studied as a vector of contamination and pollution. Other surveys will deal with specific water problems.

#### Basic data

16. A provisional dossier entitled "Basic data on fresh water resources in Mediterranean coastal States" has been prepared <sup>1/</sup> on the basis of published documents. It contains an over-all geographical presentation of fresh water resources in the Mediterranean, and also data sheets showing the groundwater resources of each coastal State. It is accompanied by a map showing average annual potential run-off in the Basin, a map showing the groundwater resources of Mediterranean coastal States and a consolidated table showing the groundwater and surface water resources of Mediterranean countries. It is obvious that, at this preliminary stage, there are some lacunae in the documentation presented in this dossier, and that the information it contains is heterogeneous in the absence of a uniform terminology and methodology and of data on surface water and the quality of water resources.

17. Nevertheless, despite its shortcomings, this dossier represents a point of departure and a working basis which, together with a note on methodology and procedures and a simplified questionnaire for obtaining further information, will be submitted to the experts of each coastal State who will be invited to suggest improvements. When the replies have been analysed, a revised dossier of basic data will be submitted to a seminar of experts from the Mediterranean coastal States. In any case, the dossier of basic data will represent one contribution which can be used directly for the purposes of the survey.

#### Present situation

##### 18. Sources of information

- Listing of public and private agencies in coastal States and of regional agencies, committees and working groups;
- Selected documentation from international agencies: final reports on UNDP water projects and progress reports on on-going projects; UNESCO's work on the arid zone, the International Hydrological Decade, the International Hydrological Programme and MAB; specific studies by the United Nations and various specialized agencies, including FAO, WMO and WHO;

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<sup>1/</sup> By the Centre for International Training in Water Resources Management (CEFIGRE)

- Work of the United Nations Water Conference, held at Mar del Plata;
- Other sources;
- Transmission to water authorities in each country of standard forms (annexes 1 to 3) and a questionnaire (para. 17) on data which are useful for a prospective study and on additional studies which may be considered desirable at the local, national or regional level.

#### 19. The historical background

- The historical study will be limited to the past 100 years - roughly the period for which quantified data are available - and only the past few decades will be taken into account in identifying signs of possible changes;
- The distant past will be referred to only in so far as it helps to explain the present situation;
- In the historical study, changes in human activity must be given priority over changes in climate;
- In the fluctuations in hydrological, ecological and other variables it will be necessary, where possible, to detect any anomalies by comparison with normal variations.

#### 20. Stock-taking of the natural potential

- Summary evaluation of water resources: global data by country, zone or basin; balance-sheet of potential renewable water resources (see form A, annex 1); run-off to the sea; physical, chemical and biological quality; unknowns;
- Mobilization of resources: resources which are exploitable in socio-economic conditions that are acceptable in the context of the development plans of the countries concerned, and with waste water disposal arrangements that are compatible with the biological equilibrium of the environment (see form B, annex 2); proportion of potential resources mobilized, consumed, transferred or degraded;
- Economic aspects: investment costs of large water engineering projects (at 1978 prices); annual operating and maintenance costs for large installations; estimate of investment costs for other installations;
- Institutional and legal aspects: to be dealt with briefly since consolidated reports on these matters have already been published in respect of some coastal States (water rights in Arab and other coastal States); possible preparation of a brief data sheet for each problem;
- Overlapping of technical, economic and institutional aspects: study of the actual application of resource management instruments in various countries with a view to assessing their effectiveness; identification of constraints.

21. Inventory of available technologies (state-of-the-art)

- Data collection techniques: national hydrometeorological, hydrological and piezometric observation networks; relations between national networks; infra-red and satellite photography, etc.;
- Meteorological and hydrological forecasts;
- Engineering, tapping and dewatering;
- New technologies: preparation of data sheets on technologies which can be introduced in the short-term, such as desalination, recycling and regeneration of used water; inventory, by countries, of desalination stations (methods and costs); waste prevention methods;
- Long-distance water transfer and transport.

22. Relationships with (or effects on) other elements of the environment

- Determination of the sensitivity or vulnerability (instability, deterioration thresholds) of various elements of the environment to the effects of human activity;
- Identification of vulnerable points in the environment, and indication of the constraints imposed on development by the conservation of these characteristics of the environment - if their conservation is desired;
- Study of the environment element by element. Some examples are:
  - the soil and landscape: erosion, transport of solid waste, storage in reservoirs, etc.;
  - the subsoil: subsidence caused by the exploitation of underground reservoirs, etc.;
  - marine flora and fauna: effects of the reduction of run-off to the sea, effects of the pollution load, etc.;
  - coastal flora and fauna: lagoons, deltas etc.;
  - the atmosphere.

23. Relationships with (or effects on) the components of development

- Analysis of present demand - demand for water and for waste water disposal facilities - and of the effects on water of the various human activities related to development, including:
  - agriculture;
  - urbanization;
  - industry;

- hydro-electric power;
- power stations;
- navigation;
- fisheries and aquaculture; and
- tourism and leisure activities.
- Inventory of water withdrawals: water demand by use and origin of water (see form C, annex 3).
- Inventory of effects, using the following brief list of variables (with additions in the case of the marine environment):
- Surface water:
  - enlargement of water bodies;
  - water level;
  - total (mean) flow of water courses;
  - frequential flows and variability of flows:
    - physical quality(ies) of the water;
    - chemical quality(ies) of the water;
    - characteristics of water course beds;
- Groundwater:
  - water table level;
  - water table recharge;
  - water table flow (output, input);
  - physical quality of the water;
  - chemical quality(ies) of the water;
  - characteristics of aquifer(s);
- Assessment of effects on development: limiting effects of constraints imposed by environmental protection (if they are respected) - and/or by deterioration of the environment (if they are not respected) - on development (procedures, growth rates).
- Consideration - at the level of the Basin as a whole - of the main effects of resource availabilities on development; identification of shortfalls and disparities.



24. Sensitive areas and imbalances

- A sensitive area may be a geographical zone or an unlocalized mechanism whose balance may be upset and which may then be in imbalance. Sensitive areas are created by development during the processes noted in the survey and will become increasingly evident as development progresses;
- Detection of sensitive areas and imbalances which give rise to problems whose solution can, or may, have regional (inter-country) consequences in the long term;
- Localization (if this is what is required) in the country concerned or in the Basin: general causes and mechanisms; trends towards imbalance; available room for manoeuvre; action to be taken.

25. Present trends

- These will be considered only with respect to sensitive areas and imbalances; they will be classified as: major trends, irreversible processes, imminent dangers and potential risks;
- The survey will also attempt to assemble the scenarios prepared in certain countries with a view to determining their possible consequences and effects;
- Priority will be given to the international rather than the national aspects: an analysis and forecast will be made of the effect of national water policies on the natural environment common to all the coastal States - namely, the Mediterranean.

26. Identification of gaps in knowledge

Where gaps are identified, there will be a specific need for information in quantities sufficient to achieve the objectives of the survey. The gaps will be identified mainly on the basis of the results of those parts of the survey which relate to the historical background and the stock-taking of the natural potential (paras. 19 and 20).

Priority action

27. Comments

In the course of the survey, priority measures will be identified, in the light of the thresholds of deterioration. The possibilities considered will include: prior control measures, conservation of balancing factors, conservation of existing or potential resources, training, dissemination of information throughout the Basin, etc. However, the United Nations Water Conference (Mar del Plata) also stressed, in its recommendations, the need to establish an international data bank for water resources and to establish training programmes for specialists in the management of water resources.

### 28. Information on fresh water in the Mediterranean

The Mar del Plata recommendation could readily be applied to the Mediterranean Basin, where a Mediterranean water data bank might be established. Such a recommendation might be submitted to water experts from coastal States for consideration at a future seminar. Prior to that, a study of methods and costs of disseminating information on water resources in the Mediterranean would be carried out as part of the survey.

### 29. Training of water resource management specialists

The recommendation to this effect made at Mar del Plata also warrants serious consideration since the Mediterranean Basin offers not only a typical framework for developing action of this kind, but also an international training centre which is already fully operational.

### 30. New and available technologies

The survey will describe (para. 21) new and available technologies and will identify techniques that have already been approved or are being tested in the Basin and might be useful to other coastal States. Such techniques might include the tapping of coastal springs of karst origin, the recovery of fresh water lost to the sea from submarine springs of the same origin, the construction of coastal mains for groundwater lost to the sea and the artificial recharge of underground reservoirs on the coast by recycled water or water lost to the sea.

State-of-the-art reports on certain technologies might be prepared as supplements to the survey.

## ORGANIZATION AND BUDGET

### Organization

31. The survey is planned to last one year, starting in January 1978. Its results will be set forth in a final report, whose outline will be finalized at a forthcoming seminar of water experts from the coastal States.

32. The survey will be conducted by two experts to be designated one from the South and one from the North, in order to take into account problems of disparities. The experts will work in liaison with UNEP Group of Co-ordination and Synthesis; they will make use of the services of coastal States through a national focal point, and of the documentation of international organizations through UNDP resident representatives. The two experts designated will establish their work programme on the basis of the timetable given in the following paragraph.

33. The survey will be conducted in accordance with the following timetable:

January - March 1978	:	survey
April 1978	:	orientation seminar and interim report
May - September 1978	:	continuation of survey
End September 1978	:	draft of final report and final seminar
November 1978	:	final report.

34. The work involved in the survey might be allocated roughly as follows:

(a) National services of the coastal States: fixing of the conventional boundary line of the Mediterranean area and of more restricted zones or "pockets" on the coast (paras. 10 and 11); inventory of useful basic data and of information necessary for prospective analysis (para. 17); listing of national agencies (para. 18); detection of major anomalies by a study of the historical background (para. 19); historical analysis of out-of-the-ordinary events (para. 19); stock-taking of the natural potential and replies to the standard forms contained in annexes 1 to 3 (para. 20); description of present trends (para. 25); identification of priority measures (para. 27); and reports on specific coastal zones where constraints on water and development are concentrated (para. 11).

(b) International agencies: selected documentation on UNDP water projects; work by UNESCO on the International Hydrological Decade, the arid zone and MAB; studies by the United Nations and various specialized agencies, including FAO, WMO and WHO; critical analysis of final reports on UNDP projects (para. 18).

(c) The two designated experts: inventory of available technologies (para. 21); studies of relationships with other elements of the environment and with the components of development (paras. 22 and 23); identification and evaluation of imbalances and sensitive areas (para. 24); other aspects of the survey which are left to the judgement and responsibility of the experts, including in particular the identification of priority measures (para. 27).

(d) Group of Co-ordination and Synthesis: linking of the survey on "Fresh water" with the other surveys; co-ordination and technical supervision of the survey; preparation of a statement of problems specific to water for prospective study.

(e) Seminars: apart from giving scientific advice, and acting as centres for reflection, they should consider the basic data (para. 17), identify gaps in knowledge about water (para. 26), and priority measures (paras. 28 to 30); and also evaluate the final report of the survey and the statement of problems for prospective analysis.

(f) Centre for International Training in Water Resources Management (CEFIGRE): preparation of the supplements to the survey and, in particular, the basic data (paras. 16 and 17); investigation of the quality of fresh water flowing into the sea; study of methods and costs of disseminating information on water in the Mediterranean (para. 28); study of a training project for water management specialists from the coastal States (para. 29); state-of-the-art reports on certain technologies (para. 30); and a monograph on urban waste water disposal and sanitation (possibly in co-operation with the United Towns Organization).

#### Budget

35. The sources of finance for the survey are primarily the appropriations earmarked for the Blue Plan (contributions from the coastal States and UNEP) and, secondarily, cash contributions from CEFIGRE and UNDP. Also, the coastal States and some international organizations such as UNESCO and FAO are expected to make a contribution in kind. Requirements for contributions in cash and in kind are listed below:

36. Cash contributions from the Blue Plan

	<u>man/months</u>	<u>\$US</u>
Experts (2)	14	35 000
Consultations (n)	4	10 000
Travel and subsistence expenses	-	10 000
Interim report (1)	-	5 000
		<hr/>
Total: <sup>1/</sup>		60 000
		<hr/>

37. Other cash contributions

UNDP may possibly make a contribution to the survey by assuming responsibility for the selective documentation and the critical analysis of UNDP reports on water.

	<u>man/months</u>	<u>\$US</u>
Consultants	4	10 000
Travel and subsistence expenses	-	5 000
		<hr/>
Total:		15 000
		<hr/>

CEFIGRE will make a contribution to the survey by assuming responsibility for all the "supplements" to the survey, as indicated in paragraph 34(f).

38. Contributions in kind

The coastal States could contribute to the survey by providing the services of an expert for one month to undertake the activities referred to under "Organization" (paragraph 34(a)). In addition, UNESCO and FAO could undertake the activities mentioned in paragraph 34(b); using the services (1 man/month) of their regional water expert based in Cairo. These contributions would amount to:

Coastal States	:	12 man/months
UNESCO	:	1 man/month
FAO	:	1 man/month
		<hr/>
Total	:	14 man/months
		<hr/>

<sup>1/</sup> Publication of the final report will be undertaken by the UNEP/Blue Plan secretariat; the experts' subsistence expenses be reimbursed on the basis of the scales applied in the United Nations.

Form A

WATER BALANCE: POTENTIAL RENEWABLE WATER RESOURCES

Annex 1

Country: \_\_\_\_\_

Total area: \_\_\_\_\_ km<sup>2</sup>

Physical coverage of balance sheet:  
Country/region/basin: \_\_\_\_\_

of which:  
Exorheic \_\_\_\_\_ km<sup>2</sup>  
Endorheic \_\_\_\_\_ km<sup>2</sup>

Balance sheet components: average annual natural flows in 10<sup>9</sup>m<sup>3</sup> per year  
Period: \_\_\_\_\_

INPUTS/INFLOWS	LOSSES/OUTFLOWS																
<p>- Precipitation (P) _____</p> <p>- Total potential inflow (P-E)=A _____ (= effective inputs or precipitation) of which:</p> <p>- potential surface inflow (= runoff) (R) _____</p> <p>- potential subsurface inflow (= infiltration) (I) _____ (I = aquifer recharge by infiltration of part of P)</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">R + I = A</div> <p>- Total imported inflow IM _____ of which:</p> <p>- Imported surface inflow IMr _____</p> <p>- Imported subsurface inflow IMs _____</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">IMr + IMs = IM</div>	<p>- Actual evapotranspiration (E) _____ (sum of actual local evapotranspiration figures, calculated)*</p> <p>- Total flow deficit (D) _____ D= P-Q</p> <p>- Total outflow (Q) _____ of which:</p> <p>- Natural surface outflow (measured and extrapolated QR consisting of two components:</p> <p>- Surface runoff (QRr) _____</p> <p>- Subsurface outflow QRs _____</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">QRr + QRs = QR</div> <p>- Underground outflow QS (concealed subsurface outflow, calculated)</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">QR + QS = Q</div> <p>Breakdown of total outflow Q</p> <table border="1" style="width:100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th></th> <th>Outflow to the sea</th> <th>Exported</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>QR</td> <td>_____</td> <td>_____</td> <td>_____</td> </tr> <tr> <td>QS</td> <td>_____</td> <td>_____</td> <td>_____</td> </tr> <tr> <td>Q</td> <td>Qs _____</td> <td>Qex _____</td> <td>_____</td> </tr> </tbody> </table>		Outflow to the sea	Exported	Total	QR	_____	_____	_____	QS	_____	_____	_____	Q	Qs _____	Qex _____	_____
	Outflow to the sea	Exported	Total														
QR	_____	_____	_____														
QS	_____	_____	_____														
Q	Qs _____	Qex _____	_____														
<p>P + IM = Q + D</p>																	

Total potential renewable water resources = A + IM  
Proportion imported:  $\frac{IM}{A + IM} \times 100 = \%$

\*/ E may differ from D not only if IM is not negligible, but also if (Q - IM) ≠ A, i.e. if part of A (of R and/or I) can also be saved from loss by evaporation. D then stands for global actual evapotranspiration (as is the case particularly in semi-arid or arid zones).

Form B

MOBILIZABLE WATER RESOURCES

Annex 2

Country/region/basin:

Date of estimate:  
Date of projection:

1. Mobilizable renewable resources/average annual flows (at present date)

1.1. Exploitable part of total potential internal inflow (A)  
(including flows from which specific volumes are reserved for  
a downstream country or region)

$q_1$ :  $m^3$  per year                      % of A:

of which: surface water\*  $q_{1r}$ :

groundwater\*  $q_{1s}$ :

(\* proportions of  $q_1$  which can be mobilized by surface  
tapping or regulation ( $q_{1r}$ ), or by underground tapping  
( $q_{1s}$ ); their relation to R and I is of no significance)

1.2. Mobilizable part of imported flows (IM) (taking into account possible  
reservations by the upstream country or region)

$q_2$ :  $m^3$  per year                      % of IM:

1.3. Total mobilizable renewable resources

$q_1 + q_2$ :                                      % of (A + IM):

1.4. Reservoir volume necessary for mobilizing average exploitable  
resources  $q_1 + q_2$

- Surface storage:  
(usable sections)                               $10^9 m^3$

- Annual usable portion  
of aquifer reservoirs                               $10^9 m^3$

2. Mobilizable non-renewable resources (reserves)

- Total estimated volume:  
(depending on maximum  
acceptable drawdown)                               $10^9 m^3$

- Hypothetical life of reserves:  
(prospective)                                      years

- Mobilizable resources available  
on this hypothesis (average flow):                               $m^3$  per year

Form C

WATER WITHDRAWALS

Annex 3

Country:

Scope of survey:  
Country/region/basin:

Population:  $10^6$  inhabitants  
Date:

1. Volumes of water withdrawn  $Q$  in  $10^6 \text{ m}^3$  per year  
Actual or prospective date:

Demand (by type of use)	Origin of water (fresh)						Total	Percentage of total	Brackish water or mainland salt water $Q$	Sea water $Q$
	Surface water		Spring water		Ground- water					
	$Q$	%	$Q$	%	$Q$	%				
1. Drinking water (public and domestic use)										
2. Industries with own water supply										
3. Power stations										
4. Agriculture and stock- breeding										
TOTAL		100		100		100		100		

2. Proportion of demand covered by fresh water from each origin:

Demand	Origin of water			TOTAL
	Surface water %	Spring water %	Groundwater %	
1.				100
2.				100
3.				100
4.				100
TOTAL				100