Transboundary Water and Related Energy Cooperation for the Aral Sea Basin Region of Central Asia

Phase I: Assessment of Issues and Definition of Phase II

Developments that Led to Initiation of New Transboundary Initiative

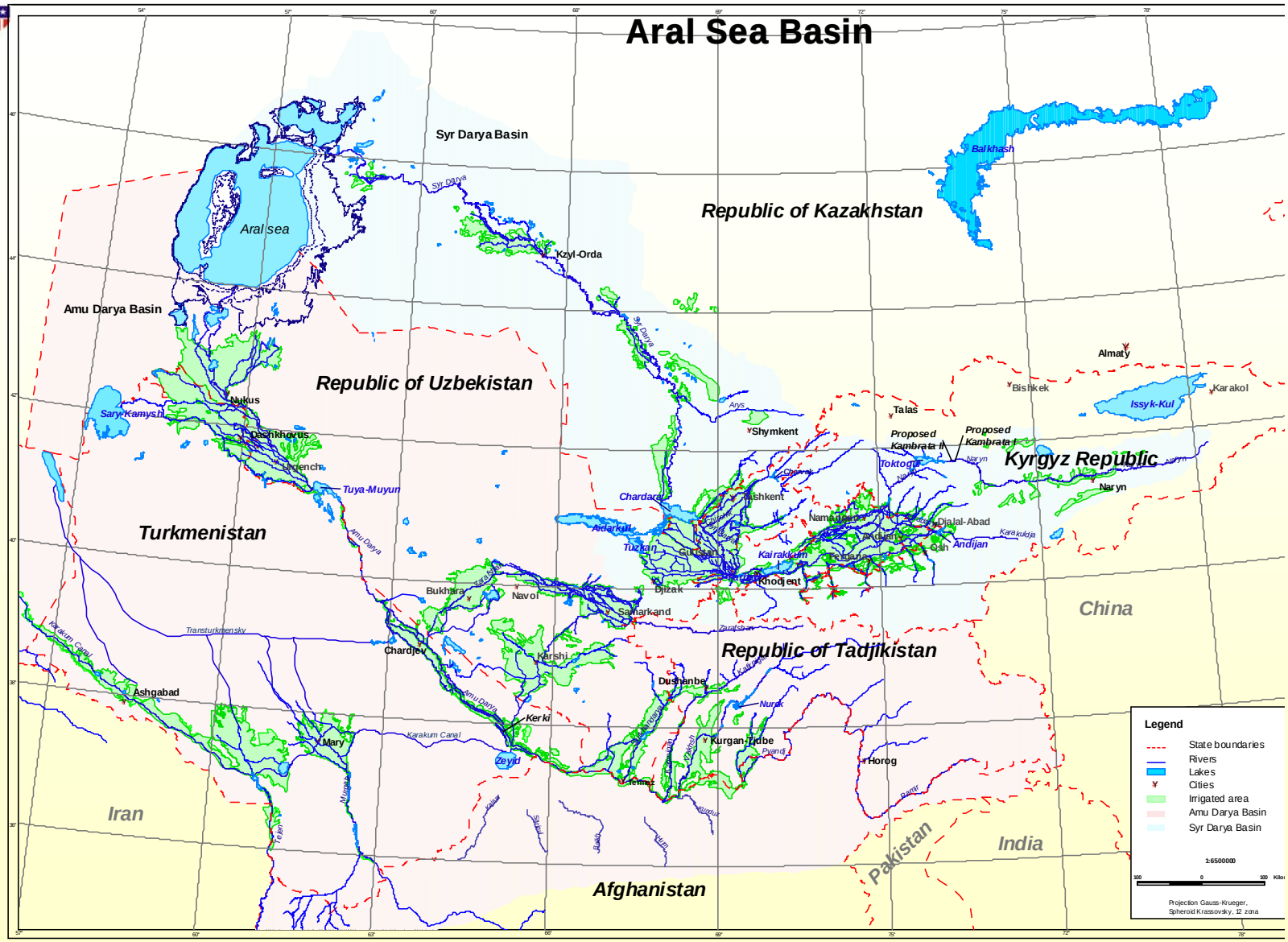
- National leaders expressed the need for more regional cooperation in the water and energy sectors.
- The 1998 Framework Agreement hasn't led to stable and sustainable management in the Syr Darya Basin.
- Other developments (Afghanistan, drought, changes in regional institutions) which offer opportunities for improvement of regional water and energy cooperation.
- Requests from donors and regional decision-makers for an increase in USAID's involvement in transboundary issues.

Phase I: Assessment of Issues and Definition of Phase II

- Implemented from January to March 2002 by PA Consulting, the contractor engaged in USAID's Natural Resource Management Project (NRMP).
- Meetings were held with most of the main stakeholders in the Aral Sea Basin as well as relevant donors.
- Many reports, protocols and agreements were reviewed.
- Priority activities for USAID/CAR support have been identified.
- The results of Phase I are described in a report that is available on request.
- The following slides provide the main findings.

Main Transboundary Issues in the Syr Darya Basin

- The main issue in this basin concerns the operation of the Toktogul Reservoir where a conflict has arisen between the energy needs of the Kyrgyz Republic and the irrigation needs of the downstream countries.
- A resolution of this issue is essential to effective transboundary water and energy cooperation.


Aral Sea Basin
Syr Darya Basin
Amu Darya Basin
Aral sea
Republic of Kazakhstan
Republic of Uzbekistan
Turkmenistan
Kyrgyz Republic
Republic of Tadjikistan
China
Iran
Afghanistan
Pakistan
India
Balkhash
Issyk-Kul
Kzyl-Orda
Nukus
Dashkhovuz
Urgench
Tuya-Muyun
Saryk-Kamysh
Shymkent
Tashkent
Chardara
Almaty
Bishkek
Karakol
Talas
Proposed Kambrata II
Proposed Kambrata I
Toktogul
Naryn
Namangan
Andijan
Djalal-Abad
Kairakkum
Khodjent
Djizak
Samarkand
Bukhara
Navoi
Chardjev
Karshi
Ashgabad
Mary
Kerki
Termez
Dushanbe
Kurgan-Tjube
Nurek
Horog
Legend
State boundaries
Rivers
Lakes
Cities
Irrigated area
Amu Darya Basin
Syr Darya Basin
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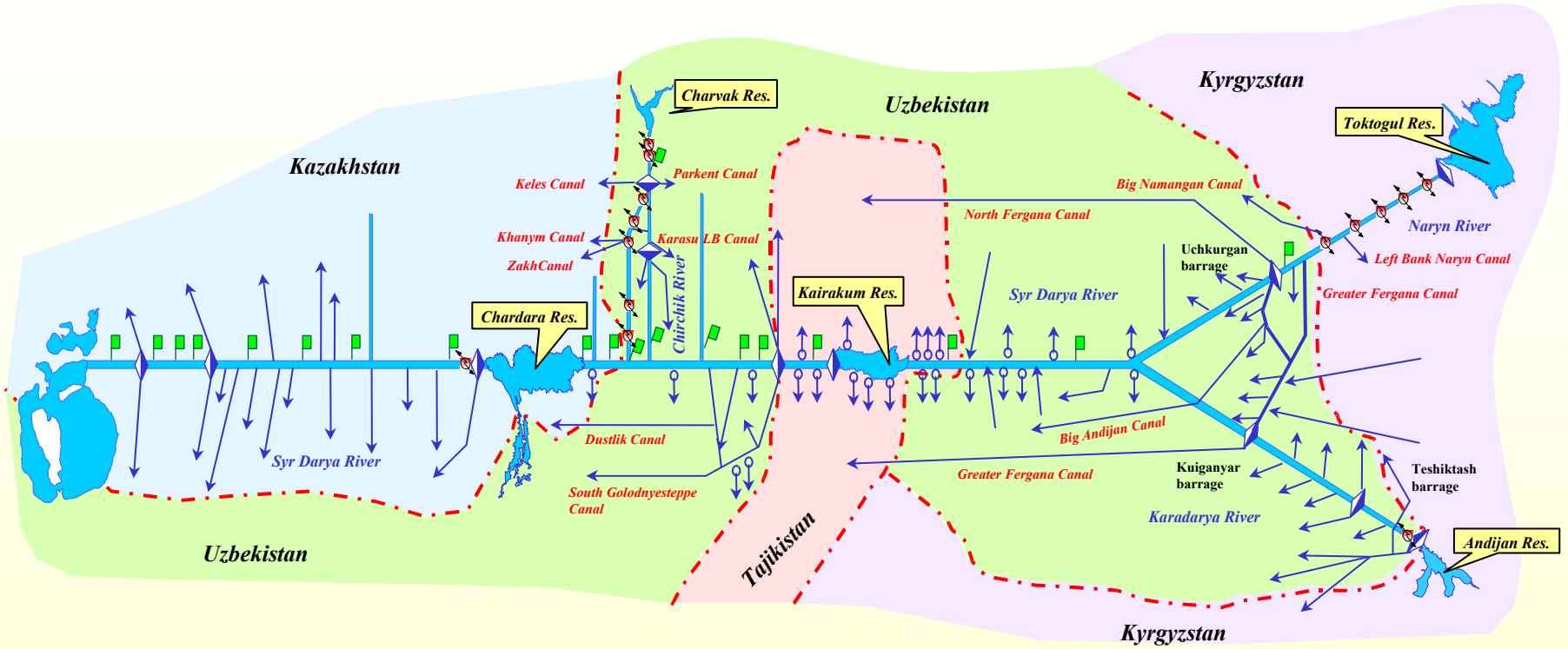
Projection Gauss-Krueger, Spheroid Krassovsky, 12 zona

Schematic Layout of the Syr Darya Basin



KEY : Dam or barrage | Hydropost | Canal | Pump station | Hydro-electro station

The Toktogul Problem

- Before 1991, Toktogul Reservoir was operated in “irrigation mode”, with large summer releases to satisfy irrigation demands in Uzbekistan and Kazakhstan, and low winter releases.
- Surplus hydropower in summer produced by the Naryn Cascade was transmitted to the downstream Republics through the CA Power Grid. During the winter, the Kyrgyz Republic received sufficient fuel to operate its combined heat and power plants.
- After 1991, fuel deliveries have not fully satisfied Kyrgyzstan’s needs. Therefore, the Kyrgyz Republic increased releases from the Toktogul Reservoir during winter.
- As a result, the reservoir operation has shifted to “power mode” with large winter releases and lower summer releases (see next slide).

Toktogul Reservoir Operation 1976-2000

Water Year Oct.-Mar.	Reservoir Inflow (km^3)	Winter Outflow (km^3)	Summer Outflow (km^3)	Total Outflow (km^3)	Summer as % of Total Outflow
76	9,191	2,207	7,472	9,679	77.20
77	10,594	1,791	8,771	10,562	83.04
78	11,641	1,239	7,417	8,656	85.68
79	12,501	2,181	5,318	7,499	70.92
80	10,888	3,058	7,068	10,126	69.80
81	11,641	2,877	9,117	11,994	76.01
82	8,628	3,305	11,167	14,472	77.16
83	11,011	2,980	8,863	11,843	74.84
84	11,013	2,547	9,340	11,887	78.57
85	10,193	2,364	7,823	10,187	76.79
86	9,448	2,894	8,951	11,845	75.57
87	14,558	2,217	3,590	5,807	61.82
88	16,479	2,710	8,769	11,479	76.39
89	10,349	4,352	10,862	15,214	71.39
90	12,406	3,930	6,783	10,713	63.32
Avg.76-90	**11,369**	**2,677**	**8,087**	**10,765**	**75.13**
91	10,715	4,907	8,848	13,755	64.33
92	11,824	5,085	6,550	11,635	56.30
93	13,690	6,085	4,540	10,625	42.73
94	15,271	7,486	6,715	14,201	47.29
95	11,019	8,203	6,298	14,501	43.43
96	12,843	8,087	6,230	14,317	43.51
97	11,015	8,350	6,062	14,412	42.06
98	14,015	7,154	3,695	10,849	34.06
99	15,117	7,981	5,068	13,049	38.84
2000	12,676	8,823	6,476	15,299	42.33
Avg. 91-00	**12,819**	**7,216**	**6,048**	**13,264**	**45.60**

Impact of Changed Operation of Toktogul Reservoir

- In Kazakhstan the Syr Darya has not enough capacity to discharge the large winter releases from Toktogul. Therefore, large quantities of water have to be wasted annually in the Arnasay Depression in Uzbekistan, damaging lands and infrastructure.
- The reduced summer flows from the reservoir have been causing considerable water shortages in Uzbekistan, Kazakhstan and Tajikistan, and a severe reduction of irrigated land in Kazakhstan.
- Existing regional water and energy organizations have not been able to exercise their mandate due to conflicting interests in the management of the reservoir.

Response to Changes in the Operation of the Toktogul Reservoir

- To address growing problems in the first half of the 1990's, the Basin States entered into annual agreements on water allocation energy exchanges in an attempt to re-establish the pre-1991 operating regime.

- The 1998 Framework Agreement on the joint use of water and energy resources in the Syr Darya Basin between the Kyrgyz Republic, Uzbekistan, Kazakhstan, and Tajikistan places these agreements on a more formal footing.

Experience with Implementation of the 1998 Framework Agreement

- The process of annual negotiations between the States to prepare and agree on the multilateral and bilateral agreements has been cumbersome.
- However, the agreed water and energy exchanges have been implemented rather well. Fuel has been delivered to the Kyrgyz Republic as required, albeit with occasional delays.
- Nevertheless, there is still a shortage of fuel for winter energy generation in the Kyrgyz Republic; downstream countries still report serious irrigation water shortages (2-4 km^3); losses in the Arnasay Depression during winter remain high (on average 3 km^3); and the Toktogul reservoir has been drawn down despite substantially higher than average inflows of water into the reservoir during the last several years (see next slide).
- Next year the first 5-year term of the 1998 Framework Agreement comes to an end. It would be automatically renewed unless any of the States objects.

Historical Inflow into the Toktogul Reservoir

Year	Annual Inflow (km^3)	Year	Annual Inflow (km^3)	Year	Annual Inflow (km^3)	Year	Annual Inflow (km^3)
1911	10.827	1934	12.900	1957	9.497	1979	12.597
1912	11.197	1935	11.416	1958	13.167	1980	10.634
1913	11.500	1936	10.696	1959	15.020	1981	11.952
1914	11.428	1937	10.177	1960	14.315	1982	8.442
1915	10.233	1938	8.015	1961	9.556	1983	11.043
1916	8.873	1939	8.368	1962	9.666	1984	10.838
1917	6.524	1940	8.913	1963	12.040	1985	10.303
1918	8.690	1941	11.282	1964	14.124	1986	9.425
1919	10.690	1942	12.869	1965	9.689	1987	14.979
1920	10.918	1943	10.157	1966	15.636	1988	16.487
1921	20.722	1944	9.193	1967	10.961	1989	10.081
1922	13.004	1945	10.606	1968	12.583	1990	12.465
1923	12.605	1946	10.529	1969	18.555	1991	10.737
1924	13.390	1947	8.159	1970	14.747	1992	12.019
1925	9.746	1948	10.555	1971	13.008	1993	13.612
1926	9.355	1949	11.369	1972	10.817	1994	15.302
1927	7.476	1950	11.328	1973	14.226	1995	10.805
1928	12.186	1951	10.548	1974	8.479	1996	13.111
1929	10.945	1952	16.376	1975	8.839	1997	10.701
1930	11.328	1953	14.602	1976	9.207	1998	14.505
1931	13.872	1954	14.954	1977	10.700	1999	15.173
1932	9.551	1955	12.429	1978	11.717	2000	12.660
1933	8.893	1956	12.966				

The Energy Shortages of the Kyrgyz Republic

- Total demand on the Kyrgyz power system in 2000 was nearly 12,000 GWh.
- In an average year, the production of Naryn Cascade plus small scattered hydro plants is about 10,600 GWh.
- In order to release at least 6.5 km from Toktogul in the summer season, the annual deficit would consist of a summer surplus of some 1,800 GWh and a winter deficit of 3,200 GWh.
- Thus in the winter the Kyrgyz Republic would have to import a combination of fuel and electricity to meet the 3,200 GWh deficit.
- The timely and full implementation of the 1998 Framework Agreement will not alone solve the problem of the existing and growing Kyrgyz winter energy shortages.
- The annual deficit will continue to grow unless the Kyrgyz Republic can develop its own fossil or hydropower resources.

Options that address the Toktogul Problem on the Territory of Downstream Countries

- Tajikistan/Uzbekistan. Water losses into the Arnasay Depression could be further reduced by structural and operational modifications of Kairakum Reservoir.
- Uzbekistan has made a start with the construction of small water reservoirs in Fergana Valley and Arnasay Depression, and studies the option to transfer water from the Chirchik-Akhangaran basins to the Uzbek and Kazakh portions of the Hunger Steppe.
- Kazakhstan. Improvement of Chardara reservoir and downstream hydraulic control of the Syr Darya with support from the World Bank will reduce irrigation water shortages and allow larger water flows to reach the Northern Aral Sea during winter.

Options for the Power System of the Kyrgyz Republic

- Loss reduction. Only 65% of the energy produced reaches the consumer. If losses in the Kyrgyz electricity system were cut to 10% from 35%, the annual saving in winter energy would be about 2,000 GWh.
- An assessment of the fuel and electricity transfers needed to stabilize Toktogul Reservoir operation.
- Development of the Kambarata I (1,800 MW and 5,200 GWh) and Kambarata II (350 MW and 1,200 GWh) Hydropower Projects upstream of Toktogul Reservoir.
- Development of coal resources at the Kara Keche Mine.



Proposed Activities for Phase II in the Syr Darya Basin

- The options for solutions for the Toktogul problem haven't been fully evaluated. Donors and stakeholders look to USAID/CAR to take leading role on this issue.
- USAID/CAR could provide support that would help the stakeholders in the basin to develop and agree on measures to stabilize the Toktogul situation in the near- to medium-term and, at the same time, explore longer-term structural solutions.
- The support could include:
  - Capacity building and promotion of consensus.
  - A few short-duration studies (1 to 3 months).
  - Practical on-the-ground (demonstration) projects.

Capacity Building and Promotion of Consensus Would Comprise

- Roundtable meetings among the key decision-makers. First consensus on possible solutions for the Toktogul problem would be sought at the technical level. Then, with the help of the key technical decision-makers, the consensus would be pursued at the policy/political level.
- Implementation of seminars to transfer international experience in: (a) the establishment and operations of an international water/power consortium to manage interstate water facilities and (b) the joint financing, development and management of interstate water facilities.
- Targeted support to interstate organizations such as the CAC and the ICWC as well as relevant national organizations.

Short-Duration Studies (1 to 3 months)

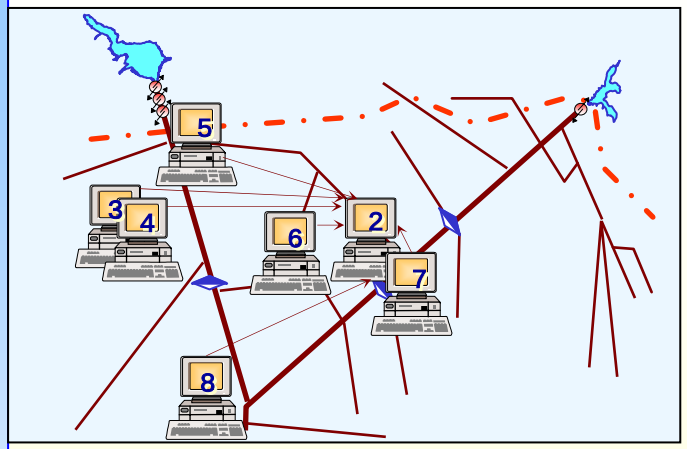
In order to make progress in promoting a consensus among the key technical decision-makers on solutions for the Toktogul problem, the implementation of the following practical and short-duration studies cannot be omitted:

- The design of a stable operating regime for the Toktogul Reservoir and an assessment of the fuel and energy transfers needed to ensure a stable operating regime.
- Definition of a loss-reduction program for the Kyrgyz Power System.
- A review of the economic feasibility of the Kambarata I and II Hydropower Projects in the context of a Power Development Program for the Kyrgyz Republic.
- Technical and economic evaluations of Uzbekistan's plans for new water reservoirs and an inter-basin water transfer project.

On-the-Ground Action

The proposed short-duration studies will also initiate practical on-the-ground projects, such as:

- Demonstration projects and outreach activities to reduce technical and non-technical losses in the Kyrgyz electricity system.
- The improvement of communications, data bases and computerization of UDC Energiya and the BVO Syr Darya to better balance water and energy demands.
- The automation and communications improvements for selected functions of the Naryn Cascade (in the Kyrgyz Republic) to improve its performance.
- Rehabilitation and improvement of the Kairakum Reservoir (Tajikistan) to increase its role in re-regulating seasonal flows.
- The joint development of the Kambarata I and II Hydropower Projects in the Kyrgyz Republic.



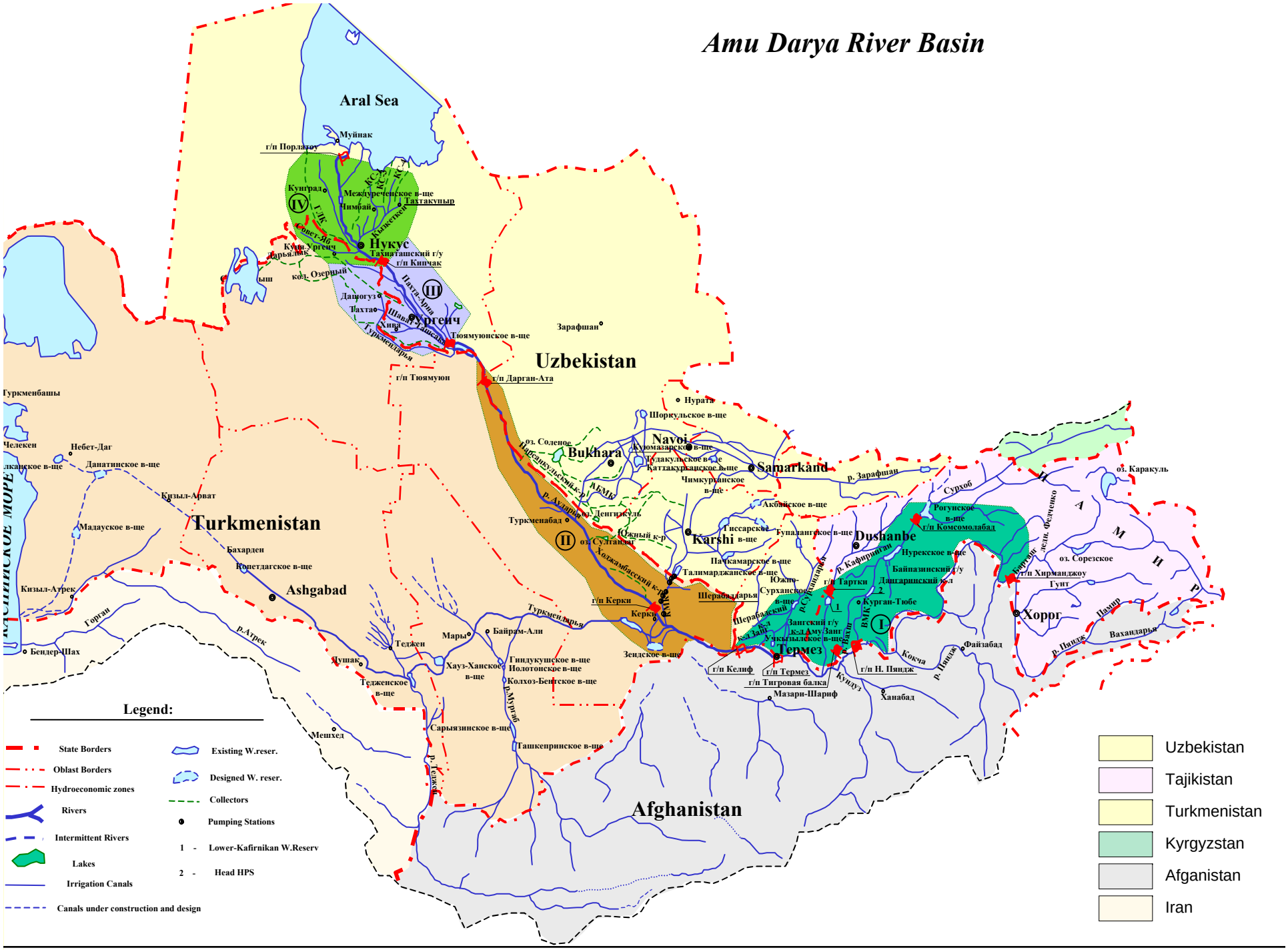
Outcomes Activities in the Syr Darya Basin

- Amendment of the 1998 Framework Agreement that would support stable and sustainable operation of the Toktogul Reservoir during the next 10 years.
- Consensus on the feasibility of the Kambarata Hydropower Projects in the Kyrgyz Republic as a longer-term structural solution with the potential to de-link water management decisions from decisions on energy generation and trading.
- Several on-the-ground projects which would improve water and energy management (see the hand-out).

Main Transboundary Issues in the Amu Darya Basin

- The two main water users (Uzbekistan and Turkmenistan) see no significant transboundary water and related energy issues.
- An emerging transboundary issue is the need to reach agreement with Afghanistan on water sharing. Reportedly, some 20% of the water resources in the Amu Darya Basin are formed on Afghan territory (see map in next slide).

Amu Darya River Basin



Activities in the Amu Darya Basin

USAID/CAR could support the stakeholders in developing a strategy and approach for negotiating a new agreement on water sharing with Afghanistan. The proposed activities could include:

- A review of the validity and legal aspects of the 1946 and 1958 Agreements between the former Soviet Union and Afghanistan as well as more recent protocols, resolutions, and plans.
- The formulation of recommendations on the strategy and approach that could be followed in negotiating a new agreement.
- Implementation of a seminar with key stakeholders in the Basin to promote consensus on a sound strategy for management of their shared water and energy resources with Afghanistan.
- Construction of transboundary measuring stations to monitor water flows in the upstream portions of the Amu Darya Basin.

Implementation Arrangements

- The contractor would field a small team of resident staff to manage the execution of the proposed project components.
- The contractor's team would employ, as a when needed, international specialists and short-term national consultants.
- Together they would collaborate with key decision-makers of relevant national and regional organizations.

Counterparts