Aspects of Transboundary Water Resources Management

V.A. Dukhovny, A.G. Sorokin

Existing realities of inter-state relations in Central Asia are conditioned by the global political processes that are in progress during last two decades. These processes have started in the mid 1980s, and from the beginning of the 1990s, the geopolitics has drastically changed – the international relations system become more unsustainable. A new situation stipulates liberty to choose own way of further development by new players on the world political arena and exclusive complexity of this choice. However, finishing of "the Cold War" allowed us to look differently at the world and a role of a human being on Earth. One of benefits inherent in a new system of international relations is the recognizing by most of states of the fact that overall security depends on joint efforts related to elaborating the ways of sustainable development. The above directly refers to new independent states in Central Asia (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan) that face new tasks of protecting their national interests, foreign-policy aspects of which are closely interrelated with problems of regional and global security. In April 2007, the 15-year anniversary of activities on governing transboundary waters in the Aral Sea basin that is jointly implemented by five riparian countries was celebrated in Almaty. In our opinion, the President of the World Water Council Mr. Loic Fauchon, in his welcome address to participants of the Central Asian International Scientific-Practical Conference dedicated to the 15th Anniversary of the ICWC, has delivered the most valuable assessment:

"There are more than 260 transboundary basins in the world. But very few examples where five states are working together, hand-in-hand. Five States that are not only dealing with planning and negotiation but also with day-to-day management and functioning of two weighty rivers: the Amudarya and the Syrdarya. My congratulations"

It is necessary to give credit for strategic wisdom of the political leaders of Central Asian countries who, already in September 1991 one month after disintegration of the USSR, have initiated the meeting of national ministers of water resources (at that time, of the republics in this region). In Almaty, on February 18, 1992, after discussing the issues related to establishing the ICWC and preparation of the agreement between the Republic of Kazakhstan, the Republic of Kyrgyzstan, the Republic of Uzbekistan, the Republic of Tajikistan, and Turkmenistan on collaboration in the area of joint management, use and conservation of inter-state water resources, they have signed this agreement. Approval of the agreement by Heads of five states on March 23, 1993 at their summit in Kyzyl-Orda has demonstrated to the whole world their political will to collaboration. In January 1994, Heads of the States have approved the Aral Sea Basin Program (ASBP-1), which envisages the major directions of works for strengthening collaboration in the region, and the concept to tackle basin socio-economic and environmental challenges. Both documents created the platform for activity not only the ICWC but also for other regional organizations that were established in the frame of IFAS (International Fund for Saving the Aral Sea): the Executive Committee National Branch Offices, ISDC, and Regional Hydro-Meteorological Centre. Declarations adopted in Nukus, Dashhowus, and Dushanbe and follow-up inter-state agreements (1997, 1999, and 2002) allowed developing the inter-state collaboration in the area of transboundary water resources management. The agreement on water-energetic resources management in the Syr Darya River basin, signed by Kazakhstan, Uzbekistan, and Kyrgyzstan in 1998, plays a central role in developing the cooperation of water management and hydropower organizations.

International financial institutions and agencies for international development of many countries such as the World Bank, Asian Development Bank, UNDP, UNECE, GEF, ESCAP, OSCE, USAID, CIDA, Swiss International Development, GTZ (Germany) and many others, as well as many target projects financed by

the EC (TACIS, EuroAid, Regional Programs), NATO, INTAS made a valuable contribution to strengthening the co-operation of our countries. It should be also noted the active participation of international non-governmental organizations such as the World Water Council, Global Water Partnership, International Network of Basin Organizations and many others in strengthening the regional collaboration and relations.

A major achievement of ICWC activity over last years, under valuable support of other national and regional organizations, is the conflict-free water supply to riparian countries, in spite of all difficulties, different interests of riparian countries and their principle water users (irrigation and hydropower sectors), and alternating of extreme drought and flood periods.

As a result of joint institutional efforts, the ICWC structure was formed as a combination of regular sessions of leaders of national water resources departments and operational activity of executive bodies acting on the permanent base. The sessions chaired by a host country are held in all riparian countries in turns to specify the tasks of regional executive bodies and national departments for the periods between sessions. The executive bodies represented by the BWO "Amu Darya", BWO "Syr Darya", ICWC Scientific-Information Center, Secretariat, and Coordination Meteorological Center (CMC) implement all operational work, including:

- A joint planning of the regime of regulating river flows with adjusting the annual water sharing process for different periods (crop growing seasons and dormant seasons);
- Operative management of water releases, water delivery from inter-state sources to national consumers, monitoring of river flow rates (including monitoring of water quality at some gauging stations belonging to the BWO "Syr Darya");
- Capacity building of ICWC executive bodies by means of procuring machinery, computers and equipment, upgrading the communication system and training of personnel.
- Developing the regional information system, providing its openness and accessibility;
- Implementing joint regional projects based on common principles ; and
- Introducing and development IWRM both at regional and national level.

Joint activity of representatives of all riparian countries and regional organizations, covering last three directions, plays a central role in strengthening a mutual understanding, developing common approaches, overall awareness of local personnel, and establishing the system of co-operation. Consolidating the personnel in the process of assimilating new knowledge and joint adopting new technologies and technique, under technical assistance of international experts, is of great importance, since there is not more powerful uniting force as collective work, face to face.

Joint efforts of the ICWC, Canadian International Development Agency, Swiss Agency for Development and Cooperation, USAID and many other agencies in developing the training network and activity that allowed more than 2000 practitioners representing different levels of water management hierarchy to improve their professional skill should be also noted. The CAREWIB Project, which was jointly developed by the consortium consisting of SIC ICWC; GRID-Arendal and UNECE and funded by mainly the Swiss Agency for Development and Cooperation and partly by the United Nations, makes a valuable contribution to popularization of regional co-operation and has wide popularity in the region and abroad. Establishing the national information systems were initiated based on the unique Central Asia Regional Water Information Base with an integrated interface that enables developing the database and a set of models combined with the GIS. One of new outputs of this system is information-analytical reports that promote the improvement of current management quality of sharing water diverted from inter-state water sources.

Noting the positive tendencies in ICWC activity, the transboundary water resources management and use can not be evaluated as sufficiently sustainable due to some external and internal causes.

External challenges **are predetermined by the following destabilizing factors:**

- *Population growth,* although its rates have reduced in comparing with the last quarter of 20th century, makes up not less than 1.5% per year resulting in annual population increase in the amount of half a million people, that even at a minimum water supply rate that equals to 1200 m^3/year/person require about 700 million m^3 of additional water resources annually;

- *Urban population growth* and expanding urbanized areas at the expense of irrigated lands causes the additional need in water resources and, at the same time, necessitates replacing them with new irrigated areas;

- *Changes in crop pattern* due to restructuring of large farms and tendency to receive second crop yields and produce high-valuable crops;

- *Raising environmental awareness* promotes fulfilling the requirements to maintain ecological flows through rivers into their deltaic areas;

- *Climate changes* that are exhibiting increasing crop water requirements and more often recurrence of extreme flood and drought events;

- *Progressing decrease in world prices on agricultural produce* against increase in prices on agricultural inputs makes the irrigated farming quite low cost-effective, but under the need of developing irrigation due to its high social significance in the region (about 60% of rural population).

- *Increase in use of hydropower potential* through construction of hydropower stations on upstream river reaches, strengthening the competition for water resources mainly due to shifting the water use regime towards the interests of maximum hydropower production, especially in winter time, for satisfying own consumption and export of electric power with the purpose of receiving extra revenues.

- *Possible increase in water withdrawals from the Amu Darya River by Afghanistan* after the stabilization of political situation in this country. Already now, there are some documents, which indicate that the Government of Afghanistan intends to raise a special demand regarding the Amu Darya water resources, considering that in the past the interests of this country have not been taken into account in the Basin Schemes of Integrated Water Resources Use.

In addition, permanent raising the world prices on electrical energy (according to the forecast, prices will increase two times up to 2025) makes other kinds of water resources utilization, including irrigated farming, are absolutely noncompetitive in comparing with hydropower production. Nevertheless, the socio-economic significance of irrigation in the region is not subjected to doubts and infringement of its interests can cause a social burst due to very low incomes in rural areas in all countries of the region.

A number of *internal challenges,* which characterize consumption factors and can be controllable, first of all, due to the introduction of IWRM in the region, should be added to the above:

- *Ignoring proper managing of water,* as extremely scarce resource, at the level of state governance;
- *Lowering an accuracy of flow rates measurement,* resulting in water losses in river channels, which have risen almost two times!!!
- *Aging and obsolescence of water infrastructure* at all levels of water management hierarchy leading to unproductive water losses and deteriorating the controllability;
- *Low level of capital investments to rehabilitating and upgrading water infrastructure;*
- *Increase in the amount of water users; and*
- *Insufficient financing O&M organizations resulting in loss of skilled personnel.*

As a result, unfortunate prospects in water supply can be met in 2030. Figure 4.1 shows what we can wait for regarding a specific water supply rates (the existing level is 2460 m^3/person/year):

- Optimistic scenario – 1870 m^3/person/year;
- Under current trends – 1560 m^3/person/year;
- Pessimistic Scenario – 1430 m^3/person/year;

It means that in dry years the mentioned values is decreasing by 20-25%, and, keeping in mind entropy of large hierarchical systems, it is expected that considerable part of end users will be provided with water at the level of 50% of their demands!!!

Such a prospect forces us, as a top-priority measure, to elaborate the strategy of surviving and sustainable development, without which conflicts and a growth of mutual distrust will spread over the whole region. In the water sector, own welfare shouldn't be built based on infringement of other users' interests, especially as multilateral links are inherent in the water system, and nobody can be absolutely independent from others. An every action causes a counteraction, and when any ambitions transcend reasonable limits of disagreement, the situation in other spheres of state relations (not related to water resources) is also worsened. This concerns both basin and inter-state levels of water management hierarchy, and all subsequent relations at the level of provinces, districts, WUAs and water users.

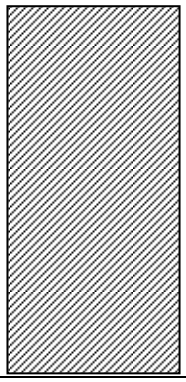
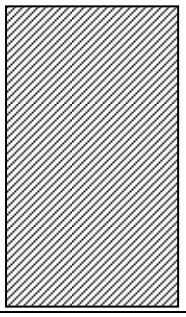
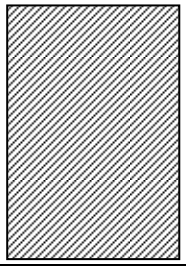
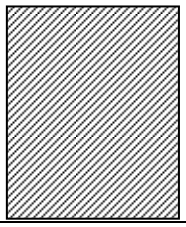
2460 m^3	1870m^3/ person.	1560 m^3/ person.	1430 m^3/ person.
			
2005	Optimistic	Business as usual	Pessimistic

Figure 4. 1 What Can Be Expected in 2030?

Therefore, the integration strategy should be adopted as the base for all hierarchical levels – integration of all kinds of waters; integration among water users and with water management organizations; integration of all economic sectors and the natural complex. All types of integration have to be aimed at achieving potential water productivity, minimizing all unproductive losses, and ensuring the sustainability and uniformity of water allocation among all stakeholders.

Unfortunately, the basic provisions of the regional water strategy elaborated in 1995 in the frame of the ASBP funded by the World Bank [9] were not further developed in the WEAMP, where they had to be transformed into the well-proportioned strategy of regional and national development. However, three developed scenarios have a self-evident significance – they demonstrate the fact that challenges of the 21st century could be solved only under harmonization of co-operation and development parameters by neighboring countries. Thus, a new united regional strategy has to be created by joint efforts of all countries in the region, and for this purpose, institutional, legal, financial, technical and planning mechanisms have to be mobilized.

A concept of this strategy should be based on the following provisions:

- Sustainable and safe water supply to the economic sectors and natural complex in all riparian countries are impossible without guarantees of sustainable and reliable management of transboundary water resources including surface waters, groundwater, and return water;

- It is impossible to solve long-term tasks are without assessment of all abovementioned destabilizing factors. By the way, apart from expected climate changes affects, such factors as population increase, possible water diversion from the Amu Darya River by Afghanistan, as well as lowering of the controllability level of depreciated water infrastructure, especially of pumping equipment, will impact on prospective water availability in the region in a considerable extent. Therefore, the concept should take into consideration both maximum and minimum parameters of external challenges. Special attention should be paid changes of the river flows regime by the reservoirs in the runoff formation zones (Kambarata, Ragun, Dasht & Jun, Yavan, and other reservoirs); and

- The concept has to reflect those political and economical changes which take place in all basin countries and to take into account their conditional character, especially in governance and water consumption in the agricultural sector as a result of the progressive introduction of market mechanisms, as well as those tendencies in overcoming increasing a water deficit which take place in the world practice.

One of key goals of the concept is *the preparedness of water sectors in the riparian countries for transition towards IWRM*, which allows, without enormous investments, to provide considerable water resources savings and increasing of land and water productivity. Special goal of the concept is the provision of water to natural complexes in the Pre-Aral deltas, preservation of rivers, water bodies and wetlands, as well as maintaining of existing biodiversity based on rational water resources use.

It is obviously that major efforts related to water saving and rational water resources use should be aimed at reducing overall water withdrawal from all sources with achieving decrease in the total water withdrawal by all economic sectors, at least, by 25% up to 2025, that is a political goal for all countries.

The crrent *institutional framework for water resources governance* at the inter-state level suffers from some "bottlenecks" that were not yet removed. Although the ICWC and its executive bodies are directly responsible for water-sharing management and improving of water resources use, there are three parallel structures at the inter-state level, which are also involved, more or less, in water governance and in solving the problems of its perspective development and improving. The IFAS and its national branches, which are responsible for providing funds for implementing the ASBP-2 and preparing new agreements and other documents aimed at improving the water management (rules, procedures etc.), with few exceptions, are ineffective, but due to their overrated ambitions, they create tension situations and parallelism in work. The Regional Hydro-Meteorological Center that was established in the frame of IFAS and has to provide improving the reliability of flows metering and forecasts, unfortunately, does not operate in the regime promoting improvements in water management. At a distance from others the ISDC exists, which should be an initiator of monitoring and management of transboundary water quality, as well as of the regional measures to achieve the MDGs in the field of sustainable development. Although the representatives of national conservancy agencies participate in the national working groups established by the ISDC for improving management of water quality, but their participation is out of the ISDC program. The Regional Ecological Center with its national branches also acts on the same field (Figure 4.2).

Hydropower production, which is coordinated, in our opinion insufficiently, by the Central Asian Energy Council and UDC "Energy", exerts great impacts on the river flows regime. Representatives of the National Ministries of Energy and United Dispatcher Center (UDC) are also involved in activity of ICWC working groups, but with a little progress.

In addition, the Eurasian Economic Community (EAEC), which established the special group for reviewing water and energy resources issues, intermittently, participates in discussions related to water resources management (these issues also discussed at the meetings of the Shanghai Cooperation Organization (SCO)). Regional influencing on the system of water governance (the organizational aspect) creates a troublesome and instable situation in water supply from transboundary sources that is reflected in indicators of water availability, and sustainability and uniformity of water supply. This situation is clearly shown in Figure 4.3 and in Box 4.2 that contains a summary of assessing water sharing and water supply in the Syr Darya basin in 2007.

Box 4.2.1

In spite of the fact that actual inflow into the Togtogul Reservoir was higher than forecasted inflow (a divergence of 7%), the schedule of water releases from the reservoir was upset; and actual water releases were less than planned ones on 1.08 km^3 (a divergence of 15%). At the end of the growing season, a water volume accumulated in the Togtogul Reservoir was on 1.8 km^3 more than a planned volume. Drawdown of the Togtogul Reservoir was uneven: in the beginning of June and July, discharges were less than planned ones on 161 m^3/sec (29%) and 209 m^3/sec respectively, but in the beginning of September, they exceeded the planned values on 63 m^3/sec (21%).

This situation could not be improved at the expense of water releases from the Andijan Reservoir, due to insufficient inflow to this reservoir (actual inflow was on 27% less than forecasted inflow) they were less than the planned water releases on 0.7 km^3 (a divergence of 27%). An actual filling of the Andijan Reservoir was close to the planned one at the end of the growing season.

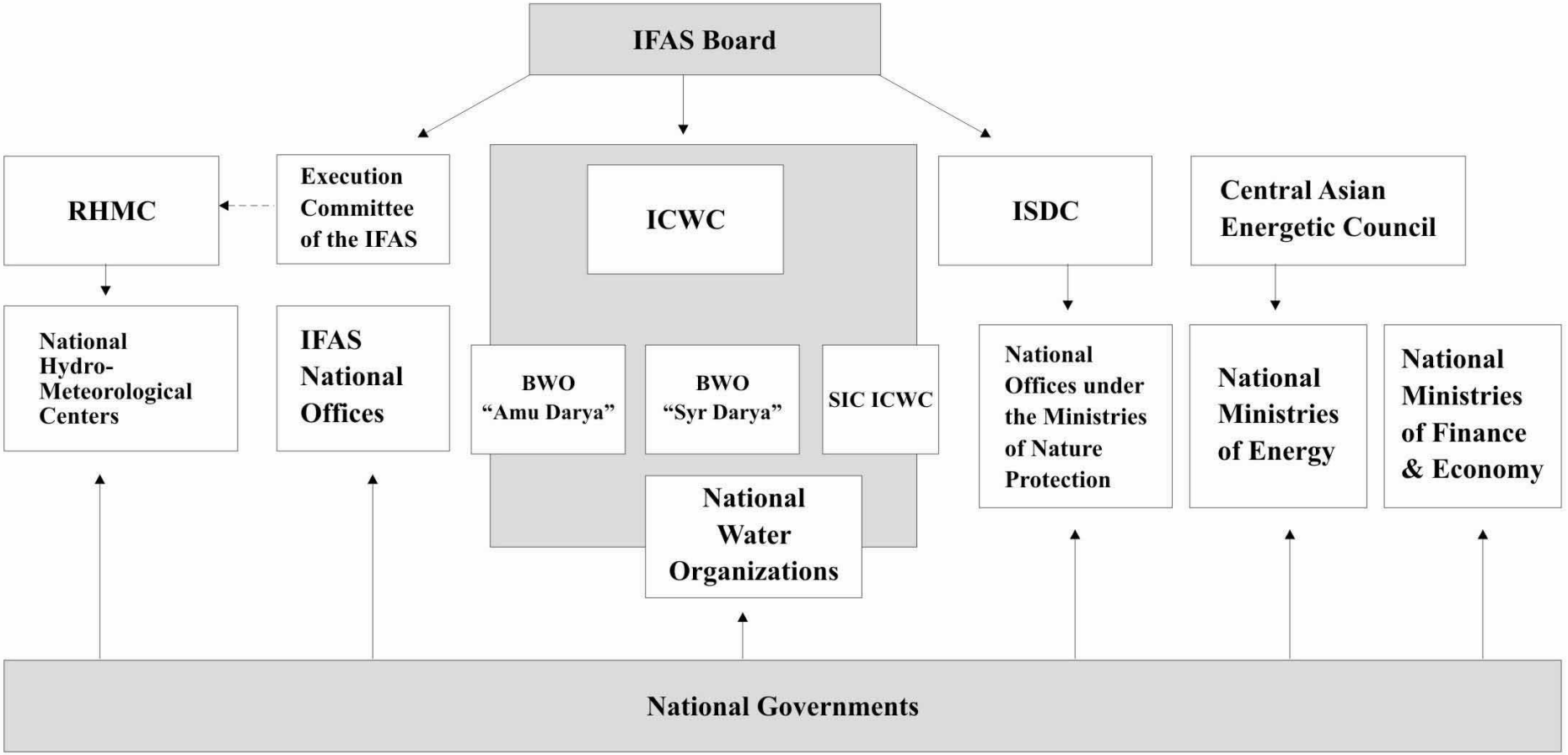


Figure 4.2 Existing Institutional Structure

It is necessary to establish the regional organizational framework with clear distributing the rights and duties, which could provide the sustainability in operation and, first of all, in financial aspects, as well as good co-ordination with national authorities related to the water sector, based on mutual trust and openness in its activity.

The following organizational structure for inter-state water governance that will allow avoiding an overlapping in operation and specifying clear rights and duties of its entities is proposed as one of options. The organizational structure of the Mekong River Commission was taken as a prototype but with taking into consideration the peculiarities of existing organizations in our region (Figure 4.3)

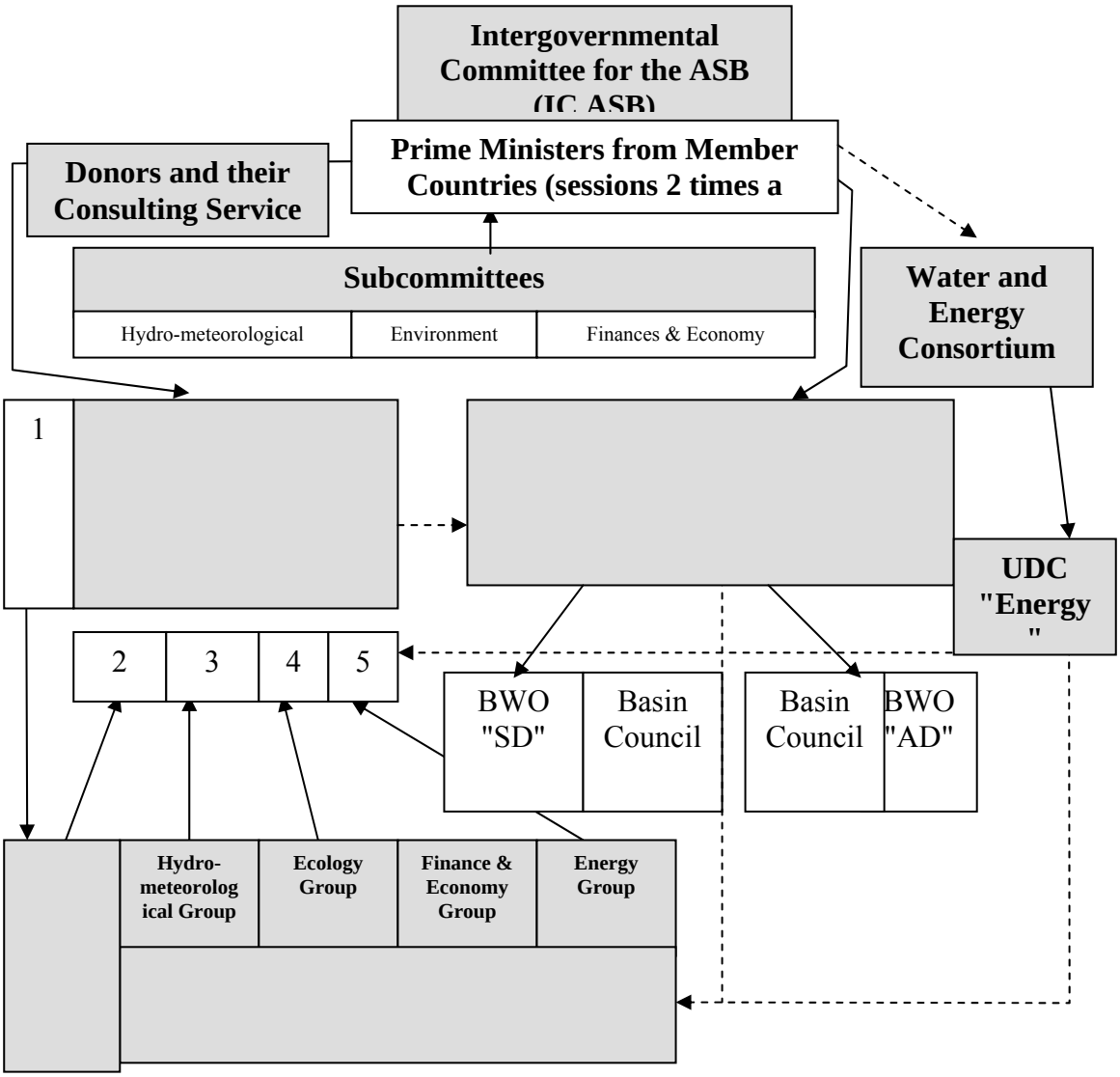


Figure 4.3. The Proposed Regional Organizational Structure for Water Governance in the Aral Sea Basin

The Intergovernmental Committee for the Aral Sea Basin (IC ASB) headed by Prime Ministers of all basin countries (in consideration of the significance of water factor) who will be, by turn, in charge of ICASB sessions that will be held strictly two times a year, prior to and after the growing season. The Committee consists of Ministers (or heads of relevant national Departments) of water resources, hydro-meteorological services, conservancy, energy, economy, as well as of Deputy Ministers of Foreign Affairs. Committee's

sessions should be held strictly on that day which was specified in the regulations without preliminary co-ordination (the experience of the ICWC shows that the process of gathering all plenipotentiaries became the procedure of long-term co-ordination according to the following path: a host country → all members of the ICWC → national governments → cross-sectoral coordination → repeated co-ordination to reach a consensus regarding a date). Over last 5 years, there were four occasions when the ICWC members did not attend the sessions, and they have signed adopted documents after the events. The proposed Committee has to replace the IFAS Board, which today lowered its status (from the representation only by Vice Prime Ministers to the combined representation by Vice Prime Ministers and Deputy Ministers)

The ICASB has to establish national offices in each riparian country, which have to replace the national branches of IFAS. ISDC, SIC ICWC, and REC. The Water Resources Management Commission for the Aral Sea Basin (WRMC ASB) becomes an executive body consisting of managers of water management departments from member countries, the Regional Hydro-Meteorological Center, subcommittee on water resources protection (former ISDC) and other subcommittees (finance and investments, energy), and UDC "Energy" (or a representative of the Central-Asian Energy Union). All chiefs of subcommittees take turns each half a year (according to the alphabetical order).

National offices include specialized subdivisions acting on behalf of appropriate ministries and departments and aimed at executing the measures adopted at the ICASB sessions for improving transboundary water resources governance and management. At the same time, a co-ordination of specialized subdivisions is implemented by relevant subcommittees in the course of their semiannual (or quarterly) meetings through personnel of appropriate national ministries and departments. Such an approach will provide their permanent participation in activity related to regional problems including transboundary waters issues, and reasonable continuity of policy, since because of frequent replacing of the sectoral representatives in the working groups and, as a result, shifts in personal attitude, hinders often the preparation of principle decisions, agreements, and operational procedures.

The United Secretariat with Scientific-Information Center in its structure will be established as a single executive body for planning, co-ordination, financing and managing water resources. This executive body will perform those functions, which, at present, are implemented with inherent fragmentariness (or have to be implemented) by the SIC ICWC (Box 1), Regional Hydro-Meteorological Center (Box 2), SIC ISDC (Box 3), Executive Committee of the IFAS (Box 4); as well as the Energy Group, which will represent the UDC "Energy" (1 or 2 persons) will be additionally established in the framework of the United Secretariat. According to the experience of activity of the Mekong River Commission, the United Secretariat should be headed by a non-resident of this region, but its personnel have to be composed by citizens of the member countries. Taking into consideration that the President of Kazakhstan Mr. N. Nazarbaev and the President of Uzbekistan Mr. I. Karimov have suggested, many times, to put the Aral See Basin Commission under the UN aegis, it would be rational if a UN representative will head the United Secretariat, with providing the diplomatic status to the United Secretariat and the WRMC ASB. In this case, the United Secretariat will work in close co-ordination with the Donors' Consulting Service, being established also under the UN aegis.

The proposed organizational structure will allow the following:

- To concentrate all governance of basin water and hydropower resources at the level of Prime Ministers, including developing key aspects of annual and long-term planning, faster developing the united legislative platform for inter-state relations, decision-making on principle issues of financing, expenditures distribution and cross-sectoral co-operation, removing any sectoral barriers and interference;

- To preserve the well-functioned management system at the national level in water-related sectors, controlling and coordinating this system with regional rules, limitations, and requirements through the United Secretariat and IWRMC;

- To involve the representatives of other economic sectors and departments, apart from water and agricultural sectors, such as hydropower specialists, hydrologists, economists, ecologists and others into the decision-making process, as well as to provide an additional status of the United Secretariat by involving the representatives of National Ministries of Foreign Affairs in its activity (therefore, reorganization of the ICWC into the IWRMC does mean not only the change of its name);

- To obviate responsibilities' overlapping, latent competition and dissipation financial resources allocated by donors and national governments, by directing them for implementing the measures clearly specified at the level of the Basin Committee;

- To establish the Water & Energy Consortium as the mechanism for coordinating interests of the energy sector with irrigation practice; and

- To involve hydro-meteorological and conservancy agencies into the united system of water management and in activity of the IWRMC in order to provide more reliable water monitoring and forecasts; to raise their responsibility for data reliability; to improve their operability in data collection and developing clear regulations for water quality control; as well as to provide their participation in monitoring and control of waste discharges for environment improvements.

Transition towards the IWRM principles at the basin level will have a great significance for improving the institutional structure. It means that activity of the BWOs should be supported by establishing the Basin Councils in each river basin with inclusion in their composition the representatives of provinces, large water users (HPS), deltaic associations and other stakeholders. Similar to the Public Canal Committees (or Water Users Unions), established in the frame of IWRM-Fergana Project on the pilot canals in the Fergana Valley, these public organizations will participate in coordinating plans and operation schedules, monitoring their implementation, assistance to the BWOs in obtaining funds for improving O&M and upgrading water infrastructure.

Along with these institutional principles, it is rational to establish the Basin Committees or Councils in the basins of small transboundary rivers. Apart from two big rivers in the region there are more than 20 basins of rivers that in the past were tributaries of the Amu Darya and Syr Darya, but currently they have lost their links with big rivers. By analogy with creating of the BWO "Chu-Talas", which is a now active, similar water management system should be established in the basins of Zarafshan, Kafirnigan and other rivers located mainly in the Syr Darya basin. At present, in the frame of IWRM-Fergana Project, such activity is initiated in river basins of Shakhimardan (Kyrgyzstan and Uzbekistan) and of Khoji-Bakirgan (Kyrgyzstan and Tajikistan). It would be rational to cover all other transboundary river basins with similar activity.

Improving legal base for inter-state collaboration

At present, there are a few principle inter-state agreements related to water resources management in Central Asian countries: two framework agreements – the first agreement adopted on February 18, 1992 and the second agreement linked to the Syr Darya River (1998), as well as earlier mentioned agreements and declarations concerning the IFAS.

An intention to support the framework agreements with more detailed legal documents was already mentioned in the Basic Provisions of Regional Water Strategy. A preliminary assessment has shown that under the general correct orientation of interstate agreements and regulations and their compliance with the international water law, their improvement, development and clarification (some aspects) are quite necessary.

It is supposed that legal and juridical provision of the water strategy will be created in the form of some fundamentals and agreements that will regulate clearly its development and implementation, including those rules and norms, which can cover various situations in regional relations and must provide sustainable conflict-free development.

Such documents, in the first approximation, have to cover the following matters:

- Inclusion of all transboundary waters, including ground water and return water, into the ICWC sphere of influence;
- Specifying the BWO's functions and its organizational structure considering the strategy being developed with the purpose of possibly full coverage of each river trunk using the BWO's capacity;
- Rules for joint use of all types of waters;
- Legislation and standards for monitoring water quality and limitations for waste discharges and disposal of some harmful ingredients into rivers and other water sinks;
- Procedures for preparing and making decisions by the inter-state water organizations;
- Arbitrage and procedures for disputes resolution;
- Liability due to infringements of water quotas, water supply schedules, operational rules, water pollution, as well as due to derangement of water supply to the Aral Sea;
- Safeguarding infrastructure and watercourses of international importance;
- Responsibility for establishing and maintaining an overall database;
- Procedures for joint activity on transboundary rivers, lakes, and streams;
- Specifying damages and procedures for their compensation, including compensations for flooding and waterlogging of lands, deteriorating of water quality etc. In addition, the further studying of these aspects and clear reflecting of studies' findings in appropriate inter-state documents are necessary;
- Public awareness and providing equal rights in water use;
- Criterion of use efficiency for transboundary waters; and
- Providing the priority of overall interests over national interests in the basin, and limitations of this priority.

At the same time, the following additional matters have to be included in some constituent documents of the inter-state organizations:

- A structure of organization;
- Official powers and duties;
- Procedures for the decision-making process; and
- Financing the inter-state activity;

Their development was started in the framework of the WARMAP Project funded by the EC, and was continued by the ICWC with participation of the EC IFAS and support of the RETA 6163 Project funded by the Asian Development Bank. At present, the ICWC has approved a text of agreement on information exchange; as well as the drafts of ICWC statute and agreement on improving the ICWC organizational structure were prepared for discussion. At the same time, under discussing a new text of this agreement on using water and energy resources in the Syr Darya basin, the existing disagreements are smoothed away by the working groups.

A considerable part of the ASBP-2 approved by Heads of the States is devoted to the need of developing a legal base for inter-state relations, in which not only the agreements developed in the frame of ADB RETA 6163 Project, but also specific procedures and rules of O&M as an attachment to these agreements were included. Thanks to the Asian Development Bank, this activity was initiated and now is in progress, though with some delay. A draft of Statute of the Water & Energy Consortium (WEC) (with different conceptions responding viewpoints of different countries) is among other problematic documents. Some experts suggest establishing the WEC as the complement body to the existing organizational structures, but other experts - as their replacement. The reasons of difficulties in forming the legal base for inter-state collaboration, first of all, consist in absence of the continuing expert group, which would tackle this problem, and in a very complicated system of co-ordination. Drafts of abovementioned documents are developed by national and regional working groups (NWG and RWG) in the frame of ICWC. Different countries have different approaches to forming and approving the National Working Groups. The Government of Tajikistan, by its decree, has approved the composition of NWG; however, in other countries the governments only coordinate the composition of experts from different ministries. Hereinafter, the procedure of elaboration and co-ordination of documents is moving forward as follows: the NWGs submit their proposals regarding the text of different documents (drafts of agreements, regulations etc.) to the RWG, and then the text is agreed at the meeting of RWG with participation of 2-3 representatives of NWGs and returned back to NWGs. As a result of coordinating with the Government and other institutions, the text coordinated with the RWG can be considerably modified. This procedure can be repeated many times. For example, the text of some agreements on the Syr Darya River went through this iteration process 11 times, but some positions remain uncoordinated. Changes in the composition of NWGs, replacements of heads of national ministries and, sometimes, lack of powers from the Government affect the coordination process.

In case of adaptation of the organizational structure proposed above (Fig, 4.3), all the coordination process will be established in the frame of the Inter-State Committee and its regional and national structures, which will have sufficient powers due to a high rank of their members. Participation of Prime Ministers and representatives of the Ministries of Foreign Affairs should provide higher status of legal documents and streamline their adoption.

At present, FINANCIAL INSTRUMENTS of the inter-state co-operation consist of proportional financing of inter-state organizations, and implementation of necessary works on the transboundary water objects within the national territory or, under co-ordination (or on request) with another country, on objects located in another country based on contractual obligations with payment for use of its territory. In the framework of the RETA 6163 Project funded by the ADB, the ICWC working groups collected data on expenditures of different countries for O&M of infrastructure on transboundary watercourses and for covering operational costs of regional organizations. In spite of some disagreements regarding the methodology employed, an assessment was made and described in the report that was submitted to ICWC members (key findings are presented in Table 4.2).

Table 4.2.

Summary of Works Implemented by Riparian Countries for Supporting of Joint Management of Amu Darya and Syr Darya Water Resources, as of 2006

	Activity/Expenditures	***Kazakhstan 000' USD***	***Kyrgyzstan 000' USD***	***Tajikistan 000' USD***	***Turkmenistan 000' USD***	***Uzbekistan 000' USD***	***Total***	***%***
1.	River training works and flood control measures	14,298.3	536.4	2750.0	4897.2	3433.9	25,915.8	42.6
2.	O&M works on inter-state water infrastructure, including works related to safety of waterworks	3300.0	1906.8	3230.0	2179.1	15,195.1	25,811.0	42.4
3	Running costs of inter-state water management organizations	307.0	32.2	347.3	3543.0	2859.7	7089.2	11.6
4	Hydro-meteorological services and forecasting	1074.5	165.8	10.0	78.8	663.6	1992.7	3.3
5	Other interventions				44.2		44.2	0.1
	GRAND TOTAL:	18,979.8	2641.1	6337.3	10,742.3	22,152.3	60,852.9	100.0
	Total in %	31.2	4.3	10.4	17.7	36.4	100.0	
		Kazakhstan	***Kyrgyzstan***	***Tajikistan***	***Turkmenistan***	***Uzbekistan***	***Total:***	
	Share of total water withdrawal, including internal sources, %	11.2	4.3	10.2	22.9	51.4	100.0	
	Water withdrawal, including internal sources, km3 (2003)	11.6	4.4	10.5	23.7	53.1	103.4	
	Total expenditures for maintaining joint water management in the basin (according to audit results), USD	18,979.8	2641.1	6337.3	10,742.3	22,152.3	60,852.9	
	Costs per1 m3 of water withdrawal, USD/m3	0.164	0.060	0.060	0.045	0.042	0.059	

Under considering expenditures for 1 m3 of water diversion from rivers, it becomes obvious that riparian countries incur different costs.

Continuing this activity, the working group has made up a list of services and costs that should be considered under specifying running costs for 2006. However, issues of distributing profit and compensation for damage, which in opinion of some countries they did not receive from their neighbors were out of consideration. In particular, this concerns damages due to incomplete use of the hydropower potential in winter time by countries located in upper watersheds and less production of electric energy. A lack of clear recommendations of the international law regarding similar precedents does not allow definitely answering what mechanism should be used for similar estimates. However, combining principles of "equitable and rational use" and "do not harm, and pay for caused damage" allows developing a certain approach, which was proposed by the specialists of the SIC ICWC (V. Dukhovny, A. Sorokin) in the process of evaluating impacts of operation of the Vakhsh Hydropower Cascade, including the Ragun HPS, on downstream users in the Amu Darya basin.

Comparing of impacts under different operational regimes of this cascade on socio-economic indicators of irrigated farming in middle and lower reaches of the river in Turkmenistan and Uzbekistan up to 2055 is given in Table 4.3. It is assumed that prices on hydropower and agricultural output are kept at the current level under a certain increase in cost of one kilowatt-hour in winter time against its cost in summer time (USD 0.02 and 0.015 respectively). Five combinations of three operational regimes (hydropower, irrigation, and combined) and two options for dam crest levels (DCL) of the Ragun Hydro-Scheme (1240 and 1290 m) were considered in comparing with the existing operational regime of the Vakhsh Hydropower Cascade.

Table 4.3.
Comparing Impacts of Different Operational Regimes and Ragun Hydro-Scheme Parameters on Socio-Economic Indicators over the Period of 2005 to 2055 (million USD/year)

Options	Losses of irrigated farming and related sectors output during the year	Reducing (-) or increase (+) of planned output against current output, including power production	Power production at Ragun HPS in money terms	Total profit against the revenues under current operational regime of the Nurek HPS
Keeping the current operational regime of Nurek HPS	94.71	-	-	-
Power regime with dam level at 1240 m	211.3	116.59	162.35	45.76
Power regime a with dam level at 1290 m	174.6	79.89	194.71	114.82
Irrigation regime with dam level at 1240 m	59.2	-35.5	159.39	194.89
Irrigation regime	37.85	-56.86	188.41	245.27

Options	Losses of irrigated farming and related sectors output during the year	Reducing (-) or increase (+) of planned output against current output, including power production	Power production at Ragun HPS in money terms	Total profit against the revenues under current operational regime of the Nurek HPS
with dam level at 1290 m				
Combined regime with dam level at 1240 m	76.18	-18.53	194.84	176.31

If to follow the "do not harm" principle, a total effect from constructing the Ragun Hydro-Scheme should differ by the amount of output losses in middle and lower reaches of the river due to affects of construction activity. In this case, both options of the power regime are less effective than three other options. At the same time, advantages of the combined regime option (irrigation and hydropower) become more obvious, because under increase in power production almost up to the level of power regime option it reduces losses in irrigation farming output in comparing with the option of current operational regime of Nurek HPS on USD 18.5 million a year, on average.

A foreign practice, for example, the experience of the USA and Canada, provides some possible solutions based on separating the functions of irrigation water management and water releases for energy production when hydropower stations should pay for water passing through turbines and, respectively, the irrigated farming sector has to pay for irrigation water supply on the commercial competitive base. Some elements of similar approaches may be used under establishing the Water and Energy Consortium (W&EC), a concept of which was proposed at the top level, but unfortunately did not get an overall understanding and supporting from all countries in the region. Some officials and experts propose to use it as a financial mechanism for implementing the water releases schedule agreed by the ICWC, but others suggest establishing a super-uniting body for governing all water and energy resources in the region. More weighted and correct solution was proposed by the Eurasian Economical Community (E. Vinokurov: Financing the Water & Hydropower Resources Complex in Central Asia, 2007) suggesting establishing the W&EC as "a permanent inter-state body with functions of a coordinator of investments and a dispatcher of the water and hydropower resources complex." This position also envisages that in the prospect the W&EC will coordinate developing the hydropower potential in the region, unutilized resources of which are estimated in the amount of 15,000 MW, for covering the winter deficit of electric power (in combination with some thermal power plants). This point of view is close to the concept developed by the SIC ICWC for the W&EC, which, first of all, is considered as the financial mechanism for regulating the necessary regimes of water releases, and then for regulating the matters related to investments into long-term development. In our opinion, the Water and Energy Consortium should be established as:

- A body, which, by means of regulating fuel and energy resources of Central Asian countries and financial flows, will organize the regular exchange of these resources with the purpose of strict coordination of the plans of water allocation and delivery to countries and their water management systems, as well as water releases from reservoirs that must be established by the ICWC taking into account social and environmental needs of riparian countries;

- An energy and fuel flows operator that provides to regional countries guaranteed supplies of fuel resources and electric energy necessary for optimal life support and functioning national economy; and

- A financial structure for seeking funds for implementing various projects with purpose of developing new hydropower capacities based on parameters of water management and water releases from the reservoirs agreed by all countries.

Activity of the regional bodies of W&EC can promote the improvement of the PLANNING MECHANISM of water allocation and the regimes of water releases from the multipurpose reservoirs with hydropower plants. At present, the ICWC is approving only water supply regimes and recommends the regimes of water releases for their coordination with the hydropower production organizations and owners of the Hydropower stations. As a result, the process of coordination with participating of the administration of national hydropower ministries, based on the mechanism of compensations for procurement of fuel resources or electric energy, is sometimes delayed until June, slowing the procedure of normal planning (prior to the beginning of a growing season (1st April) or a hydrological year that starts since 1st October).

Among other measures for improving the planning system, enhancing an accuracy of forecasts regarding natural inflow into reservoirs in the upper watersheds and lateral inflow into rivers, including return water, should be noted. Analytical documents that were placed on CAREWIB portal are showing that if a mean annual accuracy of forecasts for a growing season varies over the range of 17 to 35%, accuracy of forecasting inflow into some reservoirs (from April to June) within 50% resulting in quite unstable operation of inter-state water organizations at the beginning of the growing season. At present, BWOs have mastered the computerized technique of planning and adjusting their plans depending on updating forecasts and current water situation. However, to improve the effectiveness of this planning process it is necessary to implement some measures for enhancing the coordination of five national hydro-meteorological services, their capacity, and collaboration with national and regional water administrations, in particular:

- To put into operation the united system of record keeping and monitoring of river flows, including transboundary and ground waters;

- Specifying and permanent control of river flow losses, in their channels, that increased two times during last years;

- Preparing the reliable climatic and hydrological forecasts with special emphasis on monthly forecasts in dry and wet years;

Unfortunately, efforts of different donors an, first of all, the Swiss Development Cooperation (SDC) to assist in establishing the Regional Hydro-Meteorological Center face the ambitions and commercial egoism of some national services. On the way towards the proposed organizational structure of water co-operation under the direct leadership of five national governments, these adverse tendencies can be overcome if to proceed from the vital need to strengthen the collaboration of countries in managing transboundary water resources in the interests of all riparian countries in order to survive under the conditions of the growing water deficit.

The above system of STRATEGIC PLANNING that may create the platform for future water welfare in the region under a great complexity of coordinating the national interests and keeping in mind regional limitations has to become the cornerstone of the planning system. Undoubtedly, funds are necessary, but also other principles of joint activity – not only inviting the foreign consultants who can submit the non-committal report but also joint alternative planning of possible prospects by national institutions of strategic researches with the participation of regional water organizations based on the inevitability of seeking the joint solutions. Creating this document will be under permanent monitoring of the Inter-State Committee and former ICWC transformed into the IWRMC, which, through the United Secretariat (with the

Scientific-Information Center) will seek the regional consensus in developing the strategy and its preparation for approval by the Governments of all riparian countries.

INSTITUTIONAL MECHANISMS of the co-operation suggest, first of all, establishing the transparent and accessible regional information system including sub-systems for each river basin. It has to be coordinated with national information systems based on the principle of "information screen" and an integrated morphological structure of regional, basin, and national systems. Such a system was developed in the framework of the CAREWIB Project for top levels of water management hierarchy (the region, basin, and country) and even covers, partially, a sub-national level in the form of so-called "planning zones" that coincide with boundaries of provinces, or are their parts. Using the GIS, the planning zones are aggregated with sub-basins and then subdivided into irrigation and drainage systems. The morphological layout of the Syr Darya basin with subdivision into planning zones (PZ) is given in Figure 4.4, and the principle of their coordination with the irrigation systems, is demonstrated in Figure 4.5.

Figure 4.4 Morphological Layout of the Syr Darya Basin by Planning Zones

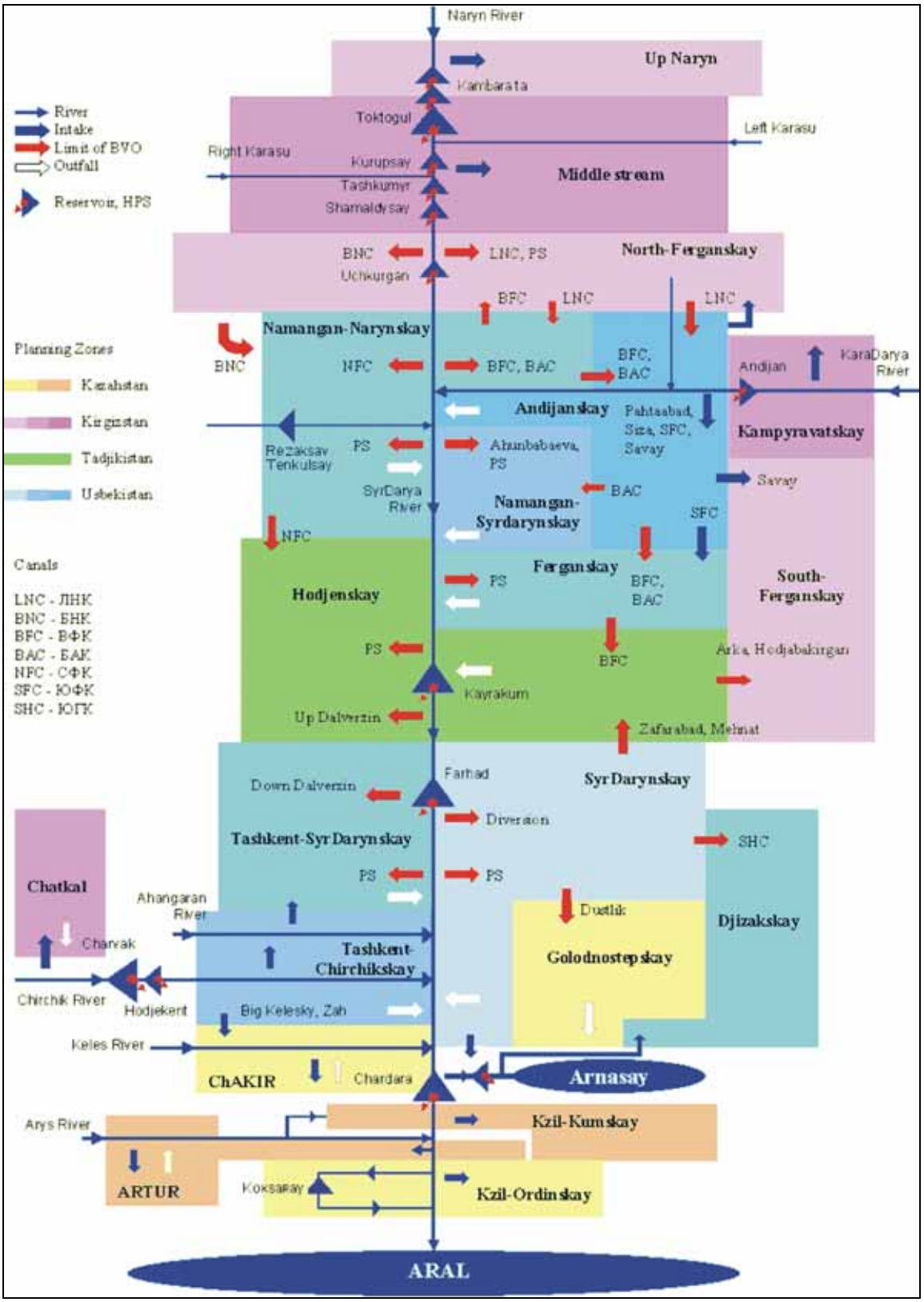


Figure4.5. The Syr Darya Basin.Interrelations of Planning Zone with Irrigation Shemes.

The Management Information System includes database, GIS, and a set of subsidiary models links of which are given in Figures 4.6 and 4.7., and which allow solving operational management problems and supporting long-term planning.

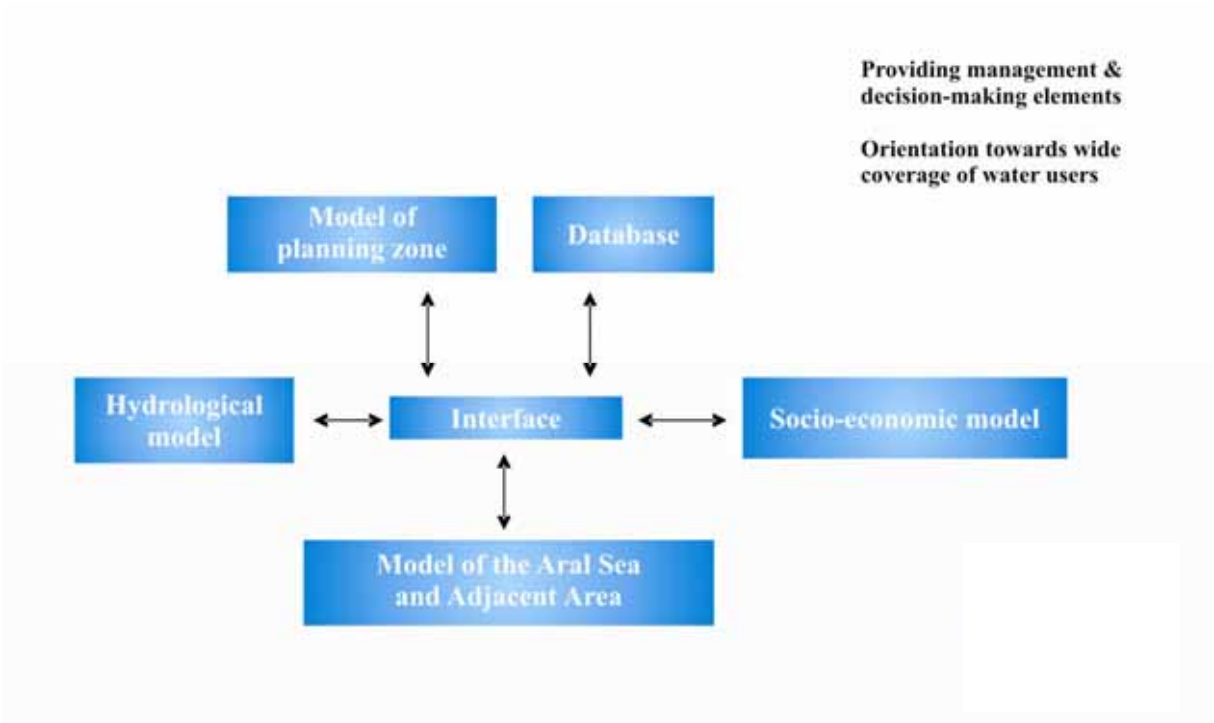


Figure 4.6 Hydrological Model (HM) of the Syr Darya Basin in a Set of ASB-MM

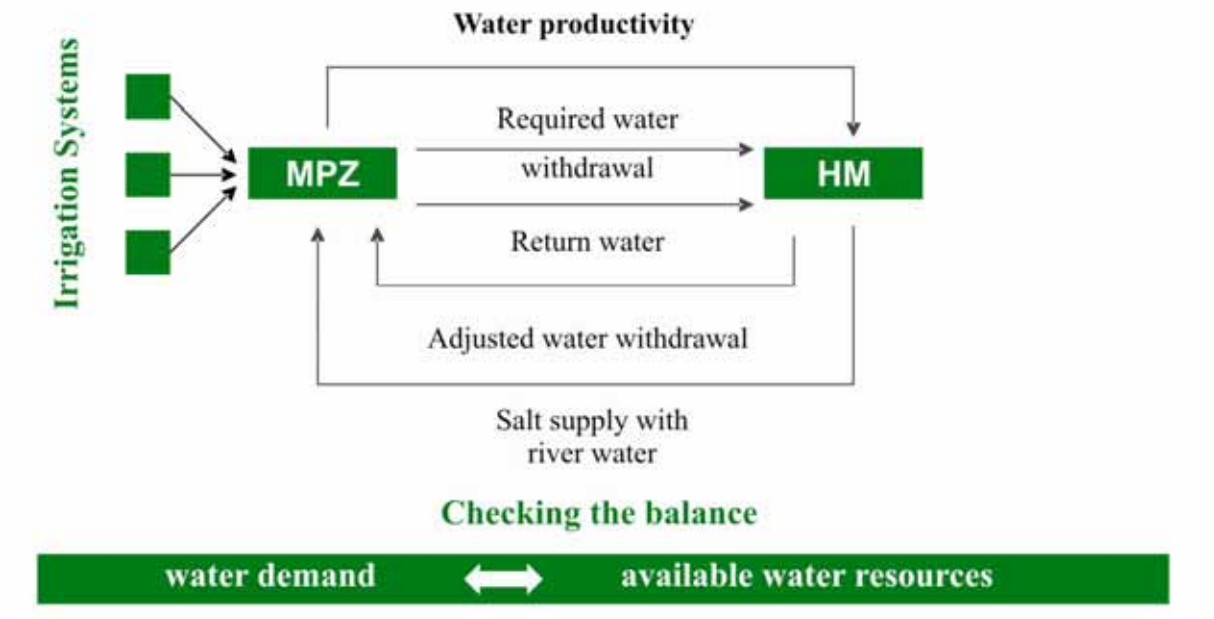


Figure 4.7 Links between the Hydrological Model (HM) and the Planning Zone Model (MPZ)

A set of models proposed for planning and evaluation of management results enables to adjust water allocation continually in order to maximize implementing the planned water use limits in each zone, country, water district, and planning zone. At the same time, socio-economic blocks allows estimating an

effect of one or another principle of water allocation and its impacts on productivity of agriculture and development of secondary services so that "initiators of actions" may understand and evaluate effects of their actions

Another important tool is the involvement of all stakeholders into the water management process. Introducing of IWRM on the South Fergana Canal (a command area of about 100,000 hectares) allowed to reduce water supply through this canal on 39% in comparing with water supply in 2003 (Fig. 4.8) only owing to use of participatory and hydrological approaches with minimum costs for improving the hydrometric practice.

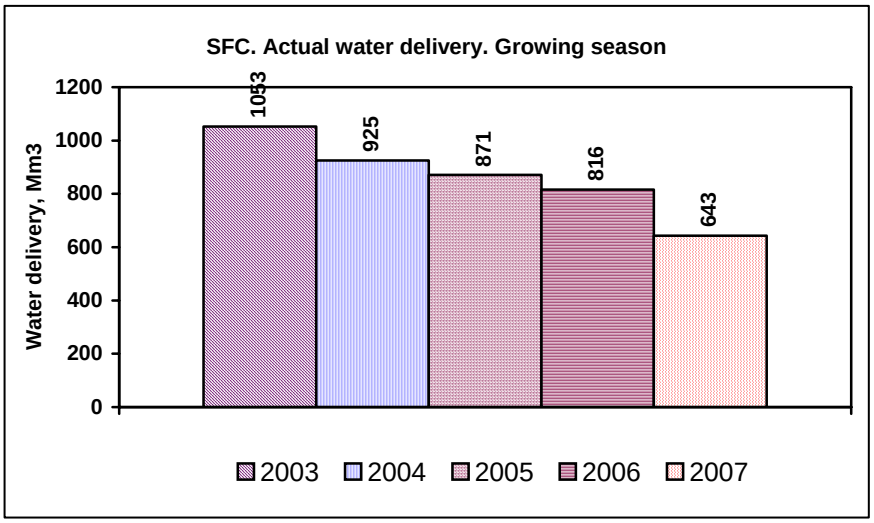


Fig.4.8. Dynamics of water delivery from the South Fergana Canal

Similar involving of water users, under establishing the Basin Councils under the BWOs "Amu Darya" and "Syr Darya", enables to enhance coordinating of different water organizations' activity and, at the same time, to assist BWOs to introduce proper order in water allocation. An experience of pilot projects shows that monthly meetings of Canal Water Council's members allow involving communities in the water management process not only as supervisors but also as parity participants responsible for maintaining planned regimes and water diversions at each river section. It is rational to subdivide the Basin Councils into separate units representing each balance site on the river, firstly, in order to monitor these parameters of water management within own site, and, secondly, to defend the interests of own site at regular meetings of the Basin Council.

It is very significant to involve the representatives of lower river reaches, especially, of deltaic water administrations, with their interests that are often infringed upon, in particular, in dry years. The Basin Councils, with their site entities, can assist clearly to specify the environmental requirements of both deltas and some basin sites for preserving the rivers as natural objects. For this purpose, water users and representatives of provincial water administrations, owners of reservoirs and hydropower stations, as well as representatives of the fishery sector, public utilities, and conservancy agencies should be members of the Basin Councils.

One more important element of water management is the training and professional development of personnel of water management organizations engaged in O&M of waterworks on the river, BWOs, national water management organizations, and water users. In 2001, the ICWC Training Center was established based on financial and technical assistance of the Canadian International Development Agency (CIDA), Swiss Development Cooperation and other donors. More than two thousands of water professionals were trained at advanced training courses covering IWRM principles, advanced technologies, international water law and a number of other areas of water management under relatively low financing by donors (about USD 130,000 annually). On the same base, affiliates of the ICWC Training Center were established in Osh, Fergana, Andijan, Urgench for covering water professionals of the intermediate and "grass roots" level, as well as water users. However, after cessation of CIDA financing, since 2006 we are forced to seek funds for training activity continually since even support of trainees (accommodation, travel expenses, daily allowances, learning aids etc.) requires the availability of currency allocations, which the ICWC does not practically have.

The Asian Development Bank renders some support, using which, in 2005 and 2006, 11 advanced training courses covering topics related to water management and water law were held for personnel of national ministries and basin organizations; and this training activity allowed promoting some improvements in operation of ICWC organizations and adopting the inter-state agreements.

It is also necessary to note two target programs funded by the ADB and OSCE. These are: the program "Water & Gender Policy", based on which the Central Asian Network of Global Water Alliance was established with broad involving of women and opening of liaison offices in all regional countries; as well as the program "Water & Education," with help of which the topics covering special knowledge on water resources will be included in a curricula of secondary schools.

Developing of gender movement in the water sector has already provided some results, namely the emergence of women among chiefs of WUAs and even CWUCs. As an example, the great organizational activity of Mrs. Maysura Sayfutdinova, the chairwoman of the Water Users Council of the South Fergana Canal, can be mentioned. Often, women-managers are more "go-getter" than men, especially, keeping in mind the local mentality. Therefore, the special training programs should be aimed at training of women-farmers and women - water users in order to strengthen a role of women in WUAs.

An interactive training method, employed in the ICWC Training Center, under which all trainees can exchange their practical experience, is exceptionally useful for creating the atmosphere of collaboration and an understanding of peculiarities and approaches of other countries, as well as for reaching the consensus in the overall view on the future of water resources use. In our opinion, development of training activity is the most profitable and effective investments into raising knowledge and capacity of water professionals, into strengthening the co-operation and creating the atmosphere of "team spirit" in riparian countries, sub-basins and provinces.

Technical assistance and enhancing of training activity at the regional level is one of top-priority objectives of the EC strategy for strengthening the co-operation between Central Asian countries. Proposals for developing training activity were jointly prepared by the SIC ICWC and UNESCO IHE and submitted to the embassies of EC countries; we hope that the international institutions, in the first place, the EC will provide the financial support to the central training center and its affiliates.

Technical mechanisms for improving water resources management at the regional level, first of all, include the system of monitoring, record keeping, and information exchange. Some progress was reached in this direction. In particular, in 1996, activity related to the introduction of the SCADA (Supervisory Control and Data Acquisition System) on the Dustlik Canal's headworks funded by the CIDA was initiated; and later on the technical and financial assistance of the SDC allowed automating operation of the first dozen of hydraulic structures in the Syr Darya basin. The SCADA, in spite of all fluctuations of water levels and flow rates near a head hydraulic structure, ensures sustainable water delivery into secondary irrigation canals in accordance with planned parameters and, simultaneously, implementation of the monitoring and control of water levels and flow rates within the irrigation system. Earlier, all changes in flow rates near the Uchkurgan Hydro-Scheme (sometimes, up to 100 m3/sec) immediately affected irrigation water supply over the whole Fergana Valley (through headworks of North Fergana Canal, Big Fergana Canal and other main irrigation canals). At present, in spite of the same flow rate fluctuations, deviations in flow rates passing through the headworks do not exceed ± 2 %.

International experts who monitor the introduction of the SCADA on irrigation canals have highly assessed the reached progress and prepared the special presentation for the ICID[1] session in Sacramento.

It is necessary to note that the participation of local personnel and use of engineering tools that earlier were employed only at USSR enterprises with restricted access ("SIGMA") allowed reducing the cost of these works 5 to 6 times in comparing with foreign prototypes, ensuring the same quality of operation. The introduction of SCADA is the cheapest way of water losses control. The SIC ICWC together with BWOs

[1] International Commission on Irrigation and Drainage

developed the proposal on completing these works in the Syr Darya basin and their full developing in the Amu Darya basin that is estimated in the amount of USD 16 million; however, unproductive water losses in the region will be reduced minimum by 7-8%.

We hope that donors and financial institutions in Central Asian countries will find the funds for completing these works in two major river basins within the next 2-3 years.

The introduction of SCADA provides two technical innovations – regular control of water levels and flow rates passing through headworks of inter-state importance and permanent monitoring of water quality. Such a continual monitoring with simultaneous transferring of data to the control units of territorial and central BWO offices allowed avoiding considerable fluctuations in flow rates that took place earlier when flow rate measurements were performed only four times a day. In addition, this system creates the trust and openness in water management in the basin. Including the network of hydrological monitoring on rivers and in upper watersheds that maintained by the National Hydro-Meteorological Services into this system is the next topical task. These works are quite significant for improving an accuracy of water records and forecasts.

DEVELOPING THE NATIONAL PROGRAMS FOR EFFECTIVE WATER RESOURCES USE is no less important instrument than strengthening the collaboration at the regional level. It is very important that, within the above framework of jointly developed strategy, all riparian countries will provide the progress in achieving those indicators of rational water consumption and improving water productivity, which were put into the joint plans.

It is also very important to return former governmental attention and support to water sector in Central Asian countries. First of all, it should be expressed in establishing the united state bodies for governing water resources at the top level as it was done in Tajikistan and Turkmenistan. At the same time, the National Water Councils under the leadership of Prime Ministers should be created in all riparian countries to provide the broad public participation in the decision-making and to coordinate other ministries in respect of rational water resources utilization.

Of course, the proposed program is not complete. This is only some considerations aimed at assisting in developing appropriate plans and measures that can be a cornerstone of the holistic survival program of Central Asian countries under conditions of a future water resources deficit.