Chapter 8

WATER RESOURCES MANAGEMENT

8.1 Overview

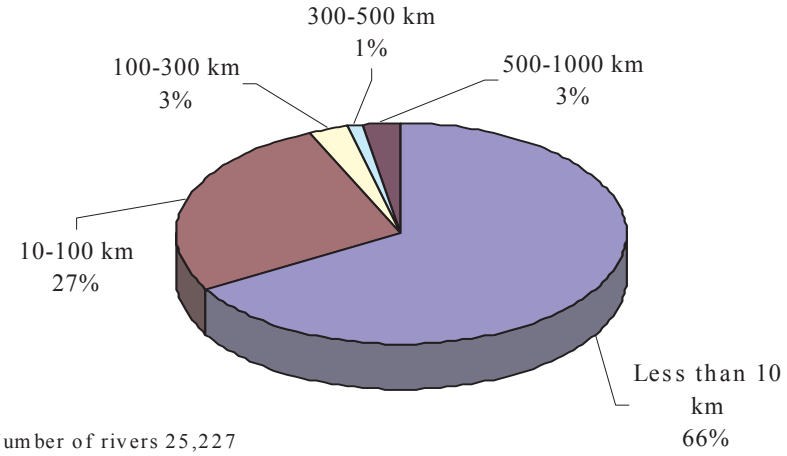
Water is crucial in Tajikistan both in a national and in a regional context. It is a key economic asset and a vital resource for the nation. It is essential for irrigation agriculture (mostly cotton) and for generating electricity, two major sources of income for the Tajik economy. Moreover, 55% of the water feeding the Aral Sea rises in Tajikistan, putting it at the core of Central Asia's political stakes around the allocation of water resources (see Chapter 5 on International Cooperation). Tajikistan actually withdraws about 20% of the volume of water formed in the country, which is well under the quota of 35% (18 billion m^3/year) agreed upon with its neighbours under regional water-sharing agreements. However, Tajikistan plans to increase its water consumption to boost its cotton crops. Its water use might then exceed its quota unless it can improve its water efficiency. Tajikistan does not make the most of its water resources at the moment as it wastes huge amounts owing to its collapsing water infrastructure.

8.2 Water resources

The specific regional context: between the glaciers and the Aral Sea

Tajikistan is very rich in freshwaters (fig. 8.1). On average 50.9 billion m^3 of water is formed annually on its territory. These resources stem from precipitation and melting glaciers, which, along with snowfields, constitute a huge reserve of water (estimated at 845 billion m^3, covering 8% of the territory). These waters drain to the Aral Sea basin, where they represent 55% of the total basin flow. They flow to the Amu Darya river (50.2 billion m^3) and the Syr Darya river (0.7 billion m^3), through Afghanistan, Kazakhstan, Kyrgyzstan, Turkmenistan and Uzbekistan. Therefore, Tajikistan's water resources have an obvious transboundary dimension.

Figure 8.1: River network according to river length, % of total river length



Source: Tajik Hydrometeorological Agency, 2004.

Climatic factors and water resources availability

Climate change prognoses foresee that in the next half century the temperature may increase by about 2-3°C, or even 5°C during the hottest seasons. Already, Tajik glaciers lost more than 20 billion m^3 of their ice volume (i.e. about 2.5%, affecting mostly small glaciers) during the 20th century. A further increase in temperature will accelerate glacier retreat. Thousands of small glaciers will disappear, thus reducing the flow of stored water that melts during the summer, at a time when irrigation is essential for downstream agriculture.

Climate change may also change precipitation patterns, causing more floods and other natural disasters as the ecological factors able to retain water flows are extremely weak (forest coverage is 3 to 3.5% of the territory and wetlands 3.5%). Floodwaters and mudflows are frequent (32% of the territory is in a high mudflow risk zone), causing huge damage. Soil erosion by running waters is also an important problem for agriculture.

Surface water: quantities and quality

Mountainous Tajikistan has a very dense network of water streams, with almost one thousand rivers with a length exceeding 10 km (see figs. 8.1 and 8.2 and table 8.1). Their maximum run-off is in the summer, when snow and glaciers melt. There are 1300 lakes containing 46 billion m^3 of water, and 9 water reservoirs (overall capacity 15.3 billion m^3, individual capacity from 0.028 to 10.5 billion m^3). The latter are mainly used to produce electricity, to irrigate crops and to protect from mudflows. Most of the lakes (73%) are located in the Pamir-Alai Mountains at an altitude of 3500 metres or more. They are often inaccessible, which makes them difficult to monitor.

Originally of excellent quality, surface waters are polluted by anthropogenic activities. The Varzob river, which supplies Dushanbe's drinking water, is polluted upstream by domestic and industrial waste water. The Kafirnigan river, another major source of drinking-water supply, receives irrigation drainage water and domestic waste water, which causes pollution and bacteriological contamination. The Vakhsh river is polluted by industry (fertilizer production and chemical plants) and also by drained irrigation water containing mostly salts and (though nowadays less) fertilizers and pesticides. The Syr Darya is so polluted by irrigation waste water that it is not suitable for drinking. The Zeravshan river may contain mercury from gold processing. Overall, the surface water quality is affected both by point pollution of domestic or industrial origin as virtually no waste water is treated, and by diffuse pollution from agriculture.

Table 8.1: Annual water discharge of major rivers

Basins and rivers	Length		Catchment area in Tajikistan	Average annual water discharge	Month of maximal flow
	Total	In Tajikistan			
To Aral Sea basin	km	km	thousand km^2	billion m^3/year	
Sir Darya	2,212	184	13.4	15.9	
Zeravshan	877	310	11.8	5.1	July-August
Surhan Darya	..	..	1.6	1.1	July-August
Kafirnigan	..	387	11.6	5.1	May-June
Vakhsh	..	524	31.2	19.6	July-August
Panj	..	921	65.0	31.8	July-August

Sources : Tajik Hydrometeorological Agency and Grida. State of the Environment report, 2002.
Note : internal administrative boundaries correspond closely with watershed boundaries.

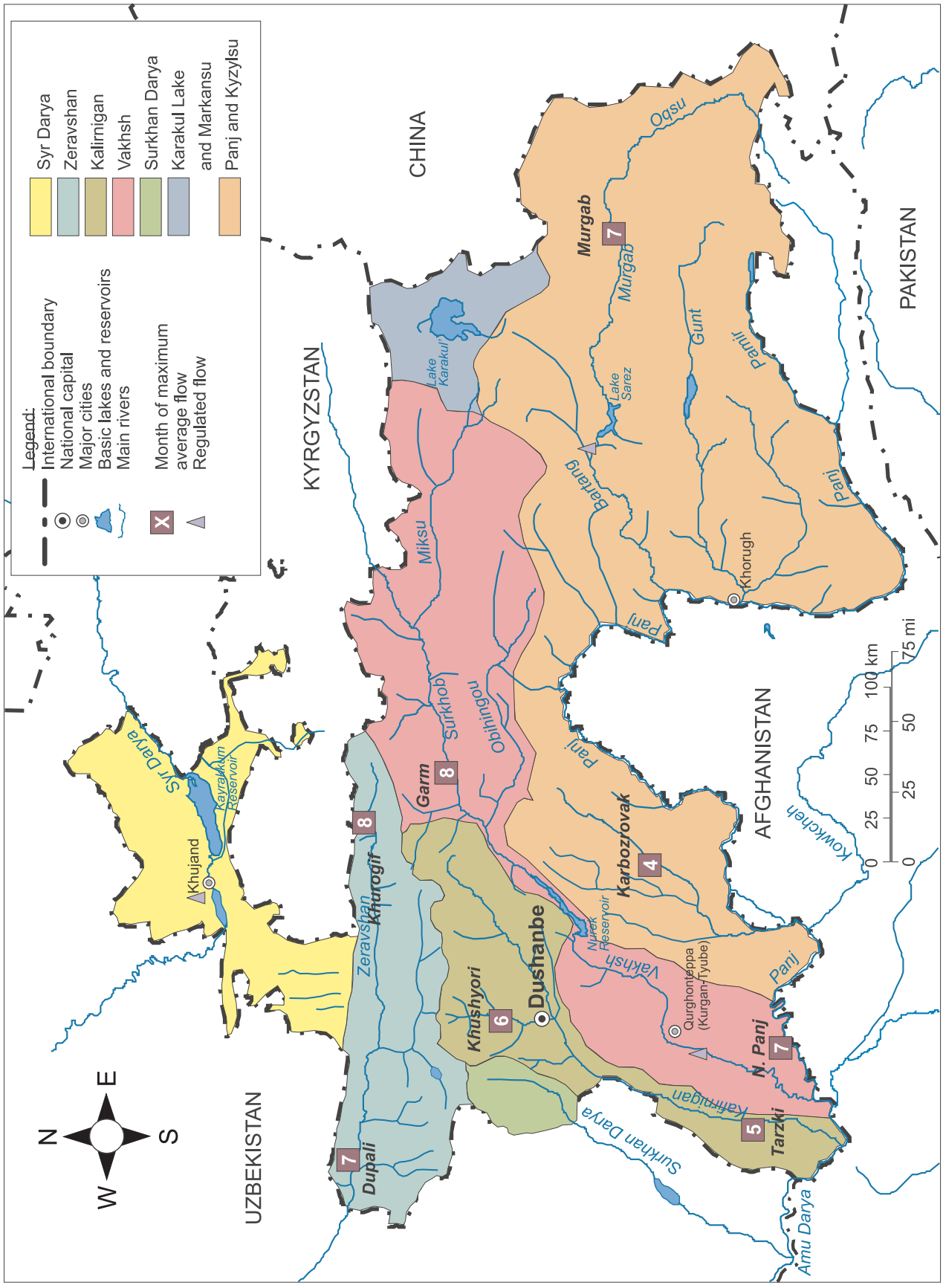


Figure 8.2: Physical map of river basins

The boundaries and names shown on this map do not imply official endorsement or acceptance by the United Nations.

Groundwater and thermal water

Significant reserves of groundwater are found in all major river basins. Total reserves are estimated at 123 billion m^3. Potential groundwater reserves are estimated at 18.7 billion m^3/year, with 6 billion approved for use but only 2-2.8 billion currently exploited. Accessible water reserves are mainly located under the large river valleys (Syr Darya, Kafirnigan, Vakhsh, Kysylsu and Yakhsu) and intermountain depressions. Originally the quality of groundwater was high, with groundwater in the north highly mineralized due to salinization.

Groundwater has been contaminated by anthropogenic activities (domestic discharges, industry and agriculture) in many places, in particular in the vicinity of factories such as the Nakhsh nitrogen fertilizer plant in Kurgan-Tyube (which resulted in the closing of supply wells), the chemical factory in Isfara and the Tajik aluminium plant in Tunsunzade. Agriculture also pollutes groundwater through the use of fertilizers and pesticides, and the discharge of highly mineralized water from irrigation.

Tajikistan is also rich in medicinal, thermal and mineral water resources and springs, which contain a wide range of chemical elements. Only 30% of their potential is used. The main sources and springs are Yavroz, Khoja-Obigarm and Garm-Chaschma.

Natural disasters

Tajikistan is prone to floods, landslides and erosion. The country is very mountainous, with half of the territory above 3000 metres and large areas (6%) covered with glaciers. The relief is characterized by steep rocky slopes, plateaux with pastures (80.6% of the territory) and narrow valleys (about 10% of the territory), where agriculture takes place. Since 1950, the irrigated zones in valleys have more than doubled, and represent 50% of the land suitable for agriculture. These areas have been cultivated at the expense of forests, which have been cut even on steep slopes. The consequence is widespread erosion on pastures and cultivated land, where there is no longer any vegetation coverage to slow down the soil-eroding water flows (see chapter 10).

Floods, mudflows, landslides and avalanches occur every year, destroying roads, bridges, embankments, construction and equipment. For instance, between 1997 and 2004, 5,900 km of roads, 760 bridges, 1,300 km of embankments and 3,800 km of irrigation works were destroyed at a cost of some 240 billion somoni, i.e about US$ 86 million. At high altitudes, many glacial lakes and lakes resulting from rock obstruction of small valleys are threatening to burst and flood downstream areas (see box 8.1 on Lake Sarez). The measures to prevent these disasters and mitigate their consequences were deemed insufficient and in 2001-2002 the Asian Development Bank (ADB) supported the preparation of a strategy to improve flood management.

Tajikistan is also located in a zone with high seismic activity and frequent earthquakes, the magnitude of which often reaches 5-6 on the Richter scale (even 9 in 1911 and 1946). An estimated 100,000 people suffered from earthquakes during the past century. Earthquakes are particularly dangerous because of their potential to cause considerable damage to dams and lakes from rock obstruction, with possible devastating consequences in the valleys downstream (see section on hydro energy below).

Box 8.1: Lake Sarez – mitigating the risk

Located in one of the most earthquake-prone regions in the world, deep in the Pamir mountains of Tajikistan, Lake Sarez was created in 1911 when a strong earthquake triggered a massive landslide, which, in turn, became a huge natural dam along the Murghob river. The resulting lake is perched at an altitude of more than 3000 m and is part of the watershed that drains the towering Akademi Nauk Range. The lake is 61 km long and up to 500 m deep, and holds an estimated 17 billion m^3 of water. Scientists have reason to fear that the natural dam might breach, or that large landslides could cause a tidal wave over the dam. The result would be catastrophic flooding along the Pyandzh, Bartang and Amu Darya rivers. Over 5 million people in Tajikistan, Afghanistan, Uzbekistan and Turkmenistan could be at risk, and damage to the environment would be devastating. Preventive and safety measures have been studied to mitigate the risk. The World Bank has provided credits for a disaster prevention project (US$ 0.47 million) to help alert (early warning emergency system) and protect vulnerable communities from a potential flood outburst. Switzerland is funding other components of the project, e.g. the development of a monitoring and early warning system and long-term safety measures (2000-2005).

8.3 Water uses and anthropogenic pressures

Water abstraction, major users and water conservation

Of a total of 10.7 billion m^3 water abstracted in 2002, about 93% was surface water and 7% groundwater. Of the 8.8 billion m^3 consumed, agriculture took up most. It consumed 85% of the freshwater intake, while the industrial and domestic sectors (urban and rural) consumed respectively 6% and 9% (fig. 8.3). Over the past 10 years, water consumption has been fairly stable. The decrease observed since 2001 is due to the deterioration of pumps and irrigation channels, and not to a more rational use of water (see table 8.2). In 2002, water consumption was 1,350 m^3/cap, while, according to the AQUASTAT database of the Food and Agriculture Organization of the United Nations, the average renewable water resources are 2,600 m^3/cap/year. Estimates indicate that more than 25% of water is lost in transit, 40 to 70% in the drinking-water supply network.

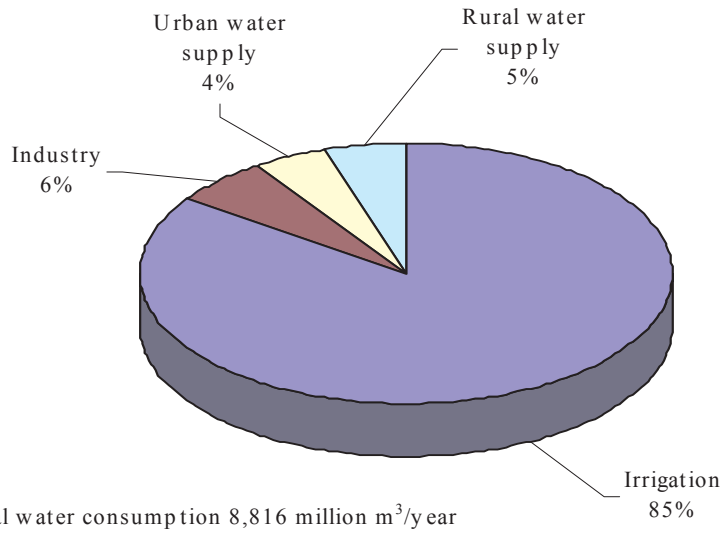
The approximately 800 million m3 of groundwater that are withdrawn annually are used for drinking (39%), irrigation (38%) and technological uses (8%). They are pumped from around 4,600 wells (out of a total of 9,000) that are still operational.

The water intakes are carefully planned every year, as they should comply with the interregional water allocation agreement concluded with the neighbouring countries. Internal adjustments are made through careful planning based on consumption forecasts. The consumers express their needs, which are consolidated at *raion*, then *oblast* and finally State levels. Then the Ministry of Land Reclamation and Water Resources proceeds with an operational updating of the schedule and allocates the water intakes in time and place according to the current status of the water resources.

Hydropower: the greatest economic resource

Tajikistan is one of the world leading hydropower producers (the highest per capita generator in the world), and hydropower is its greatest economic resource. At present, only 5% of its economically feasible potential is exploited through 17 large and 69 small hydropower plants. Since 2000, average electricity production has been about 15 GWh/year, 96% of hydro origin. The biggest hydropower plants (HPPs) are: Nurek HPP (3,000 MW, height of dam 300 m), Baipazan HPP (600 MW), Golovnaya HPP (240 MW) and Qayrroqqum HPP (126 MW). The small HPPs have a total capacity of 30 MW. New plants are being built: Rogun HPP (3,600 MW, height of dam 335 m), Sangtuda HPPs (670 and 220 MW) and Niznekafarniganskaya HPP (100 MW). They should double current production. In 2001, 15 GWh was consumed, including a 14% loss in distribution. Agriculture consumed 29%, households 18% (both sectors are growing), and industry 39% (shrinking). In 2002, the World Bank and the Aga Khan Foundation agreed to invest US$ 26 million in this sector, and a US$ 40 million project is under way to upgrade Nurek HPP. Bilateral funds are also being made available for these projects, including, for example, US $50 million provided by Iran for the Sangtuda HPP.

Figure 8.3: Water consumption by sector, 2002



Source: Ministry of Land Reclamation and Water Resources, 2004.

Table 8.2: Use of water resources

million m^3

	1990	1995	1999	2000	2001	2002
Abstracted water	13,662	12,909	13,168	13,379	13,152	10,700
Water used	12,046	11,874	11,043	10,197	9,938	8,816
Water consumption by sector						
Irrigation	9,895	9,639	9,060	8,676	8,708	7,468
Industry	594	944	922	535	454	525
Urban water supply	485	612	432	384	234	383
Rural water supply	696	659	608	602	533	440
Fish farming	2	0	0	0	0	0
Other uses	374	20	21	0	9	0

Source: Ministry of Land Reclamation and Water Resources, 2004.

Hydroelectricity is a clean (generating no carbon emissions) and renewable energy. In mountainous Tajikistan, hydropower facilities are equipped with huge reservoirs for storing water upstream of the power plants, and high dams to retain the waters ahead of the reservoirs. There are nine water reservoirs containing 0.028 to 10.5 billion m^3 of water, most of them located in the Vakhsh river basin. These facilities need careful monitoring and maintenance as they are located in seismic zones and any breach would threaten the valleys downstream. In Soviet times, dam monitoring and maintenance were planned and ensured at the federal level, and it is a task that Tajikistan on its own can ill afford today. Under-investment in the power infrastructure results in increasing leaks in dams, failing turbines and transformers, reduced staffing and monitoring. Today, Tajikistan's hydropower plants are estimated to lose 30-40% of their power output during the electricity production process (against 10% in normal operating circumstances). Switzerland has similar plants and recognized know-how, and is giving technical and financial support on dam safety to Tajikistan.

Another problem is the growing quantity of suspended solids that are washed out during rainy seasons and floods and accumulate in reservoirs, thus diminishing their retention volume. This is the result of erosion, deforestation, excess ploughing and the destruction of vegetation coverage.

Although it does not consume water as such, hydropower production greatly influences the management of water and the water use pattern of other sectors. The power production installations are expensive to maintain and secure. Electricity demand, which peaks in winter and requires water withdrawals from reservoirs at that time, conflicts with transboundary demands for agriculture that requires water in spring and summer. Hydropower production is an important factor to take into account when drawing up national and regional water allocation plans.

Agriculture and irrigation

Agriculture uses water mostly for irrigation and about 4% for other farming activities. Cotton is the main irrigated crop. The furrow irrigating method, which is used in Tajikistan, is water-intensive with 14,000-16,000 m^3/ha, although simply improving and rationalizing irrigation practices could noticeably cut consumption. Cereals, also irrigated, need less water, about 2100 m^3/ha. Of a total 815,000 ha of cultivated land, 720,000 ha are irrigated, but 12% is in bad condition because of waterlogging and salinization. There are plans to increase irrigated areas to 1.6 million ha in the coming years.

Intensive water consumption for irrigation results in water shortage in the lower streams of rivers (Isfara, Karatag, Shirkent, and Yakhsu) during the dry season.

Water distribution efficiency is around 50%, i.e. about half the abstracted water is lost in the supply network. This is due to evaporation in the open distribution channels and also to the poor quality of the irrigation infrastructure, predominantly earth irrigation channels. Around 48% of the country's irrigated land depends on pumping systems, with lift heights ranging from 10 m to more than 200 m. According to the Ministry of Land Reclamation and Water Resources, 65% of pumping systems may be out of operation, reducing the water supply by 40% or more.

Water allocations to farms are derived from a quantity estimated by the farmer and a corresponding quota allotted after consolidation of overall water demand by the administration. This system worked well when agriculture was under

State control and agricultural production planned in detail. Since the privatization of State farms began, water quantity adjustments have become difficult, and this is exacerbated by the absence of water metering and control systems. The costly rehabilitation and replacement of the irrigation system is also a serious burden that the State can no longer fully shoulder. In 1999, a model charter for water user associations (WUAs) was drawn up and officially approved by the Government. The objective was to create about 40 WUAs at the time of the privatization of collective and State farms. The Water Code provides that the ownership and maintenance expenses of the irrigation infrastructure will shift progressively over four years to WUAs, which will then be independent. However, the farmers, who are not landowners, cannot afford to pay either for the water they use or for infrastructure maintenance (see chapter 10, on Agriculture).

Fish farming, which was an important economic activity and source of food before independence, has virtually ceased.

Fertilizers that are washed out by irrigation water to freshwater bodies are an important source of diffuse pollution. Consumption has been reduced to 25% of what it was in 1990; of the 40,000 to 100,000 tons of mineral fertilizers still used each year, as much as 10 to 30% is ultimately discharged into rivers, thus contributing to their mineralization and eutrophication, and, eventually, to the mineralization of the Aral Sea (high nitrate, sulphate and potassium contents). Pesticides, irrigation drainage water and manure, all end up in freshwater bodies. A positive environmental consequence of the economic crisis and the drop in farmers' purchasing power is the drastic decrease in pesticide and fertilizer use.

Industry

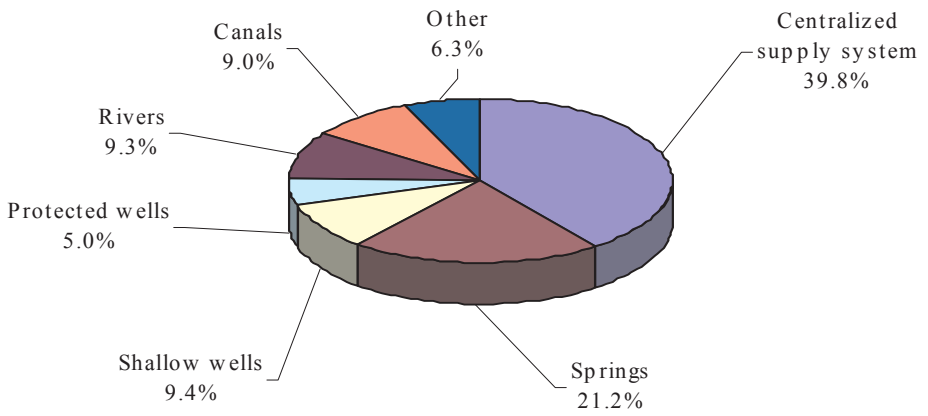
In 2002, industry used 0.5 billion m^3 of water, about half from below ground. Usually industry is supplied through the public drinking-water system. Industrial processes are often equipped with open water circuits. In 2000, 0.11 billion m^3 of – mostly untreated – industrial waste water was discharged.

Industrial production, in particular in heavy, water-polluting industries such as chemicals, metalworking and food processing, has contracted severely since 1991. In northern Tajikistan, where they are mostly developed, ore mining (strontium, silver, mercury, tungsten, antimony, gold, lead, zinc, fluorspar, non-metal and radioactive elements, and salt deposits) results in the discharge of toxic substances from the leaching of mine tailings (such as mercury, zinc or phosphorus) into surface waters, and also into groundwater through percolation. In the south, there are a few big industrial plants. The most polluting plants in the country are the Yavan chemical plant and the Vakhsh nitrogen fertilizer plant (ammonium and nitrate pollution of groundwater) in the south and the Isfara chemical plant in the north. These facilities use technologies from the 1950-1970s. The State Committee for Environmental Protection and Forestry has temporarily closed the Vakhsh nitrogen fertilizer plant, because it failed to comply with pollution limits. The facility's managers consequently installed a purification system and the plant is again on stream, though operating below capacity so far.

Domestic water supply and waste-water discharge

In 2003, about half of drinking water was supplied from a pipe system (table 8.4 (a)); 96% of the urban population has access but only 40% of the rural population. The system is in bad condition, with no sanitary perimeters around the water uptakes (only 5% of wells are protected). A third of the distribution pipes are broken and much of the rest is leaking. There is a lack of purification facilities and of chlorine for disinfection. Since water is supplied only a few hours a day (because of power shortages), there is back pressure in the worn-out pipes. As a result, 40% of tap water is of poor quality and poses epidemiological risks. Drinking water is also taken up directly from shallow wells, ponds and irrigation canals (25%), from springs (21.2%) and from rivers (9.3%). According to the World Health Organization (WHO), up to 60% of intestinal infections in Tajikistan are water-borne. In 1997-1998, there was a typhoid epidemic with a morbidity of 500 per 100,000 inhabitants (see chapter 12, on Health). Drinking water from surface water bodies frequently causes diarrhoea, dysentery and hepatitis since domestic waste water is discharged without treatment upstream of drinking-water uptakes.

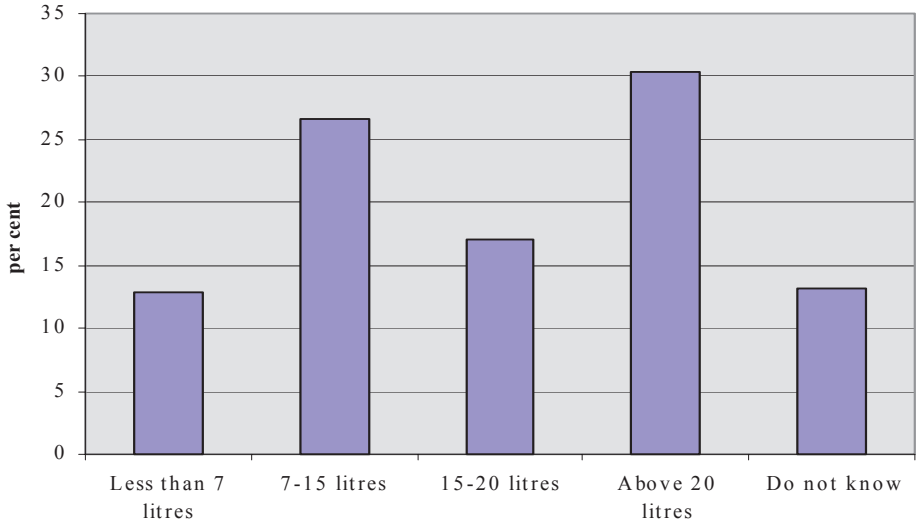
Figure 8.4: a) Primary sources of drinking water



Source: Survey by the European Commission, Humanitarian Aid Office (ECHO), National nutrition and water and sanitation survey, Tajikistan, 2003.

Domestic water consumption is reported to be 550 litres/capita/day, 60% of which is lost due to leaks, according to the World Bank. As shown in figure 8.4 (b), daily quantities of water for human consumption at the point of use in rural areas are low, essentially because few homes have direct connections to the pipe system.

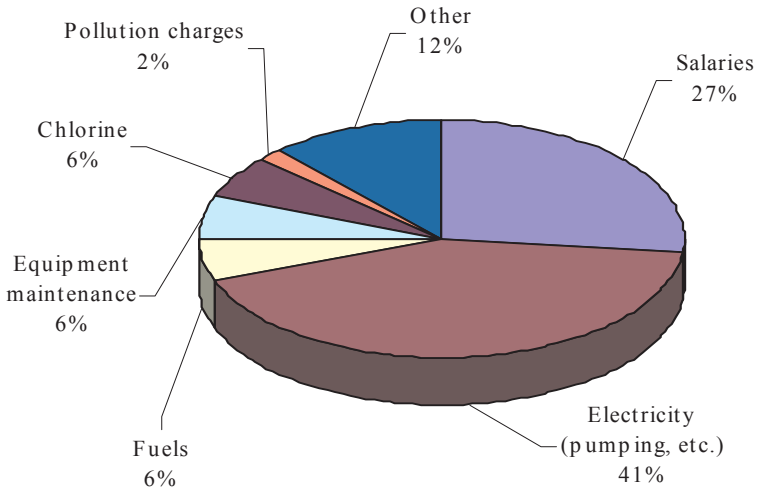
Figure 8.4: b) Overall quantities of water used daily per capita for human consumption, rural areas, 2003



Source: Survey by the European Commission, Humanitarian Aid Office (ECHO), National nutrition and water and sanitation survey, Tajikistan, 2003.

Note: It is generally assumed that 50 litres/capita/day is a minimum to cover the four basic human needs: drinking, food preparation, bathing and excreta disposal.

Figure 8.5: Dushanbe public water service, breakdown of expenditures, 2004



Source: Dushanbe Vodokanal, 2004.

Seventeen per cent of homes are connected to a sewage system, of which only 2% in rural areas. Many rural and some urban settlements have no waste-water treatment plants and use individual latrines that, in approximately two thirds of the cases, are located too close to water streams and pollute them. In 1999, domestic waste-water discharges through sewage systems amounted to 26 million m^3. These discharges have been reduced by more than half since 1990, but this is merely because many waste-water treatment plants are obsolete and no longer function. Only 20% of the 57 waste-water treatment plants still work. Except in Dushanbe, there is no biological treatment either because the plants never had the capability or because operating costs (electricity) are high. Intestinal diseases, which are frequent and dramatically increased between 1990-2000, are attributed to unsatisfactory waste-water treatment.

Overall, the drinking-water supply network and purification facilities as well as the sewage network and waste-water treatment plants are in poor condition, deprived of maintenance, crumbling and in many cases no longer in operation. The country cannot afford the investment needed to improve its water infrastructure.

8.4 Water management and objectives

Policies and strategies

Sharing water resources is both crucial and complex in Central Asia, where cotton production, one of the most water-intensive agricultural activities on the planet, is a key pillar of the economy. In Tajikistan, the situation is further complicated by a number of interrelated and conflicting interests that affect water resource management, especially the surge in demand for hydroelectricity in winter and for water for irrigation in spring and summer, and the need to manage water with the other Central Asian countries.

The sustainable use of water and its protection are high on Tajikistan's political agenda. The President has officially expressed his strong political commitment to improving the water situation on many occasions. He participated in the United Nations General Assembly when it declared 2003 the International Year of Fresh Water and, in the summer of 2003, he organized the Fourth International Fresh Water Forum in Dushanbe. On that occasion, he emphasized that the national Concept on the Rational Use and Protection of Water, adopted in December 2001, was based on international cooperation among Central Asian countries and aimed at the rational use and conservation of water resources.

The 2001 Concept on the Rational Use and Protection of Water has two essential goals:

- Reaching self-sufficiency in energy and in food production. The Concept puts particular emphasis on improving and further developing hydropower production, since this is a key economic asset.
- Improving and rationalizing irrigation practices, as irrigation is instrumental in

ensuring food security and boosting employment.

Reaching these two goals requires a number of water-conservation objectives to be integrated. For instance, the ADB Agriculture Rehabilitation Project (2001) essentially aims to rehabilitate the irrigation network to prevent water losses, and to cut water consumption by introducing more efficient irrigation techniques, shifting to less water-intensive agricultural practices (even if cotton is to stay the main crop) and metering and pricing water.

Providing safe drinking water and improving sanitation are two other key targets of the President's policy. They are also among the United Nations millennium development goals (box 8.2). As called for in the Concept, a national clean water and sanitation programme has been developed but not yet adopted.

Some of the Concept's other priorities are protecting water resources, developing research and training staff. The State Committee for Environmental Protection and Forestry is responsible for elaborating the Concept and developing both a strategy and an action plan. This, however, has not yet been done.

Legislation

According to the Constitution, water is State property, and the State is entrusted with ensuring its effective use and protection. The fundamental piece of legislation is the Water Code, which was enacted in 2000 and is now implemented through a dozen regulations. The Code strengthens the economic mechanisms for water use, and defines the organizational system for the regulation of water use and protection. It provides the legal basis for the water user associations (WUAs) and their relationship with the State water bodies. However, WUAs cannot own water-supply systems; they can only provide water management assistance. This is a serious drawback. The Water Code updates and clarifies the economic instruments. For instance, payment for water-supply services is clearly outlined. It also defines the rights and obligations of water users.

Nevertheless, this legal framework is insufficient, as pointed out in the Concept on the Rational Use and Protection of Water, which calls for regulations on updating tariffs for water use, on water monitoring, on drinking-water supply and on drinking-water protection. Other laws on water abstraction permits and the creation of an inspectorate have not yet been developed. There is still no legal basis for the abstraction and use of groundwater.

The Water Code does not introduce modern principles. It keeps water management highly centralized, does not provide for integrated management by hydrographic river basin, nor for the coordination of policies and actions among the all the bodies responsible, and says nothing about water monitoring, which is a fundamental management tool.

Institutional arrangements

Water, as a strategic economic asset, has many uses and users. Its management is shared among a number of ministries and bodies, as defined in the 2002 Government Resolution on the Division of Authority to Regulate the Use and Protection of Waters among the Specially Authorized State Bodies. Five bodies are particularly involved:

- The protection of water bodies and their ecosystems is the responsibility of the State Committee for Environmental Protection and Forestry, which is also in charge of hydrometeorology. The State Committee is in charge of overall water resources management, and in particular of the allocation of water among the various sectors of activity, the practicalities of which are left to the responsible ministries or entities. It negotiates the agreements on river water sharing with neighbouring countries and monitors the national application of the water quota.
- The Ministry of Land Reclamation and Water Resources is responsible for the practical implementation of water allocation and supply to the agriculture sector, and is in charge of the operation and maintenance of the infrastructure for irrigation and supply to the rural population. It collects the related water service payments.
- *Tajikgeologia* monitors the aquifers and groundwater quality, and drills new wells.
- The Government Committee for State Control over Industrial Safety and Mining manages thermal and mineral water and ensure the safe operation of industrial mines and monitors the water drained from mines.
- The Ministry of Energy manages water flows for hydroelectricity production.

Box 8.2: Tajikistan and the water-related millennium development goal

The millennium development goal for water, namely *to reduce by half, by 2015, the proportion of people without sustainable access to safe drinking water*, is relevant to Tajikistan. In Tajikistan this means that, by 2015, 80% of the population should have access to drinking water.

In its poverty reduction strategy paper, 2001, the Government expressed its willingness to reach this goal as soon as possible. This would cost an estimated US$ 14.8 million per year over 14 years, of which Tajikistan itself can afford to pay only 10 to 15% (US$ 1.7 million a year).

All these State institutions have *oblast* and *raion* branches.

Other entities are also involved. The Ministry of Health, responsible for monitoring drinking water quality, and especially water-borne infections, is in charge of a network of 73 sanitary epidemiological stations. These are struggling to do their job as their budgets have been slashed (see chapter 12). The Tajik *vodokanal* units (in *oblasts* and *raions*) and Tajik *kommunservis* (housing and municipal services) operate water-supply and waste-water treatment facilities throughout the country.

This fragmented water management necessitates good relationships among the various ministries and bodies in charge of parts of the system. However, to date, there is little collaboration on this issue among the ministries, departments and municipal bodies. This hampers progress toward integrated water resource management, which is necessary to improve the situation. One example is the difficulty encountered in exchanging data between the State Committee for Environmental Protection and Forestry, which is in charge of measuring water quantities and quality through its Hydrometeorological Agency, and the Ministry of Land Reclamation and Water Resources, which needs such data for managing the water resources for irrigation. Therefore, the data on water resources are consolidated both by the State Committee, with data from its local branches, and by the Ministry. The drawing-up of a computerized water cadastre, which is ongoing as called for in the Water Code (art. 135), should streamline this issue.

Management tools

Monitoring

Six different agencies monitor water:

- The State Committee's Hydrometeorological Agency operates the hydrological observation network and monitors water quantity and quality (physical and chemical parameters). There are 97 water monitoring stations, of which 81 are functioning at present. The frequency of measurements, the kinds of observations and the number of parameters controlled have been substantially reduced since 1991 owing to budget reductions (See chapter 4, on Information, public participation and education).
- The Ministry of Land Reclamation and Water Resources monitors the quantities of water withdrawn from its infrastructure by the different economic users, i.e. agriculture, hydropower, industry and domestic users.
- *Tajikgeologia* is responsible for monitoring the level and quality of groundwater below a depth of 15 m. It does this twice a year, but would like to do it every month if finances were available. *Tajikgeologia* also maintains the State groundwater cadastre.
- The rural and urban water-supply authorities (*vodokanals*) monitor the quality of water supplied to the population. They have great difficulty doing this since most of their laboratories have not worked since the civil war or have no money.
- The 73 sanitary epidemiological stations and laboratories monitor drinking water, in particular its bacteriological quality, and can enforce measures if they uncover pollution.
- The State Committee's *oblast* inspectorate is responsible for monitoring pollution sources and taking punitive action if concentrations exceed the permitted levels. It has four laboratories, which were newly equipped in 2003. They also subcontract chemical analyses to the Hydrometeorological Agency or other laboratories when needed.

In general, the monitoring institutions all have financial difficulties and little valuable information is drawn from the monitoring results at present (See chapter 4, on Information, public participation and education). Any data that do exist are used for punitive action rather than for sustaining protection or conservation measures. The most recent data

officially published on water by the State Committee for Statistics are from 2000.

Regulatory instruments (standards and permits)

There is no *water abstraction* permitting system at the moment. However, every water uptake, in particular that for hydropower, irrigation, industry and domestic uses, should be declared to either the State Committee for Environmental Protection and Forestry or the Ministry of Land Reclamation and Water Resources, which issue water use passports (see also chapter 2, on Policy, legal and institutional framework). Only the State Committee can impose sanctions for violations.

Water users report annually to their local environmental protection committees on the quantity of water that they use and the quantity and quality of the waste water (concentration of major chemical elements only) that they discharge to water bodies (see chapter 2). Users include industry, State and collective farms, water user associations, *vodokanal* enterprises, municipalities and industry. These data serve as the basis for calculating water pollution charges. Previously, charges were due only when maximum allowable concentrations (MACs) were exceeded. As of 2004, pollution charges will apply to all polluted discharges to rivers. For instance, Dushanbe *vodokanal* will be charged 0.15 somoni/m^3 if the pollutant concentration is below the MACs and five times more if it is above the MACs. Due to the current economic situation, few *vodokanals* will be able to afford these rates.

These data, based on user reports and not measurements, are aggregated annually by the regions and transmitted to the State Committee to provide an overall picture of water resource uses and protection. In parallel, the Ministry of Land Reclamation and Water Resources records the needs and consumption of its rural users, and also measures what it distributes. So two sets of data are generated separately, and they do not correspond (see chapter 2, on Policy, legal and institutional framework).

The local committees on environmental protection verify the preservation, relevant allocation and efficient use of all water resources. They also issue permits and licences for those entities discharging pollution directly into rivers and verify compliance with ambient water quality standards in theory for 197 major polluting agents, but in practice for about 30 (suspended solids, dry residue, biological oxygen demand and oil contents are mandatory). As monitoring functions poorly and local inspectorates are often understaffed, compliance with these standards is rarely checked.

Violations are listed in the Water Code. Some examples are the destruction of water infrastructure, pollution of water bodies, unauthorized water abstraction or water use, deviation from authorized use and non-compliance with water quality standards. In 2003, there were 3385 water inspections and 6763 notifications; enterprises were able to comply with about half of them after taking appropriate measures. The State Water Inspectorate applies fines and, when infringements are severe, actually closes down the facilities until they comply with the law.

Economic instruments

The system of payments for the use of water resources and for water services has existed since 1996. It has simply been incorporated into the 2000 Water Code, but the principles or levels have not been reconsidered. The rates are now being revised (see chapter 3, on economic instruments, environmental expenditures and privatization).

Water charges. The use of water, which is State property, is free of charge to the user. For instance, the hydropower industry does not pay for the water that it uses. Similarly, a company extracting groundwater does not pay for the water that it abstracts. There are water pollution charges, but they seem inadequate and their purpose is not clear. Few *vodokanals* can afford them, so in most *oblasts* the State Committee does not even levy them, preferring to let the *vodokanals* spend this money on repairs and maintenance (see chapter 3).

Water pricing. Consumers do have to pay for water-supply and sewage services (see table 3.7 in chapter 3). The Ministry of Land Reclamation and Water Resources sets the prices for water that is distributed through its infrastructure, i.e. mostly for irrigation. *Vodokanals* set different prices for supplying drinking water and collecting sewage depending on the *oblast* and the user. These prices need to be agreed to by the *hukumats*. *Vodokanals*, municipal water authorities and the Ministry, as owners of the infrastructure, have the legal right to levy these fees; water user associations do not since, by law, they cannot own water-supply systems.

According to the Ministry, few farmers can afford the fees for irrigation water. Moreover, as there is no metering, it is difficult to implement the system correctly and ensure that people pay for what they consume. The water quantities delivered by the primary and secondary channels are well known, but not those shared by communities, where there is no metering. It is therefore particularly hard to set water prices at a level that serves as an incentive to reduce consumption. The revenues from irrigation charges amount to 39 million somoni (i.e. US$ 14 million) per year**,** which is about 1/6 of the cost of maintaining the infrastructure. The change collection rate has been constantly decreasing for 10 years. Fifty-five per cent of the charges are collected at the moment, of which 25% is paid in cash and 30% in kind (e.g. agricultural products).

The payment for public water services is being increased with a view to ultimately covering the cost of the water distribution and sewage collection systems and facilities. At present, *vodokanals* face a difficult situation as revenues from the charges are insufficient to cover the full cost of operation and maintenance of their pipe networks and treatment plants (see fig. 8.5). Serious repairs and rehabilitation cannot be envisaged without external funds.

The tendency is to increase prices in an attempt to reflect better the cost of the service. For instance, in 2003 prices were multiplied by 2.5 in Khujand to 1 somoni per person per month. Although water is underpriced (30 dirams per person per month in Dushanbe) and mostly unmetered, paying for it is a serious financial burden for many people. Specific measures have been worked out by *oblasts* to ease the burden on the poorest (rebates or compensation). The State also provides subsidies: housing and municipal services received 150,000 somoni (i.e. US$ 53,500) in 2002 to provide water services to the poorest consumers. This is an important measure but is deemed insufficient according to UNDP.

The water sector is not privatized at present. The Water Code provides for the privatization of water assets and the possible introduction of foreign capital. So far, privatization has been limited to small infrastructure and minor equipment; the privatization of strategic assets (major channels, barrages, reservoirs) is not yet envisaged.

Expenditures and investment in water management

Before Tajikistan's independence, significant resources were devoted to water infrastructure, a situation that has changed dramatically:

- In the 1990s, there was a significant yearly allocation from the regular budget to the *water irrigation and drainage* network for maintenance and operation (for instance US$ 72 million in 1990), but those resources were progressively, and drastically, reduced over time (to only US$ 6.5 million/year). As a result, 50% of the irrigation system and 65% of the pumping system is worn out. According to a UNDP report (2003), roughly US$ 130 million (i.e. 26 million per year over five years) would be necessary to rehabilitate all irrigated land, and the operating and maintenance costs would then be about 22 million per year;
- The *hydropower* operating and maintenance budget was US$ 60 million in 1990; it is US$ 40 million today;
- According to the *vodokanals*, the actual budget for *water supply and sanitation* is about 1/3 of what is needed to cover operation and maintenance, i.e. excluding new investment. In 2002, the total budget for water and sanitation was 18.6 million somoni (US$ 6.6 million), of which about 25% came from domestic sources and 75% from external assistance. According to UNDP, to reach the millennium development goals US$ 207 million would be necessary till 2015.

Given the current GDP (US$ 1,210 million in 2002) and the fact that other infrastructures also have to be rehabilitated in the same sector, e.g. flood and landslide protection, and in other sectors (e.g. transport), the water sector is in an extremely difficult situation and Tajikistan will have to set priorities for its strategic investments.

International assistance programmes

Water management has benefited from important foreign funding. Over the past decade, international institutions have allocated about US$ 120 million through investment projects for the rehabilitation and development of the irrigation infrastructure and water-supply and sewage systems. The projects differed in nature and size, from a few big projects with large budgets, to numerous smaller projects developed closer to the local communities. The big

projects would not be possible without grants from donor countries to complement Tajik contributions.

The World Bank is currently financing three major projects: a water-supply and waste-water project in Dushanbe (US$ 19.5-million loan), a rural infrastructure rehabilitation project (US$ 24-million loan); and a risk mitigation project for Lake Sarez (US$ 0.5-million grant).

ADB is focusing on rehabilitating the irrigation and water infrastructure in the poorest regions. In 2002 it started a seven-year project worth about US$ 43.7 million, 20% is funded by Tajikistan and 80% with a loan. ADB also helps in capacity-building and the drawing-up of strategies and policies (for instance the strategy to improve flood management completed in 2001 but not yet implemented by Tajikistan as there is no funding for infrastructure rehabilitation).

Both the World Bank and ADB are preparing other important water projects in view of the poverty reduction strategy paper and the United Nations millennium development goals.

The United Nations also provides financial and technical assistance:

The Global Environment Facility (GEF), through the regional Aral Sea Water and Environmental Management Project (US$ 72 million, including a US$ 12-million GEF grant), has financed elements in Tajikistan, for instance on salinization, dam safety, transboundary water monitoring, efficiency in water use and public awareness.

UNDP water projects aim to provide safe drinking water and sanitation facilities and irrigation to the most vulnerable communities. It has also coordinated contributions from various donor institutions (European Commission's Humanitarian Aid Office (EU/ECHO) and Directorate General for External Relations, United States Agency for International Development (USAID)) and countries, mainly Japan and Switzerland, for clean drinking water projects, especially in rural areas. About US$ 3.8 million have been spent on the rehabilitation of 200 water systems, benefiting more than 1.5 million rural residents. These projects include training on behavioural changes in hygiene and the rational use of water, as well as capacity-building and training of system operators.

Bilateral cooperation in the water sector is also active and is essentially through grants. Water is a priority in Swiss cooperation, which is increasing its contributions to Tajikistan (from US$ 0.5 million budgeted in 2004 to US$ 2.6 million forecast for 2005). Switzerland has projects on dam safety and reservoir management, on hydrological forecasting, on integrated water resource management in the Fergana Valley, and on setting up an information base on water and water-related energy. It also participates in rural water supply and sanitation with UNDP and in the financing of a Dushanbe water supply project.

For 2002-2005, USAID is financing three hydrometeorological stations, which will improve the collection of data necessary to coordinate the allocation of water among the Central Asian countries (recipient Hydrometeorological Agency). USAID is also developing a farm irrigation pilot project to demonstrate good management practices.

In 2002-2003, EU/ECHO spent € 2 million on drinking-water facilities and is currently conducting a pilot study for the introduction of effective integrated water resource management in the Varsh river basin.

Box 8.3: A cross-border water project between Fergana Valley neighbours

Residents of both Vorukh in Uzbekistan and Ravot in Tajikistan have access to the Isfarinka river. Once the growing season begins, farmers from upstream Ravot irrigate their fields, effectively cutting off access for Vorukh. The Peaceful Communities Initiative, a three-year USAID-funded project operating in the Fergana Valley, supported a council of active citizens who designed and implemented a project to optimize water sharing and water use between the two communities. From the design and the procurement of equipment to the digging of trenches, it was the community that turned the idea of accessible drinking water into reality. Three wells were repaired, a 3.5 km water pipeline constructed, with 52 public standpipes. The total cost of the project was about US$ 17,000, half coming from the community. Residents themselves have organized a water user committee to manage the system and collect money from residents.

Education

Education is an effective tool to change water uses and water consumption behaviours. It could be particularly important in Tajikistan to achieve a more sustainable use of water. Despite the efforts of WHO and the United Nations Children's Fund (UNICEF) to develop measures and teaching material for children and women at the local level on the sustainable and safe use of water, there is little education in water conservation for the public at large (see chapter 4, on Information, public participation and education).

8.5 Conclusions and recommendations

Water resources are abundant in Tajikistan. As is often the case, however, water management is complicated by the fact that there are many types of uses and users. In addition, the mountainous topography, combined with a high risk of earthquakes and floods, means that it is even more important to have the necessary infrastructure and management in place. Since independence, Tajikistan has had to reorganize all its water management institutions and to cope with a poorly maintained infrastructure at a time of severe economic difficulties. Tajikistan still has to make progress if it wants to meet the ambitious objectives on water that its President set in 2003.

It is difficult to have a clear picture of the situation, not only because water monitoring has been scaled back drastically over the past ten years, but also because data are produced by different institutions, independently and in isolation. Data on water should be regrouped and made widely available in a timely manner to yield an accurate description of the situation and the problems. These data should serve as the basis for water management decisions. In this regard the water sector is a good example of the conclusions drawn in chapter 4 regarding information processing and use, and recommendations 4.1 and 4.2 are particularly relevant to it.

Tajikistan's water policy is expressed in the Concept on the Rational Use and Protection of Water of 2001. If this document is retained as the State policy, its recommendations and objectives should be reviewed, specified, clarified and prioritized, and its cost and social impact estimated through a strategic action plan. This action plan could serve as a target indicator for all projects and actions decided by the Government in the water sector. It should be worked out through both a top-down and a bottom-up approach, as needs should be inventoried from field level and consolidated at the State level, taking into account national strategic priorities.

According to the Concept, the State Committee for Environmental Protection and Forestry is responsible for drawing up a strategy and action plan. However, there are many stakeholders in water management – in Tajikistan as elsewhere. They all need to be involved to ensure a viable project in which all economic sectors will find their rightful place and cooperate to reach the agreed targets. At the moment, the State Committee is being restructured and does not possess the capacity or expertise to assume a leadership position in those negotiations. For this reason, it would be advisable to set up an inter-ministerial commission on water which, under the coordination of the State authority in charge of the protection and conservation of water, i.e. the State Committee, would develop the strategy and action plan in collaboration with all other ministries and bodies involved in water management.

Implementation of this action plan should be the responsibility of an operational department of the State Committee for Environmental Protection and Forestry. This department should work closely with the inter-ministerial commission on water and regularly report to it on its progress. It should delegate practical and specific tasks to other relevant bodies, e.g. ministries, local environmental protection committees and other important partners such as *vodokanals*.

Recommendation 8.1:
The Government should as soon as possible:

- *Set up an inter-ministerial commission on water to develop a strategy and action plan for the Concept on the Rational Use and Protection of Water.*
- *Entrust the State Committee for Environmental Protection and Forestry with the coordination of this commission, which should bring together all main bodies involved in water management, as well as local authorities.*
- *Make the State Committee for Environmental Protection and Forestry responsible for implementing the water action plan.*

At the moment, the capacity of the State Committee in water management is limited to a policing role, which is ensured by the State Water Inspectorate. The State Committee has no department specialized in water legislation, policy and strategies with a

long-term approach. Such a unit is necessary if the country wants to move towards modern and decentralized water management policies, including a water ecosystem management approach and an approach by catchment area.

Recommendation 8.2:
The Government should strengthen the capacity of the State Committee for Environmental Protection and Forestry in water management. It should set up a water department to this effect, staffed with experts trained in modern water planning and management approaches. Assistance for staff training should be sought from the international partners developing water projects in Tajikistan.

All water infrastructure, whether for water supply and sanitation, irrigation or flood protection, is in poor condition. This has a dramatic impact on everyday life in Tajikistan, affecting public health, diminishing food safety, limiting food production, and damaging habitat and other infrastructures. Although costly, action is necessary and urgent.

A major problem is that there are no data on the necessary investment and maintenance costs or priorities for rehabilitating and completing the water infrastructure. As a first step, a full inventory of the water infrastructure and an assessment of its status are required. In the light of this assessment and in view of the State priorities in other sectors (e.g. transport and agriculture), it would then be possible to define and rank priorities for investment in the water sector. The Government needs to set its priorities based on a cost analysis of the various options and their added value (including social implications).

Water infrastructure is known to be capital-intensive. The few data given above show how high the level of investment in water would be if Tajikistan decided to rehabilitate its water infrastructure (see the section on expenditures and investments above). In its present difficult economic situation, Tajikistan should select those projects that are the most urgent and efficient, in the water sector and in other areas as well. Once the priorities have been clearly and comprehensively set, Tajikistan would be in a stronger position to approach the international community for assistance.

When setting priorities for investment, it is important to keep in mind the commitment expressed in the 2001 Concept on the Rational Use and Protection of Water to supply safe drinking water to the population. This is further supported by the 2002 poverty reduction monitoring survey, which showed that safe drinking-water supply is the top priority for Tajikistan (see chapter 1, on Poverty, environment and economy). The Government should also favour the projects that are developed close to the users, as they have proven to be very efficient in the long run because they involve the population and contribute to behavioural training in water protection.

Recommendation 8.3:
The State Committee for Environmental Protection and Forestry, in cooperation with all relevant ministries and bodies, should:

(a) Draw up an inventory of all water infrastructures (water supply and sanitation, irrigation and drainage, flood protection, including dams) and assess their status;
(b) Set national priorities for investment in water infrastructures taking into account the needs and projects of the various sectors involved in water management. These priorities should follow the strategic lines expressed in the Concept on the Rational Use and Protection of Water, once these have been more concretely specified, and other sub-strategies of the water sector (e.g. strategy on water supply and sanitation, strategy on flood management). These priorities should also be weighed in the overall context of the country's economic and social priorities and investment projects, with due regard to their affordability;
(c) Make all information regarding priorities and investment needs in the water sector widely known, in particular to all potential donors; and regularly organize meetings and improve cooperation with donors to keep them informed of the situation;
(d) Assess regularly the situation and readjust priorities accordingly, including keeping records of the projects in the water sector.

Tajikistan also needs to modernize its management of water resources. At present, water resources are managed in a highly centralized and sectoral manner. Experience has proven that a management closer to the users and to the field gives better results. The concept of integrated water management by catchment area (i.e. hydrographic basin) is recognized to be the most efficient and rational and is becoming the international standard. Other Central Asian countries sharing water resources with Tajikistan are introducing it in their practices. The ultimate objective is to manage transboundary water basins at a regional level

(i.e. Syr Darya, Amu Darya and Aral Sea basins) in order to integrate and optimize water use and protection. The shift to a decentralized and integrated approach requires an in-depth reorganization of the institutions. This takes time and requires capacity to be built. In general, this cannot be done at once, but step by step. A first step could be the practical implementation of pilot projects of limited geographic scale, carried out in collaboration with partners having experience of such a watershed management approach (for instance EU/ECHO).

As it is now, the water legislation does not incorporate the concept of management by catchment area, which would require profound changes in the water institutions with decentralization of both decision-making and financing. The Water Code does not yet provide for such a principle and will have to be modified. Nor does it provide for sufficient incentives for water conservation and water protection. For instance, it contains disincentives to discourage users from polluting water (i.e. waste-water charges), but does not offer any positive measures to encourage and help users and polluters to improve water protection (e.g. rebates for investing in protection equipment or planting trees to protect river banks). The World Bank is willing to help in reshaping the water legislation and will start a project this year. Countries with experience in management by catchment area could also contribute. The Government could set up a working group of Tajikistan water specialists to work with foreign experts and benefit from their knowledge.

<u>Recommendation 8.4:</u>

(a) *The State Committee for Environmental Protection and Forestry should prepare and submit to* Majlisi Oli*, through the normal channels, a revision of the Water Code so that it fully incorporates integrated water management by hydrographic river basin;*
(b) *In drafting this revision, the State Committee should work closely with the Ministry of Land Reclamation and Water Resources,* Tajikgeologia*, the Government Committee for State Control over Industrial Safety and Mining, the Ministry of Energy and local authorities. It should also consider inviting foreign experts to participate in an advisory capacity.*
(c) *The Government should start implementing integrated water resource management step by step, in particular through pilot projects involving local communities. These can be implemented in limited geographic areas, i.e. sub-basins, to test decentralized management. These pilot experiences should also be used to start building capacity in this new approach;*

Floods are natural and essentially uncontrollable phenomena. Human activities contribute to an increase in the likelihood of extreme flood events and adverse impacts. Tajikistan is particularly prone to them. Such events have frequently occurred in the past, and in July 2004 again, they severely hit the population of Dushanbe. Flood protection measures are insufficient. Although a strategy has been worked out in the past, it has raised little attention and has never been implemented.

Measures should be elaborated and should focus on the development of management plans according to catchment areas, the drafting of risk maps, developing and improving information and communication, and undertaking actions in a concerted and coordinated manner along the whole length of the river.

Flood management programmes should include the following elements: prevention (avoiding construction in risky zones and promoting appropriate land-use, agricultural and forestry practices), protection (structural and non-structural measures), preparedness (flood warning systems, informing the population of what to do), emergency response (developing response plans), recovery (mitigating social and economical impacts) and research (flood forecasting and mapping).

Instead of considering flood management in isolation, it is necessary to see it as part of an integrated and comprehensive approach to river basin management. A serious approach and solid strategy may also be a positive sign to attract foreign assistance to protection infrastructure development and construction.

<u>Recommendation 8.5:</u>

The Authority responsible for river basin management, in close cooperation with all other concerned authorities and competent international organizations, should develop and implement flood risk management plans for each main river basin. These plans would include prevention, protection and mitigation actions and would be coordinated

The current legal framework requires not only a revision of the Water Code but also a number of regulations, for example, on updating tariffs for

water use, on water monitoring, on drinking-water supply and protection, on abstraction and groundwater use permits and the creation of an inspectorate. These regulations are called for in the Concept on the Rational Use and Protection of Water, and it is essential that they should be drafted and submitted for enforcement as soon as possible to provide a comprehensive and workable legal framework for water management.

Recommendation 8.6:
The respective competent authorities should draft the regulations called for in the Concept on the Rational Use and Protection of Water, including, inter alia, regulations on:

- *The water tariff structure;*
- *Monitoring water resources;*
- *Drinking-water supply and protection; and*
- *A system of permits for groundwater abstraction and use.*

The President has included providing the population with safe drinking water as a key target of his policy, consistent with the millennium development goals. Furthermore, the Concept on the Rational Use and Protection of Water calls for the development of a national programme on clean water and sanitation. This task was assigned to the Tajikistan office of IFAS in cooperation with the Ministry of Health.

Recommendation 8.7:
The Government should accelerate finalization and approval of the national programme for clean water and sanitation and start implementing it as soon as possible.