Chapter 5

WATER MANAGEMENT

5.1 Current water resources

Aspects of the water balance

The Republic of Moldova is located in a region of insufficient precipitation and has limited water resources. The average annual air temperature across the territory is +8° to +10° C. Average annual precipitation is 370 mm in the south and 560 mm in the north. Medium and moderate droughts (respectively 70% and 90% of normal rainfall) have been reported 40% of the time over the past 50 years; severe droughts (less than 45% normal rainfalls) 4% of the time only.

The available overall aquatic resources are 6.3 billion m^3 in a typical year, 4.9 billion m^3 in a dry year and 3.4 billion m^3 in an extremely droughty year. About 3.2 billion m^3 of water are needed annually for all national economic sectors and for the supply of drinking water - of which about 2 billion m^3 are used at the Moldovan Thermal Power Plant (Dnestrovsc power plant, see Chapter 9). The rest (1.2 billion m^3) is used as follows: 63% for agriculture, 15% for household water supply, 14% for industry and 8% for building, transport and other uses (see Figure 5.1). The Republic draws 56% of its water from the Dniester River, 16% from the Prut River, 8% from small rivers and 20% from underground resources (these data do not include phreatic water sources from rural regions; see Figure 5.2).

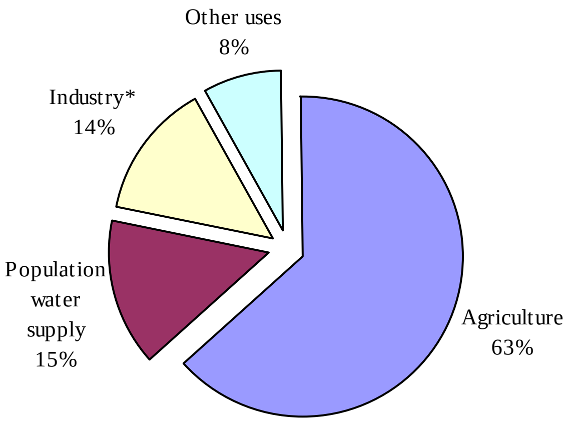
Precipitation

The rainfalls, especially the abundant ones (80%), are highly variable in time and space. The probability of short, intense torrential rains of 1-2 mm/min is 67%, and of 2-3 mm/min is 26%. The damage caused by torrential rains can be considerable, as in 1994, when GDP decreased by 31.2% as a result of drought followed by heavy rainfalls and floods.

Surface waters

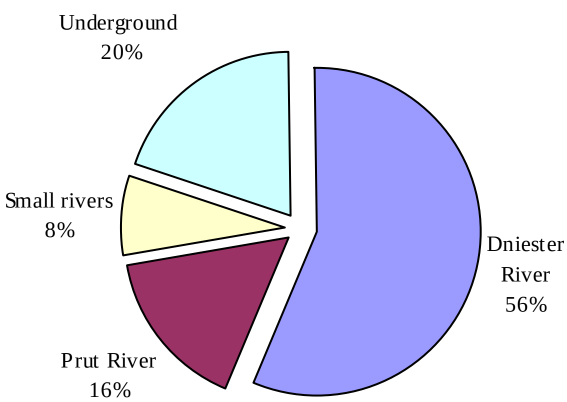
All Moldovan rivers are part of the Black Sea basin and flow from the north-west to the south-east (see map in Chapter Introduction). The country's water

Figure 5.1: Water use by different consumers, 1993



Source: The Department for Environmental Protection and the National Institute of Ecology
* Water use from the energy sector (cooling water) is excluded; it represents 50-60% of the country's overall water use.

Figure 5.2: Water sources



Source: The Department for Environmental Protection and the National Institute of Ecology.

network consists of the Dniester and Prut river systems, the rivers flowing into the Danube lakes, and the lakes in the vicinity of the Black Sea. There are 3 200 big and small rivers, permanent and temporary streams, of which only 9 are longer than 100 km. The flow of small rivers decreases in summer, sometimes drying up completely. The most intense floods take place in summer during the torrential rain season.

There are 57 lakes with a total surface of 62.2 km^2. Small lakes of under 0.2 km^2 prevail. Besides natural lakes, there are about 3 500 ponds and reservoirs, with a total volume of 1.8 km^3 and a surface of 333 km^2. Only 10% of all basins have a volume above 1 million m^3. Out of the 82 artificial water reservoirs, 75 have a capacity of 1 to 5 million m^3.

Groundwater

Groundwater resources are not uniformly distributed over the territory. The main water reserves are located in the Dniester river underlying aquifer. Moving further away from the river, the water supply of the water table decreases. Groundwater is extracted from the Cretaceous and Silurian formations (protozoic age), Baden Sarmatian, middle Sarmatian, upper Sarmatian (Neocene formations), and Meotian and Pontian geological layers.

Of the more than 200 water deposits discovered in Moldova, only half are being exploited. The degree of confirmed groundwater use is low compared with other countries and does not exceed 40%. The supplies of underground fresh and saline waters are estimated to be approximately 3-3.2 million m^3/24 hours, of which drinking water makes up 1.7 million m^3/24 hours. The extract table reserves of artesian waters are 2.1 million m^3/24 hours and the total estimated reserves are 3.4 million m^3/24 hours.

Water supply and use

The daily quantity of public drinking-water supply is 849 000 m^3. The data on water use in the economy of the Republic shown in Table 5.1 indicate a general downward trend in different sectors of the national economy. A matter of great concern is the centralized supply of drinking water because of the uneven distribution of water reservoirs on the territory and because its quality does not meet existing national standards (so far still GOST standards), especially in the south, where it has a high content of fluorine, nitrates, sulphur hydrogen and other elements.

In 1994, about 1 585 million m^3 of water abstracted from underground sources or received through central water-supply pipes were used in industry (this includes cooling water for the energy sector). Water for topping up industrial recycling systems amounts to about 800 million m^3 annually.

The main sources of drinking-water supply are the rivers Dniester and Prut, 600 springs, 6 600 artesian wells and 123 000 wells. In the future, the Danube River will also be used for water supply in the southern districts of the country. At present, water from the Dniester, Prut and Danube rivers does not meet drinking-water quality standards. River water can be used for drinking-water supply only after intensive purification, using methods based on decantation, filtration, coagulation, adsorption, oxidation and disinfection.

5.2 Water quality and waste-water treatment

There is no unified water quality monitoring system or practice in Moldova. The division of utilization, control and management functions by various entities (ministries, departments, commissions with various

Table 5.1: Water management indices

million cubic metres/year

	1985	1990	1991	1992	1993	1994	1995	1996
Water abstraction								
Total	3,647	3,827	2,981	3,026	2,622	2,559	1,889	1,766
Underground	274	312	302	283	276	..	..	..
Water utilization								
Industry	2,676	2,523	2,198	1,918	1,773	1,585	1,139	1,173
Irrigation	643	898	388	657	481	621	402	274
Agriculture	114	135	125	118	110	100	87	80
Recycling systems	766	977	947	906	788	630	558	502

Source: Statistical Yearbook, 1994 and The Republic of Moldova on the way of sustainable development, Arcadie M. Capcelea, 1996 interests) is a tradition from the former Soviet institutions. The actual situation in natural resource management and control is confusing and the system needs to be completely overhauled.

Surface water quality is classified into 4 classes, from class I (good quality) and II (moderately polluted), to class III (polluted) and IV (very polluted) for low-quality waters. The water quality of the Dniester and Prut rivers, as well as of the lakes and reservoirs, is generally satisfactory and in line with the quality standards in force. The mineralization of water increases from 290-450 mg/l total dissolved solids in the upper reaches of the Dniester (Otaci section) to 365-578 mg/l in the Olanesti section. In comparison with the 1950s, the mineralization of Dniester water has increased by 50%. A characteristic of the Dniester and Moldova's other rivers is their high turbidity. For example, in 1993, the average annual turbidity in the Olanesti section was 462 mg/l TU.

During the past two decades, concentrations of nitrogen and phosphorus have increased to 10 mg/l and 0.2 mg/l, respectively. These two levels do not exceed the standard limits for drinking-water supply, but they are rather high and are causing eutrophication, particularly in the Dubasari water basin. Downstream from Soroca, Camenca, Bender and Tiraspol, ammonia (up to 0.7 mg/l) and nitrogen (up to 0.2 mg/l) can be found as a result of residual water overflow that is insufficiently treated. Also, increasing quantities of petroleum substances (0.08 mg/l), phenols (0.02 mg/l) and detergents (0.06 mg/l) have been recorded.

The concentration of heavy metals accumulated on the bed of the Dubasari reservoir exceeds 400 times their concentration in the upstream river water, which is otherwise acceptable. The bacteriological analyses of Dniester water have detected 1.10^2 to 2.10^3 faecal coliform germs per 100 ml, reaching 2.10^3 - 2.10^4 per 100 ml in some places. On the whole, the water of the Dniester River is moderately polluted (i.e. class II), but is polluted at the confluence with the rivers Raut and Bac (i.e. quality class III).

Prut water is especially polluted by organic substances. Its level of microbial infection is quite high: the total number of faecal coliform bacteria is 3.10^5 per 100 ml at Ungheni, 2.5. 10^5 per 100 ml at Leova and Giurgiulesti. Retroviruses are periodically found (in 1994 at Leuseni and Cahul). The water of the river Prut generally falls into the class of moderately polluted water, but downstream from Ungheni, the water is polluted, even reaching the category 'strongly polluted' (i.e. class IV) near Valea Mare. The water of most small rivers falls between the classes 'polluted' and 'strongly polluted'.

From the total quantity of groundwater, only 25% can be used for economic purposes without pretreatment, because of the generally high mineralization (2.5-3 g/l), naturally high content of fluorine (5-15 mg/l), and high concentrations of ammonia nitrogen (15-20 mg/l), hydrogen sulphide and methane (up to 10 mg/l). The artesian groundwaters have so far not been seriously polluted by anthropogenic sources thanks to their surface insulation with protecting layers.

By contrast, phreatic waters undergo intensive anthropogenic pollution mainly from nitrates (in some places up to 1 000-2 000 mg/l), the main sources being livestock complexes and farms, rural settlements not equipped with sewer systems, uncontrolled waste disposal, and excess use of mineral fertilizers.

A major problem in the effort to manage water resources is to ensure adequate drinking water and waste-water collection and treatment. The Ministry of Health (MoH) has recorded an overall marked deterioration in the quality of drinking water (see Chapter 11, Table 11.3). Groundwaters under 60% of the country's territory do not satisfy drinking-water requirements. Half the drinking-water supplies from groundwater in the Prut basin have nitrate concentrations in excess of 45 mg/l (which is the Moldovan standard value, the WHO guideline being 50 mg/l). The drinking water in a good half of the village wells is estimated to be polluted with agricultural chemicals or their decay products. The tendency of well water to become polluted is evident. While, in 1985, the proportion of wells with nitrate levels above the established standards was 21%, in 1996 it was nearly 60%, showing a sharp rise. The same is true of artesian boreholes, although on a much smaller scale. In 1985 only 1.7% of the boreholes produced water with an excess nitrate content, in 1990 3.9%.

In some regions, the percentage of water samples exceeding health-related and chemical standards is very high (96% in Ciadir Lunga, 78% in Calarasi, 75% in Falesti and 71% in Slobozia). Monitoring data from natural springs and fountains indicated that 69% of samples contained nitrates and ammonium nitrogen in 1993, compared to 62% in 1991 and 60% in 1992. See also Chapter 11 for the overall situation in more recent years.

The capacity of water-supply treatment plants to produce drinking water is 391 million m^3 per year, of which 310 million m^3/year are supplied in a centralized way. The water is distributed through a network of aqueducts 4 081 km long.

Domestic sewage and waste water from industrial and other economic activities are a major source of surface and groundwater pollution. About 70% of the population is connected to municipal waste-water treatment plants, but most of the villages discharge their waste water without treatment. The total installed capacity for waste-water treatment is about 650 million m^3/y, which includes 35 municipal waste-water treatment installations with a total capacity of 336.5 million m^3 per year. The plants are designed to reach a 60-70% reduction in biological oxygen demand (BOD). In 1993, only 60% of the installations were functioning and there is no indication that the situation has improved since. They do not work for a variety of reasons:

- many industries have stopped production because of the recession;
- maintenance and repair are too costly;
- many municipal waste-water treatment facilities have been overloaded by heavy metals because some industrial facilities do not work properly;
- in some rural areas, facilities have stopped operation because their technical lifetime has been exceeded.

The annual quantity of residual domestic waste water was 280 million m^3 in 1993, i.e. 90.3% of the total drinking water supplied to consumers. Annually, about 50 million m^3 of this water is purified, some 88-90% up to the required standards. The pollution standards for residual waste water are in some cases ignored because of the limited capacity of some treatment plants compared to the high amount of discharges (Cantemir, Sangerei, Dubasari) and the high pollution load (Orhei, Nisporeni, Cantemir).

In the Republic of Moldova, like in other countries, the water system serves as a recipient for the drainage and discharge of waste water from different sectors of the national economy. In 1994, 350 million m^3 of used and residual water flowed into the water network, including 182 million m^3 of water purified up to the required standards at treatment plants, 160 million m^3 of insufficiently purified water, and 8 million m^3 of untreated and highly polluted waste water. It can be assumed that this picture has not greatly improved in recent years, although the continuing recession account for some reduction in industrial waste-water generation. At the same time, it is likely that treatment efficiency and other investment-dependent indicators have deteriorated further.

Agricultural activities greatly influence the environmental quality of the Republic (see Chapter 8). In 1994, 621 million m^3 of water were used to irrigate 310 000 ha of land. These water quantities were comparable to those used in 1985 (see Table 5.1), which were said unnecessarily high at that time. Moreover, the efficiency of irrigation fell by 77.35% between 1978 and 1985, which means a 40% rise in water use. The consequences of these practices are aggravated by the scarcity of resources in the irrigated areas. However, it seems that in 1995 the surface of irrigated land was reduced to 170 000 ha, sprinkler irrigation being used on 48% of the total. The current recession and the transition have also led to a considerable decrease in the use of pesticides and organic and nutritive substances (see Table 5.2).

Table 5.2: Mineral and organic fertilizer used in agricultural enterprises

1 000 tonne

		1991	1992	1993	1994	1995
Mineral fertilizers		**191.4**	**127.6**	**36.2**	**12.1**	**11.2**
of which:	Nitrate	82.7	61.8	20.2	8.5	9.6
	Phosphate	75.2	43.4	10.6	2.4	1.1
	Potash	33.5	22.4	5.4	1.2	0.5
Organic fertilizer		**8,600**	**5,300**	**3,100**	**1,400**	**1,500**

Source: Statistical Yearbook, 1994

Cattle breeding has a particularly important impact on the environment. In 1994, it used about 40 million m^3 a year of groundwater (50% less than during 1985-1990). Till the 1990s about 10 million

m^3 of liquid waste (e.g. manure) with a high content of salts, organic substances, pathogenic micro-organisms, etc., were applied as organic fertilizer. This quantity drastically reduced since then (see Table 5.2) The long-term storage of these livestock wastes in reservoirs without adequate protection for leakage (not reinforced with concrete) has caused infiltration into groundwaters, entailing chemical and biological pollution.

The industries that, in spite of the decline in industrial activity, still have a major impact on the environment are sugar factories, poultry farms and dairies, electroplating shops and a few tanneries, chemical and textile plants. About 50 million m^3 of industrial water are discharged to surface waters with or without treatment, of which about 40 million m^3 are reported to be polluted above the standards. Many industrial establishments are connected to municipal treatment plants. Connected industries are required to have pretreatment facilities. At least 50 industrial waste-water plants have been constructed, but many of the industries do not use them or do not maintain them in good condition. The absence of detoxifying pretreatment for waste water discharged from galvanic shops leads to an excess of heavy metals in municipal waste-water treatment plants, undermining biological treatment.

5.3 Environmental management of water issues

Policy objectives and legislation

The targets defined in NEAP, and taken from the 1987 "Comprehensive Long-term Programme for Environmental Protection and the Rational Use of Natural Resources", that are relevant for water management are:

- Consolidation of the monitoring and laboratory systems, and upgrading of their technical capacity;
- Adoption of realistic interim environmental standards, in particular for water quality, as a basis for regulatory and investment strategies;
- Implementation of a professional development programme for staff of control authorities;
- Evaluation of water resources and use, and assessment of water quality and sources of pollution nationwide;
- Design of an integrated master plan for all aspects of water resources management;
- Implementation of studies to identify and rank water quality hot spots in terms of levels and types of pollution and of human exposure;
- Replacing, for purposes of water supply, water that fails to meet applicable standards with piped water from alternative clean sources.

Apele Moldovei commissioned a study on a "National Water Resources Management Strategy". The study was entrusted to foreign consultants and was finished in 1997. It shows detailed options for the future.

The legislative framework for water management contains the following laws:

- Law on Environment Protection (1993)
- Water Code (1993)
- Underground Resources Code (1993)
- Law on Protection of Riparian Zones (1995)
- Law on Ecological Expert Evaluation and the Evaluation of Impact on the Environment (1996)
- Law on Natural Resources (1997)
- Governmental Decision on confirmation of the Complex Scheme of Water Supply and Waste Water Discharge up to 2005 (1994).
- Draft law on potable water

Institutional arrangements

In the water sector, four different State bodies deal with various aspects of environmental management: the Department for Environment Protection (DEP), the Ministry of Health, the Ministry of Agriculture and Food and the Association Geologia of Moldova (AgeoM).

Water management in DEP is performed by:

- The State Ecological Inspectorate and its zoned agencies which monitor the State of water bodies in accordance with control plans, and in cases of evidence of wilful or accidental pollution;
- The Hydrometeorological Service with its network of laboratories on the territory;
- The National Institute of Ecology.

The Ministry of Health analyses water quality through the Republic's Centre for Hygiene and Epidemiology. Till two years ago, the Ministry of Agriculture and Food relied on monitoring institutions subordinated to the State Management Committee ACVA, such as the Moldovan Institute for Research on Water and Land Improvement, the Association of Danube-Dniester Water Management, and the Hydrogeological Centre for Soil Amelioration. In 1995, ACVA became an independent body named “Apelei Moldovei” in charge of water management.

AgeoM and its Central Analytical Laboratory monitor and assess surface and groundwaters.

Utilization, control and management functions are divided amongst the various above-mentioned partners. For example, water resources are exploited by economic agents of the Ministry of Agriculture and Food, of industry, of communal services, while State control is performed by the DEP and Apele Moldovei. Underground resources are managed and monitored by AgeoM,, DEP and local authorities.

Regulatory instruments

Moldova applies a combination of command-and-control and economic instruments to achieve compliance with environmental regulations. Permitting and compliance reviews are conducted by the State Ecological Inspectorate. The right to impose administrative penalties for the violation of ecological legislation has been introduced.

Environmental impact assessments and expert surveys of project documentation play an important role in minimizing the damage caused by the construction of different facilities, and in predicting the environmental changes that they will cause. These studies must be submitted, with the whole package of project documentation, to the State Ecological Expertise Unit. (For a full description of the procedure, see Chapter 1.)

The Government Decision “On the Regulation of Some Types of Activities in the Republic of Moldova” of 1995 stipulates, *inter alia*, that the exploitation of underground resources requires Government approval.

Economic instruments

Economic instruments affect both public revenues and public expenditures. The Law on Environmental Protection and the Law on Natural Resources introduces a number of instruments on the revenue side which apply specifically to water (see Chapter 2).

Payments for the use of water resources are made in accordance with Government Decision No. 262 of May 1994. The levels of charges depend on whether the water concerned is drawn from rivers or from underground resources. They also differ according to the purpose of the use. For instance, the rate is lower for water used as cooling water for electricity generation, for irrigation or fisheries. The rates are valid for water use within the limits of established water consumption quotas, established by Apele Moldovei and the Danube-Dniester Basin Inspectorate. In excess of these quotas, the rates increase drastically. More details are given on this issue in Chapter 2.

Payments for the pollution of water resources depend on the type and level of toxic pollutants that are present in the waste water that is discharged into sewers or into nature. Payments rise progressively when discharges exceed the set limits. Although payments for pollution are obligatory for all economic actors, only enterprises and organizations located in Chisinau have actually paid up. Even here, the sums paid often represent only a small part of the payments due.

Public environmental protection expenditures have been rather stable since 1985, with a total volume of investments in the range of 1.5%-2.0% of GDP. Environmental protection investments totalled 11.65 million Lei in 1995. Of this amount, 6.72 million Lei were used for the protection of water resources, i.e. 58% of the total capital invested. The funds came essentially from enterprises (67.7%) and the State budget (28%). As shown in Chapter 2, Table 2.6, capital investments have mainly benefited water and soil protection, in almost equal shares and representing about half the amount of total capital investments for environmental protection. The National Strategic Action Plan for Environmental

Protection shows the planned allocation of financial resources for the next 10 years (see Table 5.3).

Table 5.3: Financial possibilities for environmental protection in the implementation of NSAPEP

million Lei (1992 prices)

	1995		2000		2005	
Versions	**Pessim.**	**Optimis.**	**Pessim.**	**Optimis.**	**Pessim.**	**Optimis.**
GDP	1,970	2,150	2,484	3,320	3,300	5,600
Share of environmental protection *(%)*	3	3	4	4	5	5
Availability of funds for environmental protection						
Overall environment	5.91	6.45	9.94	13.30	16.50	28.00
of which to:						
Land	1.70	1.85	3.61	4.84	6.01	10.19
Water	3.54	3.87	5.32	7.12	8.82	14.99
Atmospheric air	0.46	0.50	0.34	0.45	0.56	0.95
Mineral raw materials	0.20	0.22	0.64	0.85	1.06	1.79
Forest	0.01	0.01	0.03	0.04	0.05	0.08

Source: NSAPEP, 1995

Proposals for funding a new project are forwarded by local and/or central public authorities. Project allocation is not based on cost-benefit criteria, though optimal selection would be very important in times of budget deficits. Economic analysis is restricted to an expense assessment. There is no in-depth analysis because the proposed project does not provide the necessary information.

During the drawing-up of the investment plan, specialists essentially strive to coordinate the list of accepted objectives with the applicants, the Ministries of the Economy and Finance and the Government. Then the selected projects with their budgets are included in the investment plans, prepared by the respective unit of the Ministry of Economy and approved by the Government. Only at that stage can the project be carried out. In practice, even when the necessary funds are available, the lack of materials, technical building capacity, equipment, and specialists make it impossible to go ahead with the projects. In such situations, funds are re-allocated, deadlines delayed. When a project does go ahead, the result is faulty design and building, slapdash work, unfinished units put into operation and, ultimately, insufficient exploitation and further costly investments to correct deficiencies.

As explained in Chapter 3, Moldova participates in a number of international agreements in relation with water management and management of transboundary watercourses. In 1994, the Government of Moldova, together with foreign partners including the World Bank, prepared a three-year draft public investment programme. It is designed to seek both internal and external sources of finance. Five projects included in the programme relate to the improvement of water-supply systems for a number of major towns and neighbouring villages. This improvement is a high priority for the Government. Total resources required for the completion of the five projects were estimated at US$ 41.9 million in 1994. The proposed core projects for 1995-1997 are:

Chok-Maidan water intake in Comrat: The justification for the project are the large deficit in supply, and the poor quality of water for the city of Comrat. Cost of investment: US$ 2 138 000, with 3% completed by 1 March 1995.

Water-supply system for the town of Kainar: The existing source of water supply does not meet the standards required for drinking water. At present, the water can be used only for industrial purposes. It is considered one of the town's most urgent problems. Cost of investment: US$ 3 million (completed).

Water-supply systems for the cities of Ungheni, Kalarash and Bucovest: At present, Ungheni is supplied with only 60% of its needs, while Bucovets and neighbouring villages do not receive more than 12% of their requirements. Cost of investment: US$ 22 million (in progress).

Water supply for the Leovo Region: The objective is to improve the water supply to 37 settlements, which is currently not fit for human consumption. Cost of investment: US$ 21 375.

Water supply for the town of Telenesht and neighbouring villages: The proposed water-supply system will provide clean drinking water from the Dniester-Soroca-Belts supply network, replacing the current groundwater supply. Cost of investment: US$ 8 550 000.

In addition to the five core projects, the upgrading of the *water-supply system of Kahul* is also included in the programme. Its present system was designed in 1974 as a temporary scheme. It can meet household needs for no more than 5 hours a day. Cost: US$ 1 261 000. The World Bank is preparing other projects under the umbrella of international assistance.

As regards other foreign assistance for environmental management, the TACIS programme disbursed a grant for training courses for Moldovan experts, in view of the harmonization of ecological legislation between Moldova and EU, and the planning of environmental projects. In 1997, the European Bank for Reconstruction and Development (EBRD) provided a loan of US$ 29 million to the Chisinau Water Services Company for its modernization project.

5.4 Conclusions and recommendations

Moldova's water management authorities are sustaining a considerable effort to plan and design an infrastructure that corresponds to the needs of a market economy. They are doing this in difficult conditions, as the economy is going through a transition and recession, and the country tries to strengthen its independence. The task being truly enormous, it has to proceed in stages. The current objective of overriding importance to water resource management is covering the maintenance and operating costs of the water-supply facilities.

In general, to improve the situation with regard to water resources, the following issues need to be addressed: (a) the overall poor quality of water resources, (b) the supply of drinking water to the rural population in accordance with established standards, (c) the installation of sewers and waste-water treatment plants also in industry, (d) cost recovery, tariffs, and sustainability of water resource developments, (e) strengthening of institutional capacity in planning methodologies and in efficient management techniques, (f) watershed protection, (g) developing curricula at university level for water resources management, and increasing the qualification of water management staff especially within local authorities.

Recommendation 5.1:
The existing water supply programmes should be updated, alternative sources of supply should be included, and the involvement of local authorities should be increased.

To solve the problems involved, a number of other recommendations could be implemented in the near future. The EPR team concentrated on improvements which do not undermine the country's prime objective, but could be implemented at relatively little cost, while fitting into the overall objectives and priority tasks.

A first major problem, of which the Moldovan authorities are very aware, centres on the assessment of water's true production costs. It is an absolute priority in the light of national water resource management objectives. Water abstraction, treatment and supply, waste-water collection and sewer systems, waste-water treatment plants and their final discharge all give rise to costs, which need to be properly assessed. The lower the operating efficiency of the equipment in the different phases, the more important this assessment. A very big effort should be made to recover the cost of operating and maintaining water facilities. As energy costs increase, the capacity of water users to pay for water will be further eroded. This situation requires the formulation of an adequate tariff policy at the national level. Moldova's water management authorities are truly willing to solve these problems, also through international cooperation.

Recommendation 5.2:
The assessment of the costs of water abstraction and supply, waste-water collection, treatment and discharge should be seen as a priority for Moldova's water resource management. It is essential for revising the national water tariff policy. The assessment should include all economic costs related to the operation of all relevant technical installations, their maintenance and their replacement.

The allocation of funds to different parts of the water management system does not appear to be optimal. The blurred delineation between authorities and agencies involved in the control and management of water resources reduces the efficiency of the system as a whole. Solving this administrative deficiency appears to require the elevation of the status of the environmental administration, before operational cooperation routines can be developed. Such routines should make full use of the existing provisions for environmental impact evaluation (EIE) with the full involvement of NGOs (see recommendation 1.8, Chapter 1).

To improve the management of water resources, each river basin should be managed by its own authority under the "umbrella" of an appropriate national body. Basin-specific authorities should control water abstraction, the quality of return flows, pollution prevention, and operation and maintenance of the water management infrastructure.

Recommendation 5.3:
As a precondition for the implementation of effective cooperation between all administrations involved, water management should be represented at ministerial level as part of overall environmental management. Separating policy authority from actual exploitation activities is advisable. River basin administrative units should be created for each basin. Cooperation should be extended to NGOs in the context of EIEs. See also Recommendation 1.3.

The monitoring system is facing a complex situation and is not able to carry out all its tasks. The tasks and mandates of the authorities involved are in any case not clearly defined. One result of this state of affairs is the low rate of actually collected charges, taxes and penalties for water use and pollution. However, if the quality and coverage of the monitoring data improved, they could become the basis for planning and implementing strategies and projects more efficiently. In any case, an efficient monitoring and evaluation network is needed to prevent and control pollution. Upgrading the system of laboratories and strengthening the capability of staff to produce reliable data will initially require additional funds.

Recommendation 5.4:
The necessary streamlining of the monitoring system between the different partners should, among other results, lead to more reliable and more complete monitoring data.

International water treaties with neighbouring countries are currently being reviewed and updated (Chapter 3). Particular respect should be paid to the quality of return flows to rivers and their tributaries and the sharing of joint water resources during periods of drought. Treaties should also specify target concentrations and parameter limits. Treaties should plan a water quality monitoring network along rivers, methods of analysis and their verification, and legal and enforcement instruments and penalties.

Recommendation 5.5:
The enforcement of bilateral water treaties with neighbouring countries should lead to common monitoring systems, specifications for the use of common water resources during droughts, as well as for detailed limit values for the water parameters to be aimed at by the partners in the treaties.

The supply of safe drinking water to the rural population is another big concern (see also Chapter 11). Underground sources are very polluted. Preventing future pollutant discharges in the environment will require a major effort. Also, the waste-water treatment plants need to be upgraded, as does the sewer network in many rural areas. Small bodies of water flowing through or near villages are often used as open air sewers, creating substantial pollution risks.

The water supply to the rural population should be organized through viable least-cost systems, above all in terms of initial and recurrent investment costs. This will require optimization studies of a range of alternatives, which should in turn be analysed through pre-feasibility studies. Many different alternatives should be assessed in each different local situation in order to determine the optimal scheme. The scheme should preferably be simple, easy to implement, maintainable by users (local authorities) and based, as much as possible, on local resources.

To this end, local authorities need a legal framework enabling them to enforce the overall policy and strategy for municipal water supply and sewerage, for drainage and for the industrial use of water. An appropriate local authority should manage, operate and maintain the rural and centralized water-supply system under the guidance of a central technical authority. For municipal water supply and sewerage, the role and respective responsibilities of the partners at the local level need to be clearly defined (legal, regulatory, institutional and financial), in particular for small municipalities, villages and rural settlements.

Recommendation 5.6:
The supply of safe drinking water to the rural population should be ensured with the help of a legal and administrative (including budgetary) framework that enables local authorities to control and enforce effectively all relevant water quality standards and

the implementation of related water policies. See also recommendation 1.5 and recommendations 11.3, 11.4 and 11.5.

To adopt an adequate tariff policy, authorities should establish an efficient metering system to know how much water has been treated, extracted, pumped and piped and then supplied to users. This is the only way to ensure efficiency and to recover the real cost of water supply. It could be worthwhile exploring whether the introduction of metering equipment could be harmonized with other countries in transition, so that its production could become more attractive to investors.

Recommendation 5.7:
The water management authorities should avoid all unnecessary delays in the introduction of appropriate metering systems as a prerequisite for the recovery of water costs. See also recommendation 9.5.