EXISTING AND EMERGING BASIN ARRANGEMENTS IN ASIA:
Tarim Basin Water Resources Commission Case Study

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1. DESCRIPTION OF THE TARIM RIVER BASIN

Physical Characteristics of the Basin

The Tarim River Basin is located in the southern half of Xinjiang Uygur Autonomous Region (XUAR), PRC. It is surrounded by mountains on three sides and is a closed-basin with no outlet to the sea. Most of the inner area of the basin comprises the Taklamakan Desert. From the confluence of its three main contributing tributaries, the Tarim River mainstream extends some 1300 km to Taitema Lake. There are numerous other rivers coming down from the mountains that disappear into the desert.

Historical annual flows average over 4 billion m³, but for the past two decades there has essentially been no flow below Daxihaizi Reservoir, 300 km upstream of Taitema Lake. This 300 km reach referred to as the “green corridor”, has thus been without any significant or sustained flow during this 20 year period. As a result, the forest of *Populus diversifolia*, that was once supported by the flows downstream of Daxihaizi Reservoir, is now no longer viable. It is this gradual loss of the “green corridor” which is one of the driving reasons for developing a project aimed at better management of the water resources of the whole Tarim Basin. It has gained national and international attention as an amenity to protect, and the central government has included it in national policy. In addition, water quantity has been drastically reduced and water quality has deteriorated dramatically in the lower reaches of the Tarim River which have negatively impacted irrigated agriculture and pasture lands.

The Tarim Basin is a desert with average precipitation of 50 mm per year in the basin floor. Precipitation in the mountainous areas surrounding the basin can exceed 1000 mm per year in some areas and is mostly in the form of snowfall. A number of rivers fed by snowmelt and glacier melt begin in the mountains and drain into the basin with average annual virgin flow of about 35 billion m³. Temperatures range from bitter cold in the winter (as low as 20 degrees centigrade below zero) to hot in the summer sometimes exceeding 40 degrees centigrade. Peak flow months in the rivers are July, August and September. Lowest flow occurs in the period from January through April. Around the rivers may be found oases of small villages and agriculture.

The three tributary river systems that contribute flows to the Tarim River (Aksu, Hotan and Yerkand) join just above the Aler gauging station where the Tarim River begins. In addition the Kaidu-Konque River Basin, which is hydrologically separate from the Tarim River, contributes water to the Tarim River by means of a man-made transfer channel. Actual annual contributions
under existing conditions are estimated to be 2.9 billion m$^3$ for Aksu, 1.2 billion m$^3$ for Hotan, 0.1 billion m$^3$ for Yerkand, and 0.15 billion m$^3$ for Konque, for a total of 4.35 billion m$^3$. All of this water is consumptively used before reaching the “green corridor”.

A number of other subbasins exist within the Tarim Basin that do not contribute flows to the Tarim River because all of their flows either naturally evaporate in the desert or are used in irrigated agriculture areas. The two main subbasins in this category are the Kashgar River and the Weigan River.

Five prefectures comprising 40 counties and cities make up the administrative units of government under the Regional Government of XUAR. It is this political subdivision of the Regional Government that gives rise to rights and interests in the tributaries and mainstream flows, as each unit has economic objectives or quotas of production to meet, especially for cotton. The Tarim Basin’s population is about 5 million, most of whom are poor minorities (84% Uygur; 4% Kyrgyz, Hui, Mongol, Kazak; and 12% Han [Chinese majority]).

Therefore, with the three main tributaries upstream and in four prefectures (Hotan, Kashgar, and Aksu prefectures and the Kizilsu Autonomous Prefecture), we have the classic situation of upstream/downstream riparian claims. The mainstream is wholly located in one prefecture (Bayingol Autonomous Prefecture). Two of the tributaries originate in neighboring countries (Aksu River flows from the Kyrgyz Republic, and the Kashgar River which originates in Kyrgyz Republic and Tajikistan).

Although there are petroleum and mineral resources in the Basin, the only viable economic livelihood for the great majority of the population is farming and animal husbandry, and these are only possible through irrigation.

**Historical Perspective on Water and Land Use**

Although irrigated agriculture has been practiced in the Tarim Basin for many centuries, major increases in water use for irrigation began in the 1940s and continues to this day. There are presently over 1 million ha under irrigation in the basin and additionally about 3 million ha of irrigated pasture and range land. Irrigation and drainage systems have been developed with the main objective of increasing irrigated areas at a minimum cost. This has resulted in leaky inefficient systems. Because of the low river flows in March, April and May water availability is deficient in this period. Shallow large-surface-area reservoirs have been constructed with leaky dikes. These reservoirs are filled in the fall and used in the spring which results in extremely low irrigation efficiencies, sometimes less than 5%.

Operational practices have also been very wasteful, partly due to the geo-climatic conditions in the basin and limited storage facilities. In general water is run-of-the-river diverted whenever it is available and there is sufficient capacity to divert, regardless of the irrigation demand. There are three additional principle reasons for why the diversion and operation efficiencies are low. First, there has been no system of water rights and no recognition of downstream water allocation based on needs and rights of all riparians. Second, when water has not been needed for irrigation, diversions have been directed towards filling the groundwater reservoirs and
providing water to marginal range lands. And third, operation is easier and less costly when gates are essentially left open all of the time.

The combination of inefficient irrigation systems and questionable operational practices has resulted in dramatic decreases in downstream flows and a deterioration of downstream water quality along the Tarim River mainstream and particularly in the loss of water to the “green corridor” in the lower reaches. These inefficient systems and practices have also resulted in large areas of water logging and salinization and large areas with high groundwater tables in the subbasins. Major water losses to evapo-transpiration occur in these areas.

In recent years, the XUAR Government wherein is located the Tarim Basin and the Chinese Central Government have been paying increasingly greater attention to these water management problems in the Tarim Basin. These governments have come to realize that further development of irrigated agriculture in the Basin must be predicated on major changes in water use and management practices. Recently awareness has increased considerably at the subbasin level in the prefecture, county, township and village governments and with the water users themselves of the importance of improving water management and continuing to deliver sufficient water to the Tarim River to preserve its environment.

The governments have also acknowledged that water resources management requires their uncompromising commitment and they can not promote conflicting policies. Sustainable water resources use and development requires that good water resources management be an \textit{a priori} requirement that must be met before increases in agricultural production can be promoted.

2. THE BASIN INSTITUTION DEVELOPMENT PROCESS

\textbf{Water Law and Administration in PRC, XUAR and Tarim Basin}

Water administration and management in the Tarim Basin follows the general pattern of provincial/regional government structure. The Regional Water Resources Bureau (RWRB) of XUAR is located in Urumqi, the XUAR capital. Within each prefecture are Prefecture Water Resources Departments, and at the county level are Water Management Stations. Although there is a professional relationship between the RWRB and the prefecture and lower level water departments and stations, the latter are under the direction of the prefecture governor and People's Committee.

However, all water agencies through PRC are required to implement the national 1988 Water Law and other national water and related laws consistent with the national constitution. The 1982 Constitution established the fundamental resource principles that must be complied with by all central and local government laws, policies and regulations.\footnote{The constitution contains three articles that specifically address natural resources. Article 9 provides that “\textit{all mineral resources, waters, forests, mountains, grasslands, unreclaimed land, beaches and other natural resources are owned by the state...}” except for forests, mountains, grasslands and unreclaimed land and beaches owned by collectives by law, and further provides that the “\textit{state ensures rational use of natural resources...}”. Article 10 provides the fundamental principle that “\textit{land in cities is owned by the state}”, but “\textit{land in the rural areas and suburban areas is owned by collectives}” including house sites and privately farmed plots of cropland and hilly land, except land that belongs to the state under the law. The Constitution further provides in Article 26 that “\textit{The state...}”} The key national water and related

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laws that provide the legal/institutional framework for water resources planning, development and management and related environmental protection and management are: \(^2\) the Water Law of 1988, Water Pollution Control Law of 1984 and revised in 1996, the Environmental Protection Law of 1989, the Water and Soil Conservation Law of 1991, \(^3\) and the Flood Control Law of 1997. These are the five primary laws in the areas of water and environment. \(^4\)

The 1988 Water Law is the fundamental and “umbrella” law for water management in China. The purposes of the Water Law are coordinating and standardizing all activities for the comprehensive development, utilization and protection of water resources, harnessing of rivers, control of water related disasters and the basic law to adjust all the social and economic activities and relationships related to water. It consists of seven chapters and 53 articles. In summary, it:

- declares that water resources (surface and ground water) are property of the state, except that water in ponds and reservoirs owned by agricultural collectives is collectively owned \(^{(\text{Art.3})}\);
- establishes that the state shall take effective measures to protect and preserve water resources and the ecological environment \(^{(\text{Art.5})}\);
- sets out a system of centralized and integrated water management from the central down to the county levels \(^{\text{(Arts. 6-9)}}\); in accordance to basin development plans, hence a system of unified water administration and management;
- requires data surveys and preparation of comprehensive (basin and regional) plans and professional (specific water issues) plans \(^{(\text{Art. 10})}\), involving all relevant levels of government and taking into account the upstream/downstream interests \(^{(\text{Arts. 10-13})}\); and specifically addressing the nature and problems of groundwater extraction \(^{(\text{Arts. 25-26})}\);
- identifies priorities of use (domestic, irrigation, industrial, navigation in that order) and specifies the need for multi-purpose development \(^{(\text{Arts 14-23})}\);
- establishes a water permit system for diversions and extractions of water (except small scale household uses) \(^{(\text{Art. 32—33})}\);
- requires levying water charges for water uses \(^{(\text{Art.34})}\); and,
- pays considerable attention to flood prevention measures, standards and plans, and protection from flood conditions \(^{(\text{Arts 38-43})}\).

There are also two recent significant central government policies and implementing decrees that must be applied in XUAR. \(^5\) They are the Industry Policies for the Water Sector \(^6\) and the

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\(^2\) There are reportedly over 25 laws at the central level and over 300 laws and regulations at the provincial level that directly or indirectly concern water resources and the water sector.

\(^3\) This is the second most important law directly concerning water because of its recognition of the inter-relationship between water resources and soil (land) conditions.

\(^4\) There are many other laws of significance to water resources and development of related resources, such as the 1988 Land Administration Law, 1996 Mineral Resources Law, 1997 Energy Conservation Law, 1984 Forestry Law, and a host of other laws that affect the public, quasi-public/private and private sector agencies and enterprises, such the 1987 Principles of Civil Law, 1994 Company Law, certain tax and administrative procedures laws, and the multitude of State Council rules and regulations (decrees) adopted to implement them.

\(^5\) A total of 16 administrative laws and regulations on water issued by the State Council have been identified. Since the issuing of the Water Law, the Ministry of Water Resources, in several cases in conjunction with other ministries and commissions, has issued more than 50 ministry regulations.
Regulations for the Implementation of the Water-drawing Permit System. The Industry Policies decree defines the characteristics of different classes and categories of projects, promotes the industrialization of the water sector, promotes water savings and protection of water resources, clarifies financial issues under the Water Law, and places strong emphasis upon the implementation of a system of paying for the use of water resources and for payment of a water resources fee. In this regard, three important steps are required: (i) water use must be measured; (ii) the national water-drawing permit system is to be implemented in accordance with the Regulations for the Implementation of the Water-drawing Permit System; and (iii) according to the class of project, the water service fees will be set and collected.

Most all of the water laws are under the implementation responsibility of the Ministry of Water Resources, Beijing, which, together with the State Council, promulgates implementing decrees and rules. These laws and decrees/rules are implemented at the provincial/regional government level by "regulations" and policies adopted by the People's Committee, and further carried out by provincial and prefecture water Bureau and Department rules and circulars. The Water Management Stations have a direct relationship with the townships and villages. The XUAR has adopted implementing regulations and guidelines for the five key water and related laws and the two key implementing decrees.

**Institutional Setting in the Tarim Basin**

Prior to 1990, water management and administration was carried out by RWRD and the prefecture and lower level water departments and stations. In 1990 during the pre-appraisal of for phase I (Tarim I) project, it was recommended that the water resources of the Tarim River should be planned and managed in an integrated manner, used rationally, and managed and administered in a comprehensive and coordinated way with the ecology, economy and people's of the basin. The recommendation was to create a management structure for at least the key water source system and uses in the basin. In March 1992, the XUAR government issued Official Letter No. 20 establishing the Tarim Basin Management Committee and Management Bureau of the Tarim Basin. Subsequently, in 1994 an additional letter was issued by the government providing temporary regulations for water administration, planning and management of water resources in the basin, and a letter was issued by the RWRB delegating management and administrative powers to 40 basin management organizations, such as the Management Bureau of the Tarim Basin.

The Management Bureau actively carried out planning and management of the Tarim River, installed monitoring stations, and attempted to promote regulations for water licensing and use according the water law in order to reconcile the differences among the prefectures. However, being confined to the mainstream, they lacked the authority and status to bring the prefectures together, and they were directly under supervision of the RWRB, not the Committee. Likewise, the Committee either lacked the authority or willingness to adequately address the inter-jurisdictional issues, partly due to their structure and partly due to their composition.

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Thus, at the end of the Tarim I project, the institutional framework for water planning and management was weak and ineffective; the ability to manage the waters of the basin in an integrated manner did not materialize, the steps for project control were insufficient, and the funding to was also insufficient.

**Water Management in the Tarim Basin**

For some time, and more so lately, the international water community has been addressing the question of basin efficiency versus individual system efficiency. The main point of this debate is that individual irrigation or water supply systems may make very inefficient use of water resources with high waste and losses. However, much of these losses returns to the river or groundwater system and is used by others downstream, so the overall basin efficiency may be very high. Lining canals and plugging leaks may reduce the water needs or increase the water available to a particular system, but it may result in little incremental benefit to the basin as a whole.

To put this debate into perspective, it is useful to look at water supply and uses in the Tarim Basin. Considering the entire basin, the only water entering the system is precipitation (P) (mostly in the form of snowfall in the high mountains) and the only water leaving the basin is evapo-transpiration (evaporation from water and ground surfaces, and transpiration by plants, hereinafter referred to as ET). It is useful to divide the ET into 3 components: (i) consumptive use related to human activity in irrigated agricultural, and municipal and industrial uses (CU); (ii) beneficial ET (BET) from trees and green areas along rivers and in and around oases; and (iii) non-beneficial ET (NBET) mostly in low lying areas with high water tables (including areas of salinization) and non-ecologically beneficial water surfaces. In the Tarim Basin, average annual values of these parameters in billions of cubic meters are estimated to be: P=60, CU=5, BET=10 and NBET=45. The breakdown between BET and NBET is open to considerable debate, but in general it can be concluded that there is a very large amount of NBET, much of it directly attributable to the inefficient irrigation system development.

The overall goal of water resources management in the basin should be to maximize CU and BET and to minimize NBET. To maintain BET at its present level, increases in CU should be offset by correspondingly equal decreases in NBET. To increase BET, increases in CU should be offset by correspondingly larger reductions in NBET, which will be necessary to meet the objective of increasing flows to the “green corridor”. Water resources planning and management in the entire Tarim Basin should be firmly based on these basic concepts. It is possible to significantly improve water use in the basin because the overall amount of NBET is large. Significant increases in both CU and BET can be achieved through proper planning and management and still increase flows to the “green corridor”.

At the subbasin level, these concepts also apply. The inputs to each subbasin will be surface water (SW) and groundwater (GW) inflows from the Mountain areas (precipitation is very low and can be neglected); and the outputs are SW and GW outflows, and ET (CU, BET and NBET). Because the overall Tarim Basin goal is to maintain and enhance the BET in the lower reaches, each subbasin should be managed to maintain or increase the sum of SW and GW outflows. Because GW inflows and outflows are relatively small and because the GW outflows will not be greatly changed as a result of different development and management options, water resources
management at the subbasin level should concentrate on maintaining or increasing SW outflows. New development and water management strategies at the subbasin level should concentrate on increasing CU while effectively offsetting this increase with correspondingly equal or greater decreases in NBET within the subbasin. This is the same conclusion reached above when discussing the Tarim Basin as a whole.  

The way to achieve better efficiency in water utilization is through proper planning and management carried within an institutional framework that brings the vested interests together while allowing them (the established water and related agencies, and the water users) to effectively carry out their activities.

It is important to recognize that these physical and operational improvements in irrigation and drainage systems will make the provision of irrigation water more costly than historically provided in the Tarim Basin. This will be the case even though considerable improvements in water logged and salinized areas will result which will partially offset increased costs. The water users and government entities are aware of these increased costs but recognize that they will be the cost of doing business in the future and that without these higher costs, increases in irrigation development can not be permitted. Possible sources of funding of at least part of these increased costs are discussed later in this paper.

A Need for Change in Water Management in the Tarim Basin

Given the short period of time to experience basin management efforts, one has to consider the accomplishments as very good. During Tarim I, many opportunities through improved technologies and techniques had been identified and initiated. Considering the temporal experiences in other countries, even the institutional achievements have to be considered valuable. Weighing the opportunities for improved water management in the basin, and the constraints that had identified in the institutional and financial areas, the need for a modified approach was apparent during the pre-appraisal for Tarim II.

The spatial issue had to be addressed to cover the entire basin for integrated water resources planning and unified management. The institutional issue had to be reformed to enable an efficient and effective organizational structure with broader powers and participation by the key decision-makers of the region and prefectures. And the financial aspects had to incorporated into the entire process. These three components were considered essential, as illustrated from global experience in effective river basin development and management.

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8 NBET can be reduced by:
- lining existing canals and dikes whose seepage results in significant amounts of NBET,
- lining newly constructed canals and dikes whose seepage would result in significant amounts of NBET,
- replacing existing reservoirs with well fields for the provision of water in the spring when surface flows are inadequate (conjunctive use),
- lowering high groundwater tables in areas of high capillary flux that results in NBET through the construction of well fields and drains,
- through canal lining and on-farm irrigation improvements, and
- improving system operation to provide water to irrigated lands only when needed.
3. THE “NEW” BASIN INSTITUTIONAL ARRANGEMENT

River Basin Management in China

The concept of river basin management in China dates back the late 1920's. River administration entities were created from the earliest times. But the first organizations in the modern sense were created by specific laws for the North China Rivers in 1927, the Huai River in 1929, the Huang (Yellow) River in 1933, the Yangtze River in 1935 and the Zhu (Pearl) River in 1937. Due to the exigencies of internal conflict, they were generally ineffective. In November 1949, the then new PRC government stated that: "The water use of any river must be...planned (in a unified manner) and managed (in an integrated way) so that water resources can be fully utilized. The principle of united water administration lies in centralized... management... verifying of water right (and) appraising...deciding...and initiating multi-objective water conservancy undertakings". Three commissions were quickly established under the MWR for the Huang (Yellow), Huai and Yangtze river basins. During the 1950s river basin plans were completed for all seven major river basins and major construction works were carried out. During the 1960s and 1970s, the performance of the RBCs deteriorated due to the disturbed political conditions of the time, but after 1978 they were resurrected, and the importance of basin planning and management was confirmed by the 1988 Water Law.

There are currently six commissions for inter-provincial river basins [Songhua-Liao, Hai, Huang (Yellow), Huai, Yangtze and Zhu (Pearl)] and one Lake Commission (Tai) under the direct administration of the MWR. Their functions are delegated to them by MWR, which differs in the nature and extent of authority and responsibility, but in general they are responsible for organizing and supervising implementation of relevant laws and regulations and formulating basin-wide policies and regulations; formulating a development strategy, comprehensive plans and technical plans in cooperation with other departments and provincial governments; organizing the monitoring, surveying & evaluation of water resources; carrying out unified management of the rivers, lakes, etc.; formulating a flood prevention plan for the basin; coordinating the solution of disputes on water among the provinces; organizing efforts of prevention, supervision and treatment in major areas of soil erosion within the basin, and guiding local efforts in water and soil conservation; reviewing project proposals, feasibility studies and preliminary designs of projects; and planning, constructing and managing important water engineering projects of a controlling nature or that cross more than one province.

These commission were formed only on inter-provincial waters. The commission have no board of directors, and the Provincial Governments are not represented in their governance. Thus, they function as regional/basin agencies for MWR. Prior to the TBWRC, there were no river basin organizations wholly within one province or comprising a decision-making body represented by the key administrative or management interests of the basin. But the existence and experiences of the seven commissions provided a precedent and insight into basin institutional management needs for consideration of what options should be pursued in the Tarim Basin.
Institutional and Legal Aspects

On December 12, 1997, the XUAR People’s Congress passed "Regulations On The Management Of The Water Resources Of The Tarim Basin" that, among other provisions, established the Tarim Basin Water Resources Commission (TBWRC). These Regulations became final and effective 5 days later. The purpose of the Regulations is to insure "rational development, utilization, protection and management of the water resources of the Tarim Basin, control water disasters, fully deriving the comprehensive social, economic and ecological/environmental benefits of water resources, ensuring the sustainable development of the national economy in the basin, and improving the livelihood of the people and the environment" in the basin. It is emphasized that water resources development and management shall be under a system of unified administration and management, according to five enumerated principles.

The TBWRC is composed of two parts: (a) the Board of Commissioners (called a "Standing Committee" to be consistent with organizational terminology in PRC); and (b) the Tarim Management Bureau. The Regulations combined the two entities into one organizational framework, gave them enhanced responsibilities and accountability, and provides for mechanisms that should result in adequate funding.

The initial Board of Commissioners/Standing Committee was composed of a Director, Vice Director and approximately 14 others. The First Vice-Governor of XUAR serves as the Director of the Board of Commissioners. The Vice-Governor of the Regional Government responsible for agriculture and water resources serves as the Vice Director of the Board. Other members of the Board named in the Regulations are: Secretary General of the Regional Government; Directors of Planning, Finance, Water Conservancy, Environmental Protection, and Land Management Departments; Directors of the Kizilsu, Bayingol, Hotan, Kashgar and Aksu Prefectures; and Director of the Tarim Management Bureau. A key aspect of the TBWRC Board is that all Board members are government leaders at the Regional and Prefecture levels, and therefore they are authorized, responsible and accountable for water resources management in the Tarim Basin. If the prefecture leaders were not represented on the Board, it would be impossible for TBWRC to carry out its mandate.

The Board is to convene at least two meetings annually, decisions require support of more than half the members present at the meeting, and minutes will be kept and filed for all meetings. Timely notice of meetings shall be provided the members to ensure arrangements for attendance. The Board is to make an annual report to the Regional Government.

Because the Board is only in session twice a year, an Executive Committee shall be appointed by the Board to act on its behalf between sessions. It shall execute its powers on behalf of the Board, supervise and ensure implementation of resolutions and decisions of the Board, and set policies and make decisions as delegated to it by the Board. The Committee shall have a director, the Vice-Chairman of the Regional government responsible for agriculture and water resources, and a number of Vice-Directors comprising the Secretary General of the Regional Government and Directors of the Planning, Finance and Water Conservancy Department (Regional Water Resources Bureau), with the latter serving as the First Vice-Director of the Executive
Committee. A small staffed office in the RWRB under the direction of the First Vice-Director, shall be established to handle routine matters.

The Tarim Management Bureau (TMB) is the administrative and technical body of the Commission. It is responsible and accountable to the Board, but remains under the administrative leadership of the Water Resources Department of the Regional Government. The Director can only be appointed or removed by the Board. TMB implements the decisions made by the Board, in accordance with the national water laws and legislation passed by the XUAR Peoples' Congress. TMB conducts technical services; is responsible for specific activities in development, utilization, protection and management of water resources of the Tarim Basin; conducts analysis of hydrologic data to make recommendations on the quota of water use among the prefectures for their agreement and monitors the water uses for compliance with the quota and annual water use plan; and exercises water course management, water project management, water use management, water and soil conservancy management, and other water administrative powers. TMB is to submit to the Board annual work reports, plans, programs, projects, budgets, and so on, and reports on other matters which need coordination and resolution by the Board.

A number of departments may be established by the TMB in its internal structure as needed in the execution of its functions. The TMB may set up field offices along the mainstream and in the sub-basins to promote the implementation of the functions of the Commission. The field offices shall have frequent communication with the various prefectures and other concerned parties, and shall establish amicable relations and close coordination and cooperation between the field offices and the prefectures and other concerned parties.

As stated in the Regulations, the Commission will have the following principal responsibilities:

- Implementation of the Water Law of the People’s Republic of China, the XUAR Implementation Procedures of the Water Law, other laws and regulations, and these regulations;
- Preparing and reviewing the comprehensive master plan of the Basin, and reviewing and determining the annual gross water use quota of the various prefectures and other concerned parties;
- Organization, implementation and management in the Basin of the execution of the water withdrawal permitting system and of the collection of water resources fees;
- Flood and drought control, planned water use, water conservation, water and soil conservancy, water environmental protection, and water supply;
- Reviewing and approving all new water resources development projects and reviewing and approving funding for the new projects except for those that are locally funded;
- Construction and management of water projects;
- Management of the planning, construction, rectification and protection of water courses;
- Introduction and extension of advanced science, technology and management experience for the development and utilization of water resources and water conservation.

In addition the Commission will have the following objectives:

- To identify the quantity of surface and groundwater resources available for all uses in the basin.
- To provide equitable sharing of water among various users, consistent with environmental protection.
To operate water delivery systems on the mainstem of the Tarim in a way that balances water user and environmental needs.

To identify and evaluate short-, medium- and long-term needs for water resources development and management in the Tarim Basin and the subbasins.

To plan and develop ways with prefecture and community input to improve land and water management and productivity within the scope of the master plan.

To reach agreements and understandings with the different regional departments and prefectures on the strategies, objectives and goals for sustainable water resources development and management in the Tarim Basin and to clearly define roles and responsibilities of the different entities.

To develop a detailed understanding of the long-term environmental impact of changes in land and water use in the Basin.

To undertake and promote the protection/enhancement of the aquatic and related environment.

To promote the mitigation of the effects of flooding on the community, property and land productivity.

To establish a representative water data monitoring, processing and storage system that allows for a complete assessment of the quality and quantity of the basin’s water resources.

To provide a state-of-the-art hydrologic modeling capability that will facilitate the long term basinwide water planning process.

To define and implement detailed functions and internal procedures for annual planning, budgeting, personnel management, program management, etc. of TBWRC.

To establish technical preparation, review and approval guidelines and procedures for the various TBWRC activities.

Support the development and strengthening of self-financing irrigation and drainage districts in the Tarim Basin.

The Commission will:

- Establish, operate and maintain a hydrologic monitoring network that continuously measures streamflows and groundwater based on a strategic network concept and particularly at the significant inflow and outflow points of each subbasin, and along the mainstream of the Tarim River. Both quantity and quality should be monitored, and water use (diversions) by type and place of use.

- Establish and continuously update a GIS data base which includes all hydroclimatological data, land data (topography, soils, land use, protected areas, etc.), socio-economic data, transportation and communication systems data, etc.

- Develop and periodically update the Tarim River land and water management master plan including plans for subbasins. This should include the preparation of special studies in the areas of water, land and environment.

- Develop and implement a communications program to increase awareness and understanding of water and environmental management issues.

- Periodically prepare a report on the state of water management and the environment in the Tarim Basin and submit the report for review and approval to the appropriate government officials.
- License, monitor and control the use of water along the Tarim river mainstream and in the subbasins.
- Construct, operate and maintain gates, dikes and reservoirs along the Tarim River mainstream, and have right of inspection and control of other water diversion and flood control facilities.
- Technically manage a water management and environmental protection fund that will be used for financing: (a) well planned irrigation, drainage, land improvement and land reclamation projects that do not adversely affect the quantity or quality of water downstream and that improve local water, land and ecology management; (b) water savings projects to reduce NBET; (c) environmental improvement projects; and (d) research and development projects to improve water, land and ecology management. The portion of these project costs attributable to environmental protection and improvement, to water savings and to research and development will not be repaid by the beneficiaries.

On August 19 and 20, 1998, the People's Government of XUAR called the First Standing Committee Conference of Water Conservancy Committee of Tarim Basin at Kunlun Hotel, Urumqi. One of the major achievements from this meeting was the adoption of TBWRC Charter or Regulation. The “charter” (also called regulations in the meeting summary) document and the “Five year Working Plan” (based on the draft strategic plan previously prepared by TMB) were passed by the SC. The Five Year Work Plan is a “strategic” work plan in that it covers the major tasks, or key priority areas. The other two reports – Funds for the Water Protection Fund, and the Water Resources Assessment report (the latter required by the regulations to be prepared during the first 6 months) were not formally adopted and will be returned to the next meeting.

The second meeting was held in February 1999. The major accomplishment was to address an important internal operational rule. Previously, with a 14 member board, the five prefectures felt they had little chance to represent their interests even during the two annual meeting of the Standing Committee. And during the interim, the Executive Committee could take action on matters delegated to it by the Standing Committee, which may not be in the interest of the prefectures. A rule change was proposed and accepted that would require at least three of the five prefectures concurrence in the Standing Committee voting, and that one or more prefecture representatives would be members at large to the Executive Committee. Also, a preliminary agreement was reached to maintain the existing quota for water use on the tributaries.

It took about six months to undertake a variety of initial or formative tasks, leading to a first meeting of the peak body - the Standing Committee- on 19-20 August 1998. During this time the former TBMB (now TMB) continued to perform a water management role along the main stem of the Tarim River, and commenced work on a number of issues to be ready for submission to the first Standing Committee meeting. The first SC meeting was preceded by a working group of 10 people meeting 10 times to discuss and prepare for the meeting. XUAR then asked for a preparatory meeting to be held at vice chief level from the prefectures at which all the views of the various bureaus were offered. The Vice Chairman responsible for agriculture and water resources chaired this meeting. This practice will continue.

In reading the Charter, it is apparent that the Charter goes into much more detail than the regulation on three items: 1) Office of the Executive Committee is strictly all the department
Cooperation and Coordination with Basin Prefectures

Another issue that has interfered with the effectiveness of the historical institutions to carry out water resources management has been inter-jurisdictional questions related to water development and use on the tributaries by the up- and off-stream prefectures in their pursuit to meet the policies and production targets set by the central and regional governments. This incompatibility of objectives and authority of the prefecture agencies has made it impossible to have good water resources management and to preserve the "green corridor". Therefore the legislation reorganizing the TBWRC includes representatives of the five prefectures on its policy and decision-making, as well as representatives of key regional government officials. This makes each prefecture head and the key regional leaders directly responsible and accountable for water resources management in the basin.

Finance and Budgets

Two key related issues are the financing of the TBWRC itself and the financing of water management activities that the TBWRC will sponsor in the Tarim Basin. There are several sources from which agencies like TBWRC obtain the financing, the most direct is from government budgetary process according to the nature and function of the organization. Other sources could include water licensing fees and water charges, special assessments for improvements, government special funding available according to high priority issues such as environmental enhancement, project and program loans and grants, and the international community.

Because of the nature of the TBWRC, a "Tarim Basin Water Resources Protection Fund" will be established that will be used for financing:

- well planned irrigation, drainage, land improvement and land reclamation projects (Type 1) that do not adversely affect the quantity (NBET offset) or quality of water downstream and that improve local water, land and ecology management;
- water savings projects (Type 2) to reduce NBET;
- environmental improvement projects (Type 3);
- research and development projects (Type 4) to improve water, land and ecology management;
- construction and maintenance of hydrologic and environmental monitoring station networks; and
- setting up information systems, supervisory control systems, communication systems and data bases (Type 5).

For Type 1 projects, the portion of the costs attributable to agricultural production will be repaid to the fund by the beneficiaries; the portion attributable to environmental improvement will not be repaid. For Type 2, 3, 4 and 5 projects, there will be no repayment to the fund. The fund will
be financed by the water fees and penalty fees and through other sources of funding related to resource extraction taxes in the Tarim Basin, environmental protection funds, bilateral grants, etc.

**Community Awareness and Public Relations**

At the subbasin level the Tarim Basin II project there are two aspects of successful river basin organizations, other than having a basin-wide venue, inter-jurisdictional agreements and financial viability. They are (1) community/water user involvement and participation, and (2) a good public image that reflects the benefits of having such an organization. Water resources management will be improved in the Tarim Basin under the three-tier approach which will incorporate direct linkages between TBWRC, the water supply corporations and the water user associations. This will be limited largely to a small number of personnel in each of the three types of organizations, who come into direct contact in order to carry out planning, allocation and distribution of water. In addition:

- TBWRC will work to inform and involve the communities and water users in the objectives and tasks of the TBWRC, and the projected benefits to the inhabitants and environment of the Tarim River Basin as a result of TBWRC successfully carrying out its duties and activities;
- TBWRC will undertake programs and activities (workshops, etc.) will be designed to facilitate community awareness and participation in improving water management in the basin including the concept of NBET; and,
- an effective TBWRC public relations program will be designed and carried out in the basin to solicit ideas and means from the communities and other agencies on how the TBWRC can assist in achieving even greater benefits for all people in the basin.

**Tarim II Funding**

The project will provide funding for building and equipment, and a large amount of technical assistance and training that will have the objective of supporting the institutional development of the Tarim Basin Water Resources Commission. This will include support for (a) setting up and operating water quantity and quality monitoring systems, geographic information systems; remote sensing systems; (b) development of a Tarim River Basin Master Plan; (c) development and operationalization of computerized water and salt balance and groundwater models; (d) setting up a system of water licensing, control and enforcement; (e) investigations to improve water use efficiencies and environmental management; (f) setting up a system of review, approval and funding of water savings, environmental enhancement and water resources development projects; and (g) developing and instituting a communication program to increase awareness and understanding of water management in the Basin.

**Important Technical Areas for Tarim Basin Water Management**

**Water Allocation and Licensing**

Because inter-jurisdictional concerns exist between the riparian prefectures in the Tarim basin, the issues become more complex and require an equitable apportionment or allocation of water
resources. This is necessary in order to protect the interests of the upstream and downstream water users, and to optimize the varying watershed characteristics and the timely needs of various competing and often conflicting water users.

To implement a sound and dynamic water resources management process, there must be a means to determine how much of and when the water supply is being utilized or dedicated to certain social uses, at the water user level. This is not only to protect those existing uses against later uses, but to determine the extent of surplus waters that may be available for further or future development or dedication. Since all water in China belongs to the people and under the administration of the State, and the 1988 Water Law provides for the licensing of water uses at the provincial/autonomous region level, at least a three-step process should be carried out by the TBWRC or under its jurisdiction in preparation for a basin master plan:

1) Assessment - (through data gathering and use of analytical tools such as models)
   - determine the supply (type, source, location, quantity and quality) throughout the river system;
   - determine the current uses (diversion and in-stream, consumptive and non-consumptive by type, point of diversion, place of application, time of use or need, return flow if applicable and impact on water quality); and,
   - determine the areas of critical need (i.e., “green corridor”) and water balance (which should produce a river/groundwater profile to assess periods and areas of surplus, overdraft, and non-beneficial consumptive uses).

2) Allocation Agreement - (through discussions and negotiations with prefecture officials)
   - determine the existing quantities and qualities of upstream uses and users;
   - determine the future development potentials and needs;
   - agree upon downstream (mainstream or “green corridor”) needs to maintain water-based eco-system; and
   - agree upon consumptive use allocations, which should provide sharing measures for drought or low-flow periods, and induce basin-wide cooperation and coordination to reduce inefficiencies (NBET), improve water control structures, and jointly develop ideal storage sites.

3) Licensing of water uses - (by common group service area i.e. irrigation project, municipal water uses or type i.e. hydro-power, industrial, etc.)
   - determine existing water users (excepting minor water uses) and issue licenses identifying source, type of use, time of use, quantity of use and conditions of use (often referred to as "grandfathering in" the rights of existing users, but with conditions of use and resulting impacts);
   - designate wetland and other protected areas, and "allocation" of water for their maintenance/rehabilitation;
   - create a "registry of water users" by source; and,
   - require annual reporting requirements of time and quantity of water use as a condition of maintaining right to future uses (that is, failure to do so after a specified period of time may result in loss or reduction of right to continued future use).

At the bulk water supply and use levels, Tarim II has as one of its key components an approach that has been successfully employed in the World Bank project in PRC. This component calls for
The creation of self-financing irrigation and drainage districts (SIDDs). It supports the establishment and strengthening of water supply corporations (WSCs) for the operation and maintenance of main irrigation and drainage systems and water user associations (WUAs) for the operation and maintenance of later systems. In each of the prefectures, a full pilot SIDD (WSC and WUAs) and partial SIDDs (WUAs only) are being implemented.

The two key local water organizations are legal entities under the laws of China, created by registering under the Company Law for WSCs and under the Civil Code and implementing decree for the WUAs. The WSCs will enter into an Agreement with the Prefecture or County water agency for bulk water delivery to the WUAs, will operate and maintain the distribution system, and collect water charges from the WUAs for payment to the government. The WSC and WUAs enter into water supply and delivery contracts setting out the rights and obligations of each party, namely that the WSC efficiently will operate and maintain the distribution system and deliver water the headgate of the WUA, and that the WUA will receive the water and distribute to its members, efficiently operate and maintain its distribution system, and will collect water charges from its members for payment to the WSC. These entities will have water rights (licenses) specifying the amount of water that they can deliver/use, and that the water will be charged for on a volumetric basis.

**Water Resources Planning**

Water resources development and management should be firmly based on technically sound planning. The first step is to clearly define the objectives. The XUAR Government has defined the overall objective for the Tarim River Basin to be to improve the economic and social well-being of the inhabitants of the basin while preserving its ecological resources. Water is the key to achieving this objective for both the human inhabitants and for the ecological resources. To achieve this overall objective, the Regional Government has adopted the specific water resources related objectives of: (a) increasing irrigation development throughout the basin; and (b) revitalizing the “green corridor” in the lower reaches of the Tarim River. From a water resources standpoint these two specific objectives are in conflict with each other, because the first requires more water upstream and the second requires more water downstream. As described above the only water available for meeting both of these objectives is the NBET.

An appropriate water resources planning tool to provide a sound technical basis for devising plans to meet these two specific objectives is the computerized water and salt balance model and where possible groundwater models. A period of record (preferably about 25 years) of hydrologic data (quantity and quality) for principal inflow and outflow points in a basin (or subbasin) as well as for key intermediate points, should be used. The model is developed to simulate the operation of hydraulic infrastructure and the surface water/groundwater interactions within the basin (or subbasin). The model is essentially a water and salt balance of inflows, uses, losses and outflows performed for every year of the period of record. A without-project model run is developed to simulate the operation of the existing hydraulic infrastructure and management strategies. Various with-project model runs are developed to simulate operation of different possible combinations of works and operational strategies. Internal within the computer model are relationships and equations that estimate diversions, losses, deliveries and return flows, including groundwater and surface water interactions. The main output results of
the model run will be CU, BET, NBET and SW and GW outflows, including both water volume and salt tonnage. For the subbasins the goal will be to increase the CU and BET while maintaining the SW outflow volume constant or increasing, which will of course mean that NBET will need to decrease significantly. Water quality output should be maintained or improved.

The model can be used to evaluate different investment and operational strategies within the limitation of available financial resources and come up with the best combination to meet the goal. Examples of hydraulic works that will decrease NBET will be: (a) canal lining (the portion of seepage that will otherwise evapotranspirate from non-beneficial areas); (b) construction of drains and well fields to lower shallow water tables; (c) construction of drainage systems to selectively manage drain water, with the terminal disposal of highly saline water and the downstream delivery of better quality water; and (d) replacement of surface reservoirs with groundwater reservoir systems to reduce evaporation. Examples of operational strategies that will reduce NBET will include improvements in delivery system efficiencies and on-farm efficiencies.

In addition to being a valuable planning tool, the computerized water and salt balance model can be used to devise and improve strategies for hydraulic infrastructure operation on a year to year basis. Each year, the model can be improved and used to come up with the best possible operational strategy depending on the specific circumstances of the year at hand (water in storage in both reservoirs and groundwater, projected (forecast) inflows and recharges, downstream conditions, etc.).

**Water and Salt Balance and Groundwater Modeling Studies**

During preparation of Tarim II, preliminary water and salt balance and groundwater modeling studies were carried out for the five project subbasins (Hotan, Kashgar, Kizilsu, Aksu and Kaidu-Konque) and for the two Tarim I subbasins (Yerkand and Weigan) in accordance with the following scope. Detailed reports have been prepared by the prefecture governments for the studies for each of the seven subbasins. The purpose of these studies are threefold:

1. To evaluate and ensure that the project development will not adversely affect the downstream commitments to deliver water to the Tarim River.
2. To evaluate different alternatives for the project and select the ones that will have the least impact on river flows (largest reductions in NBET).
3. To develop models that can be improved and used during project implementation and in the future beyond to evaluate new developments and operational strategies.

The model studies are basically inflow/outflow surface water simulation models using between 15 and 25 years of record and monthly data. The models consider river and spring inflows, diversions, well abstractions, seepage losses, return flows, crop consumptive use (CU), beneficial evapotranspiration (BET) from trees and green areas and non-beneficial evapotranspiration (NBET) from high water table areas and water surfaces. Localized groundwater (inflow/outflow) models have been developed to attempt to improve the estimates of seepage losses, return flows, BET and NBET. In the case of salt balances, the various flow components from the water balance studies are assigned salt concentrations and mass balances are performed.
The following general conclusions have already been reached as a result of the water and salt balance and groundwater modeling studies:

- Development of the water and salt balance and groundwater modeling studies have been a very useful exercise because it has significantly improved the understanding of the water and salt managers in the region and in the prefectures about how the irrigation and drainage systems work and the effect of different measures (canal lining, well fields, drains, etc.) and their locations on overall water and salt management.
- The irrigation and drainage subprojects that will be implemented as a part of Tarim II will improve water management and will not adversely affect the flow deliveries to the Tarim River.
- Available data is inadequate which adversely affects the usefulness of the models. Monitoring and data base management will be improved during project implementation.

During project implementation the data collection and processing as well as the models will be improved with the objective of making the models into operational and evaluative tools that can be used in the future for improving water management in the subbasins and in the Tarim River mainstream.

**Water and Salt Monitoring**

Water and salt monitoring programs are included in the project to improve data and thereby improve the models. The design of the monitoring plans for the Tarim II sub-basins are based on the following factors:

- the experience obtained from the Tarim I monitoring program;
- the existing climatological, hydrometric and hydrogeological monitoring systems;
- the feed-back from the modeling activities undertaken during the water and salt balance studies;
- the location of the works proposed to be undertaken during Tarim II;
- the areas where the assessment of the impacts of the proposed works are difficult to estimate due to information deficiencies;
- the areas where particularly sensitive or topographically problematic features exist;
- the ability of the local authorities to manage the network both from a logistical and administrative perspective and from a budgetary viewpoint.

A major element will be water table measurement and water quality monitoring, particularly with regard to salt movement. A common approach has been adopted for proposing monitoring plans for the project. For the monitoring of surface water inflow and drainage outflow from the subproject areas, besides the existing hydrological stations and the water measuring points in the irrigated areas, necessary new stations have been planned. For the measurement of groundwater level and water quality permanent observation wells and temporary wells will be installed. To save funds the groundwater observation wells will be mainly concentrated in key project areas for detailed study. For the monitoring of soil, water and salinity in each subproject area soil water and salt monitoring points in typical farmland (high yield land, low yield land and reclaimed wasteland) will be installed.
Data Base Development and Management, and Computer Systems

One of the principle objectives of Tarim II is to improve the information systems. The project is supporting the development and integration of Management Information System which includes geographically referenced data basis, computer networks and software for GIS, monitoring, modeling, forecasting and decision support. The networks will make the data and software readily available throughout the basin and in Urumqi the capital of XUAR. Water resources planning, hydraulic infrastructure operations and general water resources management activities at the regional, TBWRC, and prefecture levels will utilize the MIS data bases, computer and network systems and the analytical tools.

4. FACILITATING THE PROCESS, AND THE ROLE OF THE BANK IN IT

Tarim Irrigation Project (Tarim I) was partially financed by the World Bank and was completed in 1997. The project was geared towards improving irrigation and drainage systems in the Yerkand and Weigan subbasins and to improving water resources management along the Tarim River mainstem and in the basin as a whole. Part of this project involved the establishment of the Tarim River Management Bureau (Bureau) and the Tarim River Administrative Committee (Committee). The Bureau was responsible for managing water and structures along the mainstream of the Tarim River, for investigating ways of improving water management along the mainstream and for monitoring and controlling the allocations of water use to the subbasins. With limited resources and authority, it has managed to admirably carry out the first two functions, but has had major difficulties in carrying out the third. The Committee was established to make policy and coordinate water and environmental management activities in the Tarim Basin. Because its was basically a forum for discussion without direct water management responsibilities, and because it was established as a separate entity from the Bureau, the Committee has been relatively ineffective. It is important to point out, however, that it was necessary to go through the process of establishing these entities and evaluating their effectiveness before more major institutional and legal changes could be made.

The Tarim Basin II Project (Tarim II) was approved for partial financing by the World Bank Executive Board on June 9, 1998. The loan/credit became effective in November 1998. It benefited from the lessons learned on the Tarim I project in both the technical/agricultural improvements and in institutional arrangements. These include: improvements in canal lining technologies and techniques; modifications to livestock component; increased involvement of the Water Resources Bureau in project decision-making and implementation; clearer definition of responsibilities and financial aspects; need to strengthen the existing Tarim Basin institutions; need for more training on irrigation and water conservancy; and the need to have a clearer understanding of the counterpart funding and repayment process.

Under Tarim II, the institutional framework for water management in the Basin has been greatly strengthened. This was partly done as a result of the experiences of Tarim I, partly based upon successful global experiences, and partly from the commitment of the governments and personnel implementing the project. What is notable, however, is that improved sustainable water management in the basin can be accomplished primarily because of the comprehensive
approach applied in Tarim II. The spatial range goes from regional to basin to prefecture to country to water user. It is based on hydrologic and hydraulic properties of water, multiple and sustained use, and covers water quantity (surface and ground water) and quality. More important, it is premised on equality of right and fairness and stakeholder involvement. It is also premised on the fact that you don't measure water and have adequate data, you can not manage the water resources.

The institutional components of Tarim II project was designed based on compatible principles for water management contained in the Chinese Government water policies and the 1993 World Bank Policy Paper on Water Resources Management. These principles are:

- Water resources should be managed and developed for multiple purposes in a comprehensive and integrated manner and consider inter-sectoral issues to insure sustainability of the water and related environments.
- Water resources planning and management should be carried out considering the inter-relationships between water, land and other natural resources, and human resources to achieve enhancing economic growth and development in and environmentally sustainable manner.
- Water is an economic resource and should be managed in an economically efficient manner.
- The river basin should be the basic unit for planning and management of water resources.
- Water users should participate directly in water resources development and management.
- Water use should be efficient and environmentally sustainable.

5. CONCLUSIONS AND RECOMMENDATIONS

A series of questions were raised by the Guidelines for preparation of the case studies that will be responded to in short answers.

✔ What “type” of basin arrangement was developed?
With the experience of Tarim I and reviewing the status of the river basin commissions in PRC, it was important to design an institutional arrangement that addressed both the hydrologic characteristics of water, i.e., jurisdiction to operate within the boundaries of the entire basin, but was cognizant of the rights and duties of the regional and prefecture governments. Thus, this TBWRC evolved from having a partial area jurisdiction in the basin to a comprehensive planning and management body with representation of the major parties in decision-making and a technical competence to carry out planning, management, and monitoring of water resources and related environments, while facilitating coordination and capacity building of the agencies and water suppliers/users in the basin.

✔ Is this an “ultimate” design?
The TBWRC is still to new to determine if it is the ultimate design. It is premature at this stage, but already there are operational and functional improvements that can be made based upon even this limited experience. Further, it must be acknowledged that many activities of the TBWRC, and particularly in relationship with the prefectures, have not been fully implemented yet. One area concerns establishing the MIS and related data bases and networking systems. It is estimated that at least five years operating is necessary to determine what major institutional
changes should be made if any. It will take a considerable amount of time for the parties to establish a mutual understanding and trust to take full advantage of the RBO and its relationship to prefecture agencies and water users.

✓ How efficient, effective and sustainable is it thought to be?
At the present time, the TBWRC can not be expected to be very efficient and effective. It is still in an infancy stage, but should start to formulate a vision and strategic plan for how it will address not only the routine matters before it, but how it will function under emergency conditions of drought or flooding, etc.

✓ Key lessons?
Tarim Basin II Project preparation pointed out the complexities of putting into practice good water resources management in a relatively simple basin. Simple in that the basin is closed, the climatological and hydrological processes are not complicated, uses are almost all irrigation with limited municipal and industrial use, and the basin is all located within one province which reduces the political complexity. The main aspects of the program to improve water resources management in the Basin are:

✓ How replicable is this approach, in the same or other countries?
Already the central government and several provinces are watching to see how well this form of river basin organization functions under the conditions of PRC. Based upon China's experiences with inter-provincial river basin commissions, the approach and experiences of TBWRC provide a valuable model. For example, extending this approach to the Huang-Huai Hai Plain (North China Plain) for improving groundwater management is an immediate potential.

✓ Compared with other cases?
In comparison to similar situations or similar approaches in other countries, the TBWRC has proceeded above average. This is partly due to the extensive legal framework for water and related resources and the environment, and partly due to the technical and management capability of personnel involved. Of course, the scarcity of water and hence the need for a successful approach due to the risk involved, an not be overlooked. In more humid or water rich area or countries, the necessity may not be so great.

✓ How should the Bank approach governments in these cases?
The Bank should have an open mind on the approach to be taken in basin institutions and rationale for improving water management. However, the Bank's policies of integrated water management can hardly be questioned, and due to the excellent process of project identification, preparation and implementation applied by the Bank, adjustments can be made to meet the particular requirements of the internal and external environments of a surface or ground water basin, and inter-basin transfer and use issues.

✓ Can we learn from other experiences, inside or outside the Bank’s work program?
Yes, as integrated and comprehensive water management is a dynamic process and challenge with considerable options to achieve similar objectives. Also, the temporal experiences in river basin management and with RBOs clearly indicate the need for monitoring for what works and why, and to determine what corrective action can be taken in a timely manner.
✓ Recommendations.

A number of recommendations are provided in summary form, specially applicable to the TBWRC, but generally applicable to other similar situations:

1) Strengthening TBWRC's internal structure and functions, including its responsibility for reviewing and approving all water resources development projects in the basin which specifically demonstrate an NBET offset.

2) Developing and implementing a system of water rights and allocations.

3) Finalizing and improving information systems including data base development and management, networking, monitoring, modeling, planning, forecasting and decision support system.

4) Insuring that not only the physical/technical and institutional components are addressed, but also the financial components.

5) Increasing public awareness and participation in water resources management throughout the basin including the concept of NBET.
Annex

REGULATIONS ON THE MANAGEMENT OF THE WATER RESOURCES OF THE TARIM BASIN
Standing Committee of the People’s Congress of XUAR
12/11/97

Article 1: These regulations are formulated for the purpose of rational development, utilization, protection and management of the water resources of the Tarim Basin, control of water disasters, fully deriving the comprehensive social, economic and ecological/environmental benefits of water resources, ensuring the sustainable development of the national economy in the basin, and improving the livelihood of the people and the environment, in accordance with the Water Law of the People’s Republic of China, and other related laws and regulations, and in light of the actual local conditions of the Tarim Basin.

Article 2: For the purpose of these regulations, “water resources” means surface water and groundwater; “Tarim Basin” mainly includes the area of the mainstream of the Tarim River (the part 1321 kilometers from Xiaojiake to Taitema Lake) and the tributaries (Hotan River Basin, Yerqiang River Basin, Kashgar River Basin, Aksu River Basin, Weigan River Basin, Kaidu River - Kongque River Basin).

Article 3: These regulations are applicable to the development, utilization, protection and management of the water resources of the Tarim Basin. Any entity or individual engaged in development, utilization, protection and/or management of the water resources in the basin must observe these regulations.

Article 4: The water resources of the Tarim Basin are owned by the state and shall be under a system of unified administration and management at various levels.

Article 5: The following principles should be abided by with respect to the development, utilization, protection and management of water resources in the Tarim Basin in accordance with the requirements on legal, scientific and standardized basis.

1) Comprehensive consideration should be given to and coordinated development shall be carried out in the tributaries and the upper, middle and lower reaches of the mainstream in order to achieve harmonious development;

2) Economic development should be integrated with ecological and environmental protection;

3) Water should be used in a planned and efficient manner, and water should not be used without payment;

4) Comprehensive master plans for the Region and the Basin should be abided by;

5) Specialized plans and other plans concerning water should be subject to the comprehensive master plan for the Tarim Basin; prefecture plans should be coordinated with the master plan for the Tarim Basin.
Article 6: The Regional People’s Government shall establish the Tarim Basin Water Resources Commission (hereinafter referred to as the Commission), which shall be responsible for the unified supervision and management of the water resources of the Tarim Basin. The Commission shall include the Board of Commissioners (hereinafter referred to as the Board, including the Executive Committee of the Board of Commissioners) and the Management Bureau of the Tarim Basin Water Resources Commission (hereinafter referred to as the Tarim Management Bureau).

The main responsibilities of the Commission are as follows:

1) Implementation of the Water Law of the People’s Republic of China, the Xinjiang Uygur Autonomous Region Implementation Procedures of the Water Law, other laws and regulations, and these regulations;

2) Preparing and reviewing the comprehensive master plan of the Basin, and reviewing and determining the annual gross water use quota, the annual limits for water usage and the annual water use plan of the various prefectures and other concerned parties;

3) Organization and management in the Basin of the execution of the water withdrawal permitting system and of the collection of water resources fees;

4) Flood and drought control, planned water use, water conservation, water and soil conservancy, water environmental protection, and water supply;

5) Construction and management of water projects;

6) Management of the planning, construction, rectifying and protection of water courses. Reviewing and approving operating and management rules for key water diversion structures on the tributaries and mainstream of the Tarim River;

7) Introduction and extension of advanced science, technology and management experience for the development and utilization of water resources and water conservation.

8) Coordination and handling of water disputes in the Basin;

9) Reviewing and approving water resources development projects within the basin and reviewing and approving funding for the projects (except for those that are locally funded);

Article 7: The Board is the policy decision making body of the Commission and makes timely effective decisions on major issues in development, utilization, protection and management of water resources.

Article 8: The Board is comprised of a Director, Vice Director and others. The Standing Vice Chairman of the Regional Government concurrently serves as the Director of the Board of
Commissioners. The Vice-Chairman of the Regional Government responsible for water conservancy concurrently serves as the Vice Director of the Board. Other members of the Board are: Secretary General of the Regional Government; Directors of Planning, Finance, Water Conservancy, Environmental Protection, and Land Management Departments; Directors of the Kizilsu, Bayingol, Hotan, Kashgar and Aksu Prefectures; Director of the Tarim Management Bureau; and Directors of other concerned departments. Addition of members to the Board may be made when necessary with the approval of the Board.

Article 9: The Board exercises its decision making authority during meetings. A minimum of two meetings shall be held annually. Every decision and resolution made by the Board of Commissioners should be passed by more than half of the members present at the meeting. Meeting minutes shall be made and filed for future reference for each meeting held by the Board. The prefectures and departments concerned shall be notified in a timely manner of the decisions and resolutions made by the Board.

Article 10: Every year the Board shall make at least one report on its work to the Regional Government.

Article 11: The Board is responsible for reviewing and approving the work reports, master plans, projects and budget reports submitted by the Tarim Management Bureau.

Article 12: The Executive Committee is the executive body of the Board. It shall execute its powers on behalf of the Board between the meetings of the Board, supervise and ensure the implementation of resolutions and decisions made by the Board, and set policies and make decisions as authorized by the Board.

The Vice Chairman of the Regional government responsible for water conservancy concurrently serves as the Director of the Executive Committee; the Secretary General of the Regional Government and the Directors of Planning, Finance and Water Conservancy administrative departments concurrently serve as vice directors of the Executive Committee; the Director of the Water Conservancy administrative department serves as the Standing Vice Director of the Executive Committee.

An Office under the Executive Committee is set up for handling routine affairs in the Regional Water Conservancy administrative department to carry out routine work. The Standing Vice Director of the Executive Committee concurrently serves as the Director of the above office.

Article 13: The Tarim Management Bureau is the administrative and technical body of the Commission. It is responsible to the Board and under the administrative leadership of the Water Administrative Department of the Regional Government. The Director can only be appointed or removed with the agreement of the Board.

Article 14: The Tarim Management Bureau shall specifically implement the decisions made by the Board, in accordance with these regulations and the resolutions and decisions made by the Board. It shall conduct technical services; be responsible for the specific activities in the basin.
of development, utilization, protection and management of water resources of the Tarim Basin; and exercise water course management, water project management, water use management, water and soil conservancy management, and other water administrative powers. It shall submit to the Board annual work reports, plans, programs, projects, budgets, and so on, and reports on other matters which need coordination and resolution by the Board.

A number of offices may be established by the Tarim Management Bureau as needed in the execution of its functions. The Tarim Management Bureau may set up field offices along the mainstream and in the sub-basins to promote the implementation of the functions of the Commission. The field offices shall have frequent communication with the various prefectures and other concerned parties, and shall establish amicable relations and close coordination and cooperation between the field offices and the prefectures and other concerned parties.

Article 15: The Tarim Management Bureau, within the first six months of implementation of these regulations, shall submit to the Board reports on annual average runoff amounts of each tributaries, as well as suggestions on how to maintain the necessary annual water amount for the sustainability of the ecological environment and other water related relevant environments of the mainstream of the Tarim River.

Article 16: Suggestions on water allocation plans should be made by the Board on the basis of adequate consultation with each prefecture and other concerned parties. Each prefecture and the other concerned parties should work out water use plans in light of the suggestions made by the Board.

In a timely manner, the Board shall study the water use plans submitted by the prefectures and other concerned parities, and within the first year of implementation of these regulations shall sign written agreements with the prefecture and other concerned parties on the annual gross water use quota and limits under different conditions and circumstances; on rights, duties and responsibilities, etc.; and on responsibilities to assume upon violation. The agreements become legally binding upon signature.

In the case that the above agreements have not been reached within the time schedule stipulated above, the Board shall report to the Regional Government the issues that should have been specified in the agreements. Decisions shall be made by the Standing Meeting of the Regional Government within three months. Resolutions made during the Standing Meeting of the Regional Government should be carried out by each prefecture and other concerned parties.

Article 17: The annual gross water use quota shall be established on an experimental basis for a period of three years and be thereafter formally set upon evaluation, appraisal and examination. It shall not be changed without the approval of the Board.

The annual water use plan for the prefectures and other concerned parties in the Basin shall be determined and assigned for implementation through consultation between the Board and the prefectures and the other concerned parties in conformity with the annual gross water use quota.
Article 18: The following tasks and requirements must be considered in determining the annual gross water use quota and in establishing the water allocation system:

1) The amount of water fed from the tributaries to the mainstream;

2) The hydrologic characteristics of the river system and the groundwater recharge conditions;

3) The amount of water required for the ecological environment along the tributaries and the mainstream;

4) The annual runoff and inter-year fluctuations, their impact on the ecological environment of the mainstream, and the time interval for reduced flow or no flow which does not adversely affect the ecological environment along the mainstream of the Tarim River;

5) The unit quota for water use, water delivery efficiency of the canals, and the efficiency for water utilization;

6) The water resources development potential and the expected social and economic benefits;

7) The degree of improvement of diversion, withdrawal and water use efficiencies resulting from comprehensive utilization and unified management of the water resources and the relationship between the development and utilization of water resources and the sustainable economic development of the prefectures.

Article 19: The comprehensive master plan for the Tarim Basin should be prepared through the joint effort of the Executive Committee of the Board, the departments and agencies concerned, each prefecture within the basin and other concerned parties. The above plan will assigned and be carried out after it has been reviewed and agreed to by the Board and approved in accordance with relevant regulations stipulated by the State and the Regional Government.

Article 20: A water diversion permitting system should be implemented within the Tarim Basin. All entities or persons that divert water directly from rivers, lakes or from the underground by means of hydraulic works or pumps should first obtain a legal license, pay water resources fees and take water in accordance with the relevant regulations.

The Tarim Management Bureau is responsible for organizing and implementing the approval and issuance of licenses and for the collection of the water resources fee within the management area of the river course along the mainstream of the Tarim River; for other areas of the Basin, the above work shall be undertaken by the water management administrative departments at and above the county level as authorized by the Board and under its supervision.

Article 21: Water management administrative departments at all levels and other concerned departments should carry out laws and regulations made by the State and Regional Government
with respect to prevention and treatment of water pollution and water quality management, and should enhance supervising and management and prevent water pollution to ensure that the water environment quality is up to the standard stipulated by the State and Regional Government.

Article 22: The Tarim Management Bureau should prepare the operating and management rules for key water diversion structures on the tributaries and mainstream of the Tarim River on the basis of adequate consultation with each prefecture and other concerned parties. These rules should be implemented after review and approval by the board. The Bureau shall establish the data base for hydrological and meteorological monitoring, and other related data and information, and establish, strengthen and be responsible for the flow and quality monitoring and control of the main monitoring stations in the Basin.

Water administrative departments and hydrological and meteorological departments in the Basin shall regularly submit to the Tarim Management Bureau irrigation and drainage plans and data and information on hydrology, meteorology, water conditions, water quality, water and soil erosion monitoring and so on.

Article 23: The administrative expenses for the activities of the Commission shall be included in the financial budget of the Regional Government.

Article 24: The main financial sources for the development, utilization and protection of the water resources of the Tarim Basin are:

1) Project funds arranged by the regional financial budget;
2) Project funds arranged by local financial budgets in the basin;
3) The part of the funds for water system rehabilitation for the Tarim Basin arranged by the Central Government;
4) Various low-interest and preferential loans;
5) Funds raised through legal financing methods;
6) Domestic and foreign donations;
7) Loans from the World Bank, and governments and financial institutions of other countries and the regions;
8) Other sources.

Article 25: The Tarim Basin Water Resources Protection Fund shall be set up by the Regional Government for the purpose of the development, utilization, protection and management of the water resources within the Basin. Detailed measures will be stipulated by the Regional Government.
Article 26: All hydraulic works to be constructed within the Basin should undergo review and approval procedures, but also be reviewed by the Tarim Management Bureau and approved by the Board, including those works which need to be further reviewed and approved by the concerned departments of the State Council.

Article 27: Entities to apply for use of the project funds shall make a written application submitted to the Tarim Management Bureau in accordance with the requirement of the bureau. The amount, usage and using period of the funds should be specified in the application report and the project approval document and other relevant information attached.

The Tarim Management Bureau should review and provide comments on project fund application reports and submit the reports to the Board for review and approval. For those application reports with small amount of the funds, the Board may authorize the Executive Committee to review and approve.

Article 28: Funds without obligation to repay may be applied for and used for any of the following projects.

1) Construction and maintenance of hydrological monitoring station networks;

2) Setting up information systems, supervisory control and communication systems and data bases;

3) Special topic research and surveys, and extension of advanced science and technology;

4) Award for taking water savings measures, improving efficiencies in water diversion, delivery and use as well as in water management;

5) Environmental preservation and enhancement measures;

6) Other projects specified by the Board.

Article 29: The use and management of the project funds should follow the financial and accounting regulations and shall be audited and financially supervised in accordance with the law.

Article 30: For minor cases involving violation of these regulations in which the annual gross water quota or annual water use limits are exceeded, penalties under ten thousand yuan shall be imposed by the Tarim Management Bureau in accordance with the Xinjiang Uygur Autonomous Region Procedures of the Water Law; for serious cases, the Tarim Management Bureau may submit them to the Board for a decision to take any of the following measures:

1) Reduce or suspend project investments;

2) Take over the management and operating functions for major diversion facilities;
3) Suspend the power to review, approve and issue water withdrawal permits.

Article 31: For cases involving violation of these regulations in which water is discharged in the Basin below the State and Regional water pollution standards, penalties shall be imposed in accordance with laws and regulations related to environmental protection. In the event that the Tarim Management Bureau discovers the above mentioned violations in its inspections, it may submit the cases to be handled by the environmental protection administrative department in accordance with the law.

Article 32: For other activities which merit administrative penalties involving violation of these regulations, the Tarim Management Bureau shall make penalties in accordance with the Water Law of the People’s Republic of China, the Xinjiang Uygur Autonomous Region Implementation Procedures of the Water Law, and other relevant laws and regulations.

Article 33: These regulations shall become effective upon the day of their promulgation.