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TO A QUESTION ON WATER DEVELOPMENT SCENARIOS OF THE CHIRCHIK-AKHANGARAN RIVER BASIN (CENTRAL ASIA)

Introduction

Scientific-information Center of Interstate Coordination Water Commission (SIC ICWC) of Central Asia, together with partners from Germany and a line of other countries of Europe and Africa, realizes the "Rivertwin" project. Main goal of the "Rivertwin" project is integrated regional model of water resources strategic planning and management adaptation, calibration and use in twinned river basins with different climate, ecologic, social and economic conditions. Regional model will take into account impact on water resources by geographic trends, economic and technologic development, climate change, water and land use and other parameters (water management organizational setup, water supply and consumption, water demand, water quality, economic pressure and incentives, new working places creation, life quality, real population income, public participation, etc.) necessary for description of basin water resources management (WRM). "Rivertwin" project will determine sustainable development strategy and will be provided the European Water Framework Directive fulfillment in terms of basin WRM. River basins (RBs) twinning will promote sharing experience, knowledge and technologies in WRM between European and third countries. Initially model is developed and validated for European RB (Germany - Nekar RB). Model transfer to the regions with other parameters will be tested in West Africa (Benin - Quem RB) and Central Asia (Uzbekistan, Kazakhstan, and Kyrgyzstan - Chirchik-Akhangaran RB).

Project leadership and coordination are performed by Hohenheim University (Germany).

On basis of modeling the integrated water development scenarios is supposed for each RB. Since model is devoted to scenarios development in appropriate RBs with regard to probable climate warming and land use changes as well as social, economic and ecologic restrictions in time and space, one project objective is natural resources use integrated scenarios formulation with main water consumers in different RBs. Scenarios, as a base for basin WRM-plans, will be developed with main water users participation in selection of social, economic and ecologic indicators of basin development sustainability. Scenarios will be presented to relevant bodies as a tool for strategic planning of socio-economic development in RB.

Scenarios should give answers to the following basic questions:

- Social, ecologic and economic objectives of basin development;
- Expected anthropogenic impact on water quality under current and future water consumption and land use with regard to climate change;
- Anthropogenic factors impact on flood and peak of flows recurrence;
- Recommended measures on sustainable water use without damage to water and environment quality and optimal measures combination;
- Ecologic resources and water services with regard to water supplies and demand;
- Equality of upper and lower river reaches' interests ensuring;
- Public participation degree in water resources management.

SIC ICWC conducts research to identify priorities and key issues of water management in Central Asian site of the "Rivertwin" project - Chirchik-Akhangaran basin (CHAB).

Total command area of CHAB is about 21.9 thousand km^2, of which:

- Chirchik and Akhangaran RBs in Uzbekistan - 15.6 thousand km^2 (71.2%),
- Keles RB in Kazakhstan – 3.3 thousand km^2 (15.1%),
- Chatkal RB (upstream) in Kyrgyzstan – about 3.0 thousand km^2 (13.7%).

CHAB completely covers Tashkent province (Uzbekistan), where socio-economic, WRM and nature use issues are the most representative for solution of tasks as foreseen in the project, a part of Shymkent (Kazakhstan) and Jalalabad (Kyrgyzstan) provinces.

Note: in present paper water development scenarios for Kyrgyz part of the Chatkal RB are not considered, as the expected water use in this zone can not render essential influence on flow's redistribution in the CHAB. Below the basic preconditions, as bases of development of the scenarios, are given with reference to the optimistic (most acceptable) development scenario, on the basis of existing problems and tendencies of development.

The basic assumptions and restriction are given as a whole without explanations, which are submitted separately in a report on the appropriate position of the "Rivertwin" project.

1. Surface water resources

Irrigation infrastructure remain most advanced in Uzbekistan (Tashkent oasis), less complex - Kazakhstan (Keles zone), concerning underdeveloped - Kyrgyzstan (Chatkal zone).

Up to 2030 construction of the Pskem reservoir will be finished (see further).

CHAB multiyear water resources remain in limits at 9.32 km^3, of which the surface flows will make 8.67 km^3 (93 %). The insignificant changes of flows' volume will be taken into account depending on climate change in CHAB (see further).

The water distribution between CHAB-countries remains former: Uzbekistan - about 88 %, Kazakhstan - about 12 %, Kyrgyzstan - less than 1 %.

Kazakhstan (Keles zone) and Uzbekistan (Tashkent province) develop economy within the established water limits.

1.1. Surface waters' quality

The quality of CHAB water resources will be improved considerably owing to realization by the appropriate departments of a line of measures directed, in particular:

- On achievement of higher degree of the industrial and other drains' clearing,
- On reduction of the returnable waters' volume from irrigated lands,
- On reduction of the water use for irrigation.

1.2. Waste water cleaning

Quality of waste water cleaning will be raised owing to:

- Increase of efficiency of cleaning by working cleaning structures,
- Replacement of the obsolete equipment on working cleaning structures.
- The constructions of cleaning structures on objects, where they are absent,
- Decision of a problem of large dumps of dust (their recycling).

2. Groundwater

The CHAB groundwater volume remains at a former level - about 350 millions m^3.

The flow of the Tashkent province springs remains at a former level - 33 millions m^3.

In Chirchik valley groundwater is used from the confirmed reserves (1.800 millions m^3/day) in volume about 48% (0.864 millions m^3/day) for the modern period. In the long term groundwater use will be raised proportionally to the population growth and industry development.

In Akhangaran valley the groundwater reserves (1.172 millions m^3/day) are authorized for municipal-drinking and technological water supply for the modern period.

Akhangaran groundwater deposit has no additional resources, in the long term filling its reserves it is possible by transfer a part of the Chirchik RB surface water to the Akhangaran RB.

2.1. Groundwater quality

Groundwater quality will be raised, because:

- The planned measures concerning surface waters will be carried out. As surface waters are connected with groundwater, these measures should have by result improvement of water quality.

- The measures on protection of the drinking structures (establishment the sanitary protection's zones etc.), planned by Uzbek State Committee on protection of a nature, will be carried out.

2.2. Groundwater management problems

For decision of the groundwater management problems it is obviously necessary, in particular:

- Creation of a public organization answering for interdepartmental coordination at management by surface and ground water, as they are interdependence; this organization should answer for management of groundwater' quality also,
- Restoration of a regime observant network up to a level 1990 (as a minimum).

3. Integrated WRM (principles, institutes etc.)

3.1. Not only basin principle, but also other basic integrated WRM principles will be a basis of the national water politics in the "Rivertwin" project countries.

3.2. In part of preparation and acceptance the appropriate legal acts:

- In Uzbekistan will be accepted the Water Code and Law "About Water User Association".

3.3. WRM organizational structure will not change essentially. At the same time, the increase of the status of the Main Water Agencies in Kazakhstan and Kyrgyzstan is not excluded, but it will not essentially affect on water conditions in the project zone.

3.4. Basic functions of the Basin water organizations (BWO) in the project zone (Jalalabad BWO in Kyrgyzstan, Aral-Syrdarya BWO in Kazakhstan, Chirchik-Akhangaran BWO in Uzbekistan) will not undergo essential changes.

3.5. BWO "Syr-Darya" will be allocated wider authorities at management by trans-boundary water objects in zone of its influence.

4. Water resources management: the basic problems.

It is supposed that in the nearest prospect (5-10 years), in particular:

4.1. At interstate level:

- The volumes of the water flows for ecosystems' needs will be established,
- The coordinated operation regime of the Charvak reservoir (in more remote prospect - mode of operation regime of the Pskem reservoir) will be established,
- The Pskem HEPS-construction will be coordinated with the Kazakh party,
- The uncertainty, connected with climate changes in CHAB, will be specified,
- Between the Parties the effective information interchange's system will be organized,
- The mechanisms of conflicts' resolution (on questions of water use, compensation of harm caused by infringement of the arrangements etc) will be developed,
- The general approaches, direction and program of the water development will be developed;
- The questions of an estimation of consequences from transformation of a natural mode of the CHAB-rivers will be decided (at possible re-distribution of the river flows);
- Community's knowledge and degree of the public participation on all levels of the WRM-hierarchy will be increased (including a process of the decisions' acceptance);

4.2. At national level:

- The priority of the nature protection measures is erected in a rank of state politics at management by water complex,
- The mutual interest of the water users and water management organizations on the questions of the water consumption's reduction is increased in all sectors of national economy,
- The effective economic basis of the mutual relations' regulation between water suppliers and water consumers and users is developed,
- The strong legislative base of the IWRM on local level is developed,
- The appropriate measures are developed and realized for increase competitiveness of agrarian sector at a state level,
- The legal base of public participation at WRM is developed,

- Interdepartmental information interchange and strong coordination between national economy sectors-basic water consumers are supplied; etc.

5. Climate change and water resources

5.1. According to the climatic scenarios, it is expected (including atmospheric precipitation):
- Akhangaran River: increase of the yearly flow on 2-9 %, vegetation flow on 2-6 %,
- Chatkal River: increase of the yearly flow on 3-6 %, vegetation flow on 2-5 %,
- Pskem River: reduction of the yearly flow on 1-2 %, vegetation flow on 2-5 %,
- Inflow in the Charwak reservoir: the yearly inflow remains within the limits of norm or reduction up to 3 %, vegetation inflow will decrease on 2-7 % (climatic scenario IS92ef).

5.2. According to the climatic scenarios, it is expected (excluding atmospheric precipitation):
- Akhangaran River: reduction of the yearly flow on 1-2 %, vegetation flow on 3-6 %,
- Chatkal River: reduction of the yearly flow on 1-3 %, vegetation flow on 2-8 %,
- Pskem River: reduction of the yearly flow on 1-2 %, vegetation flow on 2-5 %.

5.3. By development of the preliminary scenarios the river flow's change is not accepted into attention owing to their insignificance (3-5 %). By development of final scenarios the maximal reduction of the vegetation flow since 2020 is supposed for a basis of accounts:
- Chirchik RB: reduction on 6-8 % (average - 7 %).
- Akhangaran RB: reduction on 6 %.

5.4. Loss of the glacier flow (as a consequence of glacier reserves' reduction to 2020 on 1/3 their volumes in 1960), and increase it rainy component (on 7-10 %) is taken into account as proportional increase of the freshet phenomena in CHAB.

5.5. The consequences of climate change for agrarian sector are taken into account through a beginning and duration of the cultivated cultures' vegetation period.

6. Soils

The significant changes of soil differences in CHAB will not take place up to 2030.

7. Ecological situation: possible prospect

7.1. **First zone** (higher 900m under sea level): ecological situation is remained favorable.
- For ecological stability's preservation the following measures are carried out:
    - Maintenance of the local population by gas or coal for the savings of a wood from cutting down,
    - Restriction the cattle's quantity up to normative parameters for the purposes of excessive loadings' reduction on pastures.
- Recreational potential from Charvak reservoir and higher is completely used by means of the "step by step" development.
- The construction of Pskem HEPS is used in parallel for the purposes of recreational potential's development of the first ecological zone.
- The measures, directed for neutralization of negative consequences of Pskem HEPS' construction an environment, are developed and take root.

7.2. **Second zone** (600-900m): the measures for preservation of satisfactory ecological situation will be undertaken, in particular, loadings on an environment from dumps of a line of the industrial enterprises, agriculture, domestic facilities will be reduced.

As a whole the measures will be directed to increase of cleaning structures' capacity and cleaning's efficiency, to exception of waste water's dump in surface water and ground water basins, to realization of a number of other measures for improvement of ecology of a zone.

7.3. **Third zone** (the heights 280-600m): cardinal measures for improvement of an ecological situation should be carried out. Complex program of actions for essential improvement of an ecological situation will be developed. The program is developed by water specialist together with the representatives of the basic sectors of economy, and other interested parties

8. Approaches on the basis of the development scenarios

As a basis of CHAB development scenarios it is necessary to accept the appropriate counts of planning bodies, theoretical researches of the scientific-research and other institutes and all basic stakeholders. Such approach will allow to estimate available material critically and to give the offers on updating the different positions of planned development.

8.1. In particular, SIC ICWC of Central Asia has developed following scenarios:

- "Optimistic scenario" (OS);

According OS the significant decrease of the population growth's rates is expected to 2020 - till 1.0% per year. Water use for irrigation should decrease till 9400 m^3/ha as a result the introduction water economy technologies in agrarian sector.

- "Medium scenario" (MS);

According MS the insignificant decrease of the population growth's rates is expected - till 1.23% per year to 2020. Water use for irrigation will make about 11000 m^3/ha.

- "business as usual scenario" (BAUS)

According BAUS the population growth's rates will be made 1.9% per year, water use for irrigation will make 12000m^3/ha.

Obviously, that «optimistic scenario» realization will require revision of existing approaches to water resources use, since irrigated agriculture development is possible within existing water limits.

8.2. In accordance with «General Scheme of irrigated agricultural and water sector of the Republic of Uzbekistan for the period up to 2015» (Tashkent, State Institute «Vodproekt», 2002) following Concepts of development are accepted:

- Development based on existing rate (ER) and structure of realized measures.

According this Concept, developing agricultural production decreases in sustainable manner. By 2015 provision by food staff will decrease by 25%, area with favorable reclamation conditions will be decrease, water and reclamation systems' technical state will grow worse.

Therefore, ER Concept is unacceptable.

- Stop-development Concept (SDC).

Under this Concept, irrigated area remains the same, new lands are not developed, all financial means are allocated to land reclamation measures and irrigation and drainage systems improvement. By 2015 all irrigation systems and water objects should be rehabilitated and upgraded.

At that irrigated area will decrease by 51200 ha (due to land retirement for different objects and communication systems). Provision with food will increase only by 3% (from 61 to 64%) due to irrigated hectare productivity increase.

In opinion of the experts, SD Concept is also unacceptable.

- Maximum development Concept (MDC).

Under this Concept all measures of SDC will be realized, additional irrigated lands will be developed allowing provide population with food.

According to «General scheme…», there is possibility to provide necessary land, water and labor resources under any scenario of development. But only under MDC food provision, irrigated land favorable reclamation state, effective water and land resources us can be achieved.

8.2.1. Scenario «recommended development» (SRD) is based on MDC and analysis of all previous Concepts' and real possibilities of investment in agricultural and water sector. To certain extent, assumption about realization of political, social-economic prerequisites of transition to market in agricultural sector by 2015 as well as structural transformations related to transition to market relations between agricultural producer and the state.

Orientation on MDC is justified in terms of IWRM and CAB principles' adoption that will allow substantial adjustment of proposed official scenarios of social-economic development of Tashkent province. Concept of MDC is realized by scenarios:

- I scenario. Agricultural production providing (ARP) population with food by 70% of average weighted volume required for full provision according to optimal food allowance;

- II scenario. ARP growing population with food by 65% against 61% currently that is in fact keeping positive trend of food provision not depending on number of population.

It is meant that levels of development by scenarios are stages of MDC realization, ratio of water-related measures in these scenarios is adopted according to ratio obtained at full development[1]. Now became obvious that the purposes put in "General scheme …" are impracticable to a target date (2015), therefore temporary frameworks of their achievement are represented expedient to be moved on 10-15 of years forward – to a level of 2025-2030 that corresponds to the prognostic period of the "Rivertwin" project.

9. Basic assumptions and restrictions

By development of the preliminary CHAB-development scenarios, also a line of rules and assumptions under scenarios of the Nekar RB (Germany) are accepted, as a basis:

- Scenario A – globalization (focus is made on the free market and technologies);
- Scenario B – regionalization (stress is made on the ecological and social problems).

The named above approaches are developed by Coordinator of the "Rivertwin" project (Hohenheim University). From each of the preliminary scenarios' the acceptable for CHAB provisions are accepted, which are reduced to the following:

- Fast economic growth (scenario A - globalization),
- Rather low and stable rates of the population's growth (globalization),
- The profit is invested in new economic opportunities (globalization) and in the decision of ecological and social problems (scenario B - regionalization),
- Low political intensity (globalization),
- The people, capital and technologies have regional roots (regionalization),
- Introduction of ecologically safe technologies (regionalization),
- Constant improvement of ecosystems quality (regionalization),
- Strong regional (local) profile (regionalization),
- Strong public values and decisions (regionalization),
- Priority to well-being of man and education (regionalization).

10. Others basic data, assumption and restriction

10.1. Considered period – 2005-2030.
10.2. Basic year – 2003; at averaging – as a rule, for last 5 years.
10.3. Population (2003, on 01.01.2004, **base**):
- Tashkent province – 4930 thousand, including:
- Rural population – 1470 thousand,
- Urban population, as a whole – (2500 + 960) thousand = 3460 thousand, from which:
- Tashkent city – 2500 thousand,
- Other cities in Tashkent province – 960 thousand.

10.3.1. Yearly population growth (1999-2003), average:
- Urban population (trends): 0.8-0.9 %/year (1999-2003): 0.9 %/year (**base**)
- Rural population (trends): 1980-2003 – 1.6 %/year, 2001-2003гг. – 1.5 %/year (**base**).

10.4. GNP:
- First variant - for 2003: 0.9 billion $ (**base**),
- Second variant - averaging for 1999-2003: 1.32 billion $ (**base**)

10.4.1. Rates of GNP growth:
- Up to 2010 - 6-8 %/year (**base** - 7 %),
- 2011 -2020 - 8-12 %/year (**base** - 10 %),
- 2021- 2030 - 5-7 %/year (**base** - 6 %).

10.5. New land development:
- (Trends: 1995-2003 – growth on 5.43 thousands ha; 2000-2003 - irrigated lands' decrease on 3.01 thousands ha);

[1] In the considered scenarios the "maximal development" Concept means "acceptable development", instead of maximal development in direct meaning of word "maximal".

- In 2006-2020 new land development takes place inside of available irrigated lands (as a whole);

- Up to 2020 development of virgin is not expected,

- Development of land reserves (about 40 thousands ha of virgin) is expected in 2021-2030.

10.6. Waters consumption and expected volumes of return water are accepted according to the "General scheme …" at moving time of their performance on 15 years forward (see above).

10.7. Distribution of agricultural lands depending of the ownership's forms on the rural areas is accepted as the following (previously):

- 2003 (**base**):

- State agrarian enterprises (shirkats) - 62 % of irrigated lands,

- Farm enterprises - 28 %,

- Personal subsidiary and dekhkan enterprises - 10 %.

- 2006-2010 (there is a process of irrigated lands transfer to the farmers and dekhkans):

- State agrarian enterprises - 15-20 % of irrigated lands,

- Farms - 60-70 %,

- Personal subsidiary and dekhkan enterprises - 15-20 %.

- 2011-2020 (end of process of irrigated land redistribution between the market's various subjects on rural area - merge and division, integration):

- State agrarian enterprises - 5-10 % of irrigated lands,

- Farm enterprises - 70-75 %,

- Personal part-time farms - 15-25 %.

- 2021-2030 (the market mechanisms on the rural areas work completely, and there is complete feedback of introduction of market mechanisms on a rural areas of Tashkent province)

- State agrarian enterprises (shirkats) - 5 % of irrigated lands (circulating capital),

- Farm enterprises - 70 %,

- Personal part-time farms -25 %.

The basic results under the preliminary CHAB development scenarios (according to the listed above assumptions and restrictions) are given below (table).

Table

The basic results to the preliminary CHAB development scenarios

(Period for scenarios - 2005-2030)

##	Parameter	Base	2020	2030
1	2	3	4	5
1	**CHAB water resources,** km^3			
1.1	Multiyear,	9.3	9.3	9.3
1.2	- including surface flow	8.7	8.7	8.7
2	**Water distribution between CHAB countries**, %			
	Uzbekistan (Chirchik and Akhangaran RBs) – about 88 %	~88	~88	~88
	Kazakhstan (Keles massif) – about 12%,	~12	~12	~12
	Kyrgyzstan (Chatkal upstream) – less than 1%	<1	<1	<1
3	**Water resources of Tashkent province ("Rivertwin" project site in Uzbekistan)**			
3.1	Groundwater flow, million m^3	350	350	350
	Approved groundwater reserves, thousand m^3/day			
	Chirchik river valley	1800	1800	1800
	Akhangaran river valley	1172	1172	1172
	Groundwater reserves, thousand m^3/day			
	Chirchik river valley	936	936	936
	Akhangaran river valley	000	000	000
3.2	**Multiyear surface flow of the basic CHAB rivers**, km^3/year			
	Chirchik (including tributaries – Chatkal, Pskem, Ugam, Koksu etc)	7.20	7.00	7.00
	Akhangaran	0.72	0.70	0.70
	Keles	0.07	0.07	0.07
4	**Climate change and river flow's reduction** (since 2020), % of multiyear flow			
	Akhangaran river:			
	- annual	0	1-2	2
	- vegetation	0	3-6	6
	Chatkal river:			
	- annual	0	1-3	3
	- vegetation	0	2-8	8
	Pskem river :			
	- annual	0	1-2	2
	- vegetation	0	2-5	5
	Inflow in the Charvak reservoir:			
	- annual	0	2-3	3
	- vegetation	0	2-7	7
	Chirchik river basin, as a whole	0	7	7
	Akhangaran river basin	0	6	6
4.1	**Chirchik river basin: glaciers' reduction and basic consequences**			
	- Glaciers reserves (base – 1960)), reduction of area, %	20	34	40
	- Increase of the rain parts of surface water flows, %	00	7-10	10-12
	- Increase of the flood's repeatability, %	00	7-10	10-12
5	**Annual population growth (trends),** %			
	- Urban: 1999-2003 – 0.8-0.9%, **(base – 0.9%)**	0.9	0.9	0.9
	- Rural 1980-2003 – 1.6%, 2001-2003 – **1.5% (base – 1.5%)**	1.5	1.5	1.5
5.1	**Population's change (base - 2003),** thousand			
	- Tashkent province,	4930	5917	6597
	including:			
	- Rural population	1470	1887	2190
	- Urban population, as a whole,	3460	4030	4407
	including:			
	- Tashkent city	2500	2900	3175
	- Other cities of Tashkent province	960	(1130)	(1232)
	- Population of Tashkent province without Tashkent city	2430	3017	3422

5.2	**Population growth to the 2030 (in comparison to basic year - 2003)**, times			
	All population	1.0	1.20	1.34
	Urban	1.0	1.16	1.27
	Rural	1.0	1.28	1.49
5.3	**Ratio of the urban and village population, %**			
	Urban	70.2	68.1	66.8
	Rural	29.8	31.9	33.2
	Without Tashkent city:			
	Urban	39.5	37.5	36.0
	Rural	60.5	62.5	64.0
6	**General national product (GNP)**			
6.1	**GNP growth,** %	(7)	(10)	(6)
6.2	**GNP, Tashkent province (including Tashkent city),** billion $:			
	- Variant 1	2.31	10.43	18.53
	- Variant 2	2.73	12.18	21.89
6.3	**GNP (without Tashkent city)**, billion $/year			
	- Variant 1 – for 2003г. **- 0.90 (base)**	0.90	4.14	7.23
	- Variant 2 – average for 1999-2003 - **1.32 (base)**	1.32	5.89	10.59
6.4	**GNP, Tashkent city (base – 2003: 1.41 billion** $)	1.41	6.29	11.30
6.5	**GNP per capita,** $/year			
	- Tashkent province, as a whole (Variant 1)	469	1762	2809
	- Tashkent province, as a whole (Variant 2)	(554)	2058	3318
	- Tashkent city	564	2168	3559
	- Tashkent province, without Tashkent city (Variant 1)	370	1372	2113
	- Tashkent province, without Tashkent city (Variant 2)	(543)	1952	3095
7	**Irrigated area** (base – 2000: 385 220 ha), thousand ha	385	385	425
7.1	**New land development (NLD)**, thousand ha	000	000	40
7.1.1	**NLD, trends: a)** 1995-2003 – increase on 05.43 thousand ha; **b)** 2000-2003 – reduction on 03.01 thousand ha; **c)** last years there is no NLD.			
7.1.2	**NLD, forecast: a)** up to 2020 development of virgin lands is not expected; **b)** NLD (about 40th. ha of virgin) is expected in 2021-2030.			
8	**Irrigated lands' distribution depending of the ownership's forms** (**base - 2003**), %			
	- State agrarian enterprises (shirkats)	62	5-10	5
	- Farm enterprises	28	70-75	70
	- Personal subsidiary and dekhkan enterprises	10	15-25	25
8.1	**Land ownership's forms (trends, forecast): a)** 2006-2010: there is a process of irrigated lands transfer to the farmers and dekhkans; **b)** 2011-2020: (end of process of irrigated land redistribution between the market's various subjects on rural area - merge and division, integration); **c)** 2021-2030 (there is a stage of complete feedback of introduction of market mechanisms on rural areas)			
9	**Productivity of the basic agricultural cultures (base – averaging for 1999-2003)**, c/ha			
	Cotton (2003 - 19.8)	23.2	33	35
	Wheat (2003 - 41.0)	36.8	39	41
	Potato (2003 - 212)	177	127	197
	Vegetables (2003 - 225)	214	220	246
	Melons and water-melons (2003 - 170)	16.1	154	154
	Fruit (2003 – 59.0)		54	54
	Grapes		100	100
	Rice	38.4		60
9.1	**The Note:** on a level of 2020 productivity is accepted according to the "General Scheme …", on a level 2030 productivity is accepted according as average on Tashkent province for three years the maximal productivity for the period 1980-2003			
10	**Efficiency of irrigation systems**	0.5-0.6	0.7	0.8
10.1	**Base – the "General Scheme… ": a)** Scenario I: 0.78; **b)** Scenario 2: 0.80; **c)** "Complete development": 0.82 (it is removed to 2030)			
11	**Water consumption (Base -** "General Scheme …", complete development to 2030), million m^3			

	Common, including: - for irrigation - non-irrigational (industry and other sectors)		(6.757) (4.354) 2.403	6.232 3.829 2.403
11.1	**Water consumption (SIC ICWC database, modern level),** million m^3			
	Water for irrigation (dry 2000) Water for irrigation (wet 2004) Water consumption, including groundwater consumption (GWC) and water reuse (WR), (2000) Water consumption, including GWC and WR (2004) Energy-industrial water consumption (2000) Energy-industrial water consumption (2004)	2.944 4.049 6.464 5.567 2.141 0.771		
12	**Removal of water (base -** "General Scheme …", complete development to 2030), million m^3			
25	Common, including: - irrigational - non—irrigational (industry and other sectors of national economy)		3.022 1.613 1.409	3.083 1.674 1.409
12.1	**Removal of water (SIC ICWC database, modern level)**, million m^3			
	Water dump in the rivers and reservoirs (2000) Water dump in the rivers and reservoirs (2004)	1.741 1.814		
13*	**Keles massif (project zone in Kazakhstan)***			
13.1	**Irrigated lands area,** thousand ha, - including lands, irrigated from Chirchik river	67.0 61.2	82.0 76.0	98.0 92.0
13.2	**Limiting water volume for Kazakhstan,** million m^3 - including from the Chirchik river			1250 1.140
13.3	**Common water consumption,** million m^3 - including from Chirchik river (base – for 1998-2004) - including (from common water consumption, %): - irrigational - non—irrigational	578 540 94-96 4-6	783 726 95 5	1.250 1.140 94 6
13.4	**EFFICIENCY:** - irrigation systems, as a whole - main irrigation channels	 0.5-0.6 0.8-0.9	 0.6-0.7 0.8-0.9	 0.7 0.8-0.9

The note: 13* - As agreed with the interested parties, in particular, with RSE "Yugwodkoz" of the Water resources Committee (Republic of Kazakhstan) "optimistic" scenario of development is chosen as most acceptable for the Kazakh part of the "Rivertwin" project.