APPENDIX 2

BASIN PROFILES

CHARACTERISTICS OF MAJOR RIVER BASINS

This appendix contains characteristics of some of the main basins in the republic. Data about water quality is limited, but water quantity data, demographic data, and information about the most significant polluters provide an understanding about the basins and their conditions.

Syrdarya Basin

The Syrdarya is one of two major rivers that feed the Aral Sea. It originates in the Kyrgyz Republic as the Naryn River and its total length is 3,019 km. The river passes through four republics (Kyrgyz Republic, Tajikistan, Uzbekistan, and Kazakhstan) and is a point of contention (in terms of water quantity and quality) between governments of the four republics. The total length of the Syrdarya in Tajikistan is 185 km. Many of the tributaries of the Syrdarya in Tajikistan do not reach the Syrdarya year-round, but major tributaries include the Isfara, Khodjabakirgan, Isfana, and Aksu.

Table A2.1: Sediment Loads and Turbidity of Syrdarya and Isfara Rivers

River	Monitoring Point	Average Annual Flow (m^3/second)	Average Annual Flow (million m^3)	Average Sediment Load (kg/second)	Average Turbidity (mg/l)
Syrdarya	Akdjar	483	15,400	790	1.2
Syrdarya	Kzylsu	479	15,100	No data	No data
Syrdarya	Bekobod	152	4,790	35	.30
Isfara	Tashkurgan	14.5	457	13	.56

Source: Ministry of Environment.

Turbidity levels register beneath the maximum permissible concentration (MPC) of 1.5 mg/l. Noteworthy is the decrease in flow of roughly two-thirds between the Kzylsu monitoring station before the Kairakum reservoir and at Bekobad, located shortly before the river crosses into Uzbekistan. The withdrawal is mainly for agricultural purposes, and although some drainage water is returned to the river, the net loss in flow is considerable.

Major point-source polluters are:

- Kairakum: Wastewater treatment plant;
- Khodjent: Milk plant, bread plant, meat processing plant, canning plant, furniture factory, enameled cooking ware plant, Leninabad chicken breeding plant, and wastewater treatment plant;
- Kanibadam: Cotton processing plant, bread plant, canning factory, and oil processing plant;
- Isfara: Reinforced concrete factory, chemical plant, and metallurgy;
- Proletarskoye: Bread plant, chicken breeding plant; and
- Gafurov: Beer factory, wine factory, and meat processing plant.

According to data from the early 1990s, pollutants identified in the rivers are fewer and in less concentrations than in other parts of the republic, even though Leninabad oblast is the most industrialized region of the country. Most of the factories and plants are working at

reduced capacity (30-50 percent), which may account for such results. The monitoring and analytical facilities in Leninabad are reported to be the best in the republic.

Zeravshan Basin

The Zeravshan River runs due west across the northern part of the country through a well-defined valley. It used to turn to the south to join the Amudarya, but for almost three decades has not reached the Amudarya because of excessive withdrawals for irrigation in neighboring Uzbekistan.

Table A2.2: Sediment Loads and Turbidity of the Zeravshan River and its Tributaries

River	Monitoring Point	Average Sediment Load (kg/second)	Average Annual Sediment Load (thousand tons)	Sediment Load during High Flow Season (thousand tons)	Percentage High Flow Sediment Load of Annual Average	Average Turbidity (mg/l)
Zeravshan	Dunuli	140	4,300	4200	97.6	0.83
Fandarye	Pete	13	420	350	83.5	0.26
Magindarye	Sugdiana	4.1	130	120	92.3	0.41

Source: Ministry of Environment.

The Zeravshan, which originates in glaciers in Tajikistan, quickly becomes a powerful river that dwarfs its rather short tributaries.

Table A2.3: Flow and Demographic Characteristics of the Zeravshan River Basin

River and Monitoring Station	Area of Basin Accounted for by Monitoring Station	Flow (m^3/second)		1990 Population (thousands)		Population density (km^2)
		Annual Average	Lowest	Total	Urban	
Yangob (Takfon)	1,490	32.60	3.27	8.2	2.1	5.5
Fandarye (Pete)	2,990	54.00	8.70	13.8	2.1	4.6
Iatcha (Pokhyt)	4,300	79.10	12.90	14.1	Not applicable	3.3
Magidarye (Sugdiana)	1,100	8.14	1.98	36.2	Not applicable	32.9
Zeravshan (Khushekat)	8,020	147.00	25.60	38.0	2.1	4.7
Zeravshan (Dupuli)	10,200	155.00	32.10	105.2	2.1	10.3
Zeravshan (Pyanjkent)	11,400	165.00	34.00	214.8	30.4	18.8

Source: Ministry of Environment.

Levels between 1.1 and 1.8 times the norm of BOD_5 are found at monitoring stations throughout the valley throughout the 1990s. Population densities are lower than the nationwide average of 42.5 people per square kilometer, and the source of decaying material that would raise biological oxygen demand is not clear.

Vaksh Basin

The Vaksh river is 524 km long. It originates as the Kyzylsu in Kyrgyz Republic and terminates in the Amudarya River. The area of the headwaters is 39,100 km^2, 10.8 percent of which is comprised of glaciers. There are 569 alpine lakes in the basin, most of which are found between the altitudes of 2,800 and 3,500m. The sources of the river are defined as follows: 22 percent from glaciers, 48 percent from seasonal snow, and 30 percent from groundwater. This is the only river basin in which groundwater is identified as an important part of the hydrological cycle of the river. Maximum flows for the Vaksh and its tributaries are May to August, and the record-setting maximum flows tended to be in the 1960s. As Table B.4 shows, average minimum flows contrast markedly with the record-setting maximum flows. This high variability may contribute to the average turbidity levels in some tributaries that are up to six times the MPC of 1.5 mg/l.

Table A2.4: Sediment Loads and Turbidity of the Vaksh River and its Tributaries

River	**Monitoring Point**	**Average Sediment Load (**kg/second)	**Average Annual Sediment Load** (thousand tons)	**Sediment Load during High Flow Season** (thousand tons)	**Percentage High Flow Sediment Load of Annual Average**	**Average Turbidity** (mg/l)
Vaksh (above Surkhob)	Garm	1,400.0	44,000	39,000	90.0	6.70
Vaksh	Sarimazar	930.0	30,000	Not available	Not available	3.50
Kyzylsu	Dombracha	100.0	3,200	3,300	97.8	Not available
Muksu	Davsear	440.0	14,000	13,000	98.7	3.90
Sariob	Kalasang	2.9	89	85	93.6	Not available
Surkhsu	Takob	5.9	190	180	94.5	1.00
Obigarm	Obigarm	4.0	130	150	76.8	.81
Nurek	Dagana	9.4	300	290	88.1	9.00

Source: Ministry of Environment.

Table A2.5: Flow and Demographic Characteristics of the Vaksh River Basin

River & monitoring station	Area of Basin Accounted for by Monitoring Station	Flow (m^3/second)		1990 Population (thousands)		Population Density (km^2)
		Annual Average	Lowest	Total	Urban	
Data for Vaksh tributaries						
Kzylsu	8,370	73.3	Not avail.	29.1	Not applicable	3.5
Muksu (Davosea)	6,550	111.0	18.1	9.2	Not applicable	1.4
Obikhangau	5,390	159.0	74.6	8.5	Not applicable	1.3
Data for the Vaksh						
Istok	14,920	184.3	Not avail.	38.3	Not applicable	2.6
Garm	20,000	324.0	128.0	116.9	5.5	5.8
Nurek	29,500	900.0	209.0	175.9	9.8	6.0
Golovnoi Hydrostation	32,200	575.0	Not avail.	264.0	47.8	8.2
Tigrovaya Balka	36,200	539.0	Not avail.	1,063.5	209.5	29.4

Source: Ministry of Environment.

Data gathered about pollutants in the early 1990s are erratically presented, but indicate that the higher reaches of the river were characterized by concentrations of naturally occurring sulfate that exceed the maximum permissible concentration. However, these concentrations at some monitoring stations were recorded at 7, 12, and even 14 times the MPC of 100 mg/l. Interestingly, concentrations of NH_4 and NO_2 that exceed the MPCs were recorded at monitoring points above the nitrate fertilizer plant, suggesting that agricultural runoff has more of an impact on water quality than do effluents from the plant itself, at least after 1990.[1] At one half kilometer downstream of the plant, excesses of the MPC were also recorded, but at the same or less concentrations than those upstream.

[1] Other reports identify the fertilizer plant as one of the major point source polluters in the republic, especially prior to 1990. No data were available to support this claim.

Table A2.6: Monitoring Points on the Vaksh River

Year	Component	MPC	1.5 km Above Fertilizer Plant		0.5 km Below Fertilizer Plant	
			Concentration (mg/l)	Relationship to MPC	Concentration	Relationship to MPC
1990	NO_2	0.02	0.060	3.0	0.026	1.30
1991	NO_2	0.02	0.070	3.5	Not applic.	Not applic.
	NH_4	0.39	0.510	1.3	0.039	0.10
1992	NO_2	0.02	0.024	1.2	0.026	1.30

Source: Ministry of Environment

Other major polluters in the Vaksh basin are municipal wastewater from Kurgan Tyube, Nurek, and the village of South Tajikistan and agricultural runoff from Nurek, Sarband, Kurgan Tyube, and Bokhtar.

Kafernigan Basin

Kafernigan River is the longest river in the republic, running from the northeastern part of the country to the southwest corner. It is the last tributary to enter the Amudarya from the republic. Its sources include 343 glaciers in the Pamirs.

Table A2.7: Sediment Loads and Turbidity of Kafernigan and its Tributaries

River	Monitoring Point	Average Sediment Load (kg/second)	Average Annual Sediment Load (thousand tons)	Sediment Load During High Flow Season (thousand tons)	Percentage High Flow Sediment Load of Annual Average	Average Turbidity (mg/l)
Kafernigan	Chinar	33.0	1,000	988	98.8	.28
Kafernigan	Tartki	230.0	7,400	6,300	85.1	.11
Varzob	Dagana	16.0	500	310	62.0	.33
Ziddi	Mouth	1.60	510	449	88.0	.18
Alibegi	n/a	5.10	160	150	93.7	.44

Source: Ministry of Environment.

As with most rivers in Tajikistan, sediment loads during the high flow period are 85 percent or higher than the annual average. The Varzob river, a major tributary, differs from the Kafernigan and other tributaries in that the high flow period sediment loads are not as high as the other profiled stretches (62 percent as compared with 85 percent and higher) and it has a lower annual average flow. It also has a relatively high turbidity, although at .33 mg/l, turbidity levels are still well within water quality standards. Population densities in the Varzob sub-basins are at least half as high as the national average of 42.5 people per km^2. The other rivers and sub-basins that comprise the Kafernigan basin have similar profiles in terms of flows, turbidity levels, and population densities.

Table A2.8: Sub-basins, Flows, and Demographics of Kafernigan Basin

River & monitoring station	Area of Basin Accounted for by Monitoring Station	Flow (m^3/second)		1990 Population (thousands)		Population density (1 person /km^2)
		Annual Average	Lowest	Total	Urban	
Varzob (Dagana)						28.500
Varzob (mouth)	1,740	38.0	6.0	707.0	609.8	0.008
Ilyak (Yakgiyul)	823	13.6	5.25	130.4	17.0	158.400
Kafernigan (Chinar)	3,040	101.0	16.1	7.4	Not applicable	0.1600
Kafernigan (Tartki)	9,780	162.0	44.4	1,365.0	699.3	139.600
Kafernigan	11,600	1,62.0	44.4	1,545.6	711.2	133.200

Source: Ministry of Environment.

Major polluters are the wastewater treatment plants at Shartuz, Dushanbe, RRS Poultry plant, and Kafernigan raion, the cattle and dairy feedlot in Kabodiyon raion, cement factory in Dushanbe, and the Khodja Obi Garm health facility. Run-off from agriculture is also cited as a major—though non-point source—polluter.