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Working Group on Integrated Water Resources Management

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Item 3 (a) of the provisional agenda

Status and finalization of the second Assessment of transboundary rivers, lakes and groundwaters in the UNECE[1] region: main findings of the second Assessment for all subregions

Working Group on Monitoring and Assessment

Twelfth meeting
Geneva, 2–4 May 2011
Items 5 (b) and 9 (a) of the provisional agenda

Assessment of the status of transboundary waters in the UNECE region: assessment of transboundary rivers, lakes and groundwaters in Central Asia

Status and finalization of the second Assessment of transboundary rivers, lakes and groundwaters in the UNECE region: main findings of the second Assessment for all subregions

Finalization of the second Assessment of transboundary rivers, lakes and groundwaters in the United Nations Economic Commission for Europe region

Major findings of the assessment for Central Asia

Note by the secretariat[2]

[1] United Nations Economic Commission for Europe.

[2] The present document has been submitted late due to late receipt of inputs by concerned countries and resource constraints in the secretariat.

Summary

This document was prepared pursuant to decisions taken by the Meeting of the Parties to the Convention on the Protection and Use of Transboundary Watercourses and International Lakes at its fifth session (Geneva, 10–12 November 2009), which entrusted the Working Group on Monitoring and Assessment, in cooperation with the Working Group on Integrated Water Resources Management, with finalizing the second Assessment of Transboundary Rivers, Lakes and Groundwaters in time for its submission to the Seventh "Environment for Europe" Ministerial Conference, to be held in Astana from 21 to 23 September 2011 (ECE/MP.WAT/29, para. 81 (e)). The document presents the main conclusions and trends of the second Assessment for Central Asia, drawing upon those detailed assessments by basin and aquifer that relate to the Central Asian subregion presented in documents ECE/MP.WAT/WG.2/2011/9, ECE/MP.WAT/WG.2/2011/10, ECE/MP.WAT/WG.2/2011/11 and ECE/MP.WAT/WG.2/2011/12.

Contents

I. Background and proposed action by the Working Group on Monitoring and Assessment and the Working Group on Integrated Water Resources Management

1. The subregional assessment of transboundary waters in Central Asia covers transboundary rivers, lakes and groundwaters shared by two or more of the following countries: Afghanistan, China, the Islamic Republic of Iran, Kazakhstan, Kyrgyzstan, Mongolia, the Russian Federation, Tajikistan, Turkmenistan and Uzbekistan. It has been prepared by the secretariat of the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) with the assistance of the International Water Assessment Centre (IWAC) — hosted by the Slovak Hydrometeorological Institute — on the basis of information provided by countries. The present document contains the main findings, tendencies and conclusions of the Central Asia assessment. It draws upon the assessments of the different transboundary rivers, lakes and groundwaters in Central Asia that are presented in documents ECE/MP.WAT/WG.2/2011/9 (transboundary waters discharging into the White Sea, the Barents Sea and the Kara Sea), ECE/MP.WAT/WG.2/2011/10 (transboundary waters discharging into the Sea of Okhotsk and the Sea of Japan), ECE/MP.WAT/WG.2/2011/11 (transboundary waters discharging into the Aral Sea and other transboundary waters in Central Asia) and ECE/MP.WAT/WG.2/2011/12 (transboundary waters discharging into the Caspian Sea).

2. An important step in the assessment preparation was the workshop on transboundary water management in Central Asia, which was held from 13 to 15 October 2010 in Almaty, Kazakhstan. The workshop was jointly organized by the United Nations Economic Commission for Europe (UNECE), the Ministry of Environment Protection of Kazakhstan, IWAC, and the Regional Environmental Centre for Central Asia (CAREC).

3. The assessment of transboundary waters in Central Asia also contains an assessment of a number of selected Ramsar Sites[3] and other wetlands of transboundary importance with different transboundary settings: the Gomishan Lagoon (Islamic Republic of Iran), the Aydar-Arnasay Lakes system (Uzbekistan) and the Tobol-Ishim Forest-steppe (Russian Federation) are sites where these Governments have unilaterally designated their side of the transboundary waters/basin as a Ramsar Site but the Government on the other side of the border which the wetland extends across, have not. The Ramsar Site of Xingkai Lake National Nature Reserve (China) and Lake Khanka (Russian Federation), as well as the complex of Daurian Wetlands, have been independently designated by the countries sharing the wetland from their side of the waters as a Ramsar Site, but have missed a joint official designation of the site as a transboundary wetland. The Ili Delta (Kazakhstan), an important wetland linked to a transboundary river, is being introduced as a potential candidate for wetland protection. These assessments were prepared in cooperation with the secretariat of the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention) and the Parties to that Convention.

4. The assessment is based on information received from the countries in the Central Asian subregion in response to questionnaires from the secretariat. Unfortunately, not all countries in Central Asia completed the questionnaires or submitted information in other forms. The Russian translation of this document is submitted as an unofficial document.

[3] Wetlands designated as internationally important under the Ramsar Convention.

5. The Working Group on Monitoring and Assessment and the Working Group on Integrated Water Resources Management may wish:

(a) To review the assessments of transboundary rivers, lakes and groundwaters in Central Asia and in particular the present document with the major findings, and to endorse the document in terms of content;

(b) To express its appreciation to the designated experts from Afghanistan, the Islamic Republic of Iran, Kazakhstan, Kyrgyzstan, Mongolia, the Russian Federation and Tajikistan, as well as IWAC and the Convention secretariat, for the substantive work done;

(c) To invite Parties and non-Parties to provide any necessary corrections to the information contained in documents ECE/MP.WAT/WG.2/2011/4−ECE/MP.WAT/WG1/2011/4, ECE/MP.WAT/WG.2/2011/9, ECE/MP.WAT/WG.2/2011/10, ECE/MP.WAT/WG.2/2011/11 and ECE/MP.WAT/WG.2/2011/12 **by 20 May 2011;**

(d) To entrust the secretariat with the finalization of the assessment including the relevant comments and performing the needed editing and shortening to meet editorial needs.

II. Introduction

6. Water resources in Central Asia are predominantly of a transboundary nature, with the five Central Asian Republics heavily dependent on transboundary waters in the Aral Sea Basin. The transboundary rivers, lakes and groundwaters in the subregion, as well as selected Ramsar Sites assessed, are listed in the table at the end of this chapter.

7. Most of the region's surface water resources are generated in the mountains of the upstream countries Kyrgyzstan, Tajikistan and Afghanistan, eventually feeding Central Asia's two major rivers, the Syr Darya and the Amu Darya, which flow though the downstream countries Kazakhstan, Turkmenistan and Uzbekistan, and are a part of the Aral Sea Basin. Many of the rivers are glacier and/or snow-melt fed and consequently — when not regulated — typically have their peak discharges from late spring to summer (May-August). Overall, Central Asia is dominated by arid and semi-arid zones.

8. The region has experienced quite drastic changes in the past due to the extensive development of large-scale irrigated agriculture, mainly the development of cotton production from the 1950s onwards. The scarcity of water in the Aral Sea Basin, resulting primarily from the extensive irrigation as well as ineffective management and use, adds to conflict potential, putting water at the heart of regional security and stability. The population in the Aral Sea Basin has more than doubled from 1960 to 2008, to almost 60 million, increasing the pressure on water resources. In particular, population growth in some urban centres of the Central Asian region has been rapid in the past 20 years. South-west Uzbekistan, the Fergana Valley, southern Tajikistan (notably the Vakhsh Valley), and northern Afghanistan, for example, are densely populated zones in Central Asia.[4]

9. Establishment of a parliamentary government in Kyrgyzstan is the only major political change in the Central Asian former Soviet republics, where the political changes since the break-up of the Soviet Union have been limited. Nevertheless, since then the national legal systems and governance structures in the Central Asian Republics have

[4] *Environment and Security in the Amu Darya Basin*, forthcoming from the Environment and Security Initiative (ENVSEC) in May2011.

evolved to become quite different, with a highly diverse level of economic development and availability of water resources.

The transboundary rivers, lakes and groundwaters as well as selected Ramsar sites (or other wetlands of transboundary importance) in Central Asia

Basin/sub-basin(s)	*Recipient*	*Riparian countries*[a]	*Lakes in the basin*	*Transboundary groundwaters within the basin*	*Ramsar Sites/wetlands of international importance*
Ural	Caspian Sea	KZ, RU		South-Pred-Ural, Precaspian, Syrt	
- Ilek	Ural	KZ, RU			
Atrek	Caspian Sea	IR, TM			Gomishan Lagoon
Murgab	Desert sink	AF, TM			
- Abikajsar	Murgab	AF, TM			
Tejen	Desert sink	AF, IR, TM			
Sombar		IR, TM			
Malyi Uzen	Kamysh-Samarsk Lakes	KZ, RU	Lakes of Kamysh-Samarsk	Precaspian	
Bolshoy Uzen	Kamysh-Samarsk Lakes	KZ, RU		Precaspian	
Amur	Sea of Okhotsk	CN, MN, RU		Middle Heilongjian-Amur River Basin; Yalu River Valley	
- Argun	Amur	CN, RU			Daurian Wetlands
- Ussuri	Amur	CN, RU	Lake Khanka		Xingkai Lake National Nature Reserve — Lake Khanka
Sujfun	Sea of Japan	CN, RU			
Tumen	Sea of Japan	CN, KP, RU			
Yenisey	Kara Sea	MN, RU			
- Selenga	Lake Baikal > Angara > Yenisey > Kara Sea	MN, RU			
Ob	Kara Sea	CN, KZ, MN, RU		North-Kazakhstan	
- Irtysh	Ob	CN, MN, KZ, RU		Preirtysh	

Basin/sub-basin(s)	*Recipient*	*Riparian countries*[a]	*Lakes in the basin*	*Transboundary groundwaters within the basin*	*Ramsar Sites/wetlands of international importance*
- Tobol	Irtysh	KZ, RU			
- Ishim	Irtysh	KZ, RU			Tobol-Ishim Forest-steppe
Amu Darya	Aral Sea	AF, KG, TJ, UZ, TM	Aral Sea	Xorezm, Karatag/North-Surhandarya, Amudaryia, Kofarnihon, Sherabad	
- Surkhan Darya	Amu Darya	TJ, UZ			
- Kafirnigan	Amu Darya	TJ, UZ			
- Pyanj	Amu Darya	AF, TJ			
-- Bartang	Pyanj	AF, TJ			
-- Pamir	Pyanj	AF, TJ			
- Vakhsh	Amu Darya	KG, TJ		Quaternary aquifer	
Zeravshan	Desert sink	TJ, UZ		Quaternary aquifer	
Syr Darya	Aral Sea	KZ, KG, TJ, UZ		Osh-Aravan, Dalverzin, Zafarobod, Sulyukta-Nau-Isfara, Sulyukta-Batken-Nau-Isfara, Almos-Vorzik, Syr Darya 1–3, Maylusu, Karaungur, Naryn, Chust-Pap, Yarmazar, Chimion-Aval, Nanay, Kasansay, Ahangaran, Sokh, Kokaral, Havost, Dustlik, Batken-Isfara-Shorsu, Pretashkent, Iskovat-Pishkaran	Aydar-Arnasay Lakes System
- Naryn	Syr Darya	KG, UZ			
- Kara Darya	Syr Darya	KG, UZ			
- Chirchik	Syr Darya	KZ, KG, UZ			
-Chatkal	Chirchik	KG, UZ			
Chu	Desert sink	KZ, KG		Chu/Shu	
Talas	Desert sink	KZ, KG		North-Talas, South-Talas	
Assa	Desert sink	KZ, KG			
Ili	Lake Balkhash	CN, KZ	Lake Balkhash	Zharkent; Tekes	Ili Delta, Balkhash Lake

[a] Country names have been abbreviated as follows: Afghanistan (AF); China (CN); Democratic People's Republic of Korea (KP); Islamic Republic of Iran (IR); Kyrgyzstan (KG); Kazakhstan, (KZ); Mongolia (MN); Russian Federation (RU); Tajikistan (TJ); Turkmenistan (TM); and Uzbekistan (UZ).

III. Legal, policy and institutional frameworks for transboundary water management

10. Regional cooperation to manage shared water resources, in particular for the two main rivers, Amu Darya and Syr Darya, became urgent after the Central Asian former Soviet republics became independent in 1991. The legal framework for this regional cooperation was put into place in the early 1990s, immediately after the break-up of the Soviet Union. It is increasingly considered that this legal framework, building on the Soviet-era allocation of water, has become largely outdated, resulting in generally poor implementation, and requires improvement. During the past few years, the agreed arrangements on water allocation have not been fully implemented or it has proven impossible to agree on water allocation. A limitation is linked to the fact that the energy sector (hydropower, more precisely) is not a part of the existing regional organizations engaged in water management cooperation. Finding sustainable long-term solutions for the use of water resources including for hydropower has proved to be a difficult task.

11. Moreover, key principles of integrated water resources management (IWRM) like the basin approach are not appropriately reflected in the existing agreements, despite the effort to establish basin-level structures for the main basins, the Amu Darya and Syr Darya. Cooperation largely focuses on water sharing and allocation according to Soviet practices, while cooperation on water quality or water-related ecosystems is almost non-existent.

12. At country level, a bottleneck for an integrated approach to water resources management is the frequent lack of intersectoral coordination. The water management in some of the countries falls under the competence of one sectoral ministry, e.g., the ministry of agriculture in Kazakhstan and Uzbekistan, focusing on water quantity issues in the interest of irrigation, or the ministry of energy, e.g., in the Islamic Republic of Iran. At the same time, effective structures and mechanisms for inter-agency cooperation do not exist. The organization of water management in the countries in the Central Asian subregion is described in annex I.

13. The current legal framework includes both binding instruments and various semi-formal agreements and documents. In addition to regional agreements which are general in nature, there are a number of bilateral and some trilateral agreements on specific issues or watercourses (see annex II for a list), most of them from the 1990s. Many of the agreements focus on water sharing and water allocation, but implementation is often poor — the agreement on the Chu and Talas Rivers between Kazakhstan and Kyrgyzstan focusing on the joint financing and use of certain dams and canals being one of the few positive exceptions. Afghanistan has not signed water management agreements with its neighbours downstream. Moreover, one of the shortcomings of the existing legal framework is insufficient links between the various legal instruments.

14. The basic agreement concerning transboundary waters in the region is the Agreement on Cooperation in Joint Management of Use and Protection of Water Resources of Interstate Sources signed in 1992 by Kazakhstan, Kyrgyzstan, Uzbekistan, Tajikistan and Turkmenistan. Under this agreement, the principles for water allocation as developed under the Soviet Union are applied.

15. Based on the 1998 intergovernmental agreement signed by the countries sharing the Syr Darya, Protocols were signed annually (from 1999 to 2003) on the use of water and energy resources of the Naryn-Syr Darya cascade of reservoirs, depending on the dryness

of the year. Since 2004, Uzbekistan has preferred to negotiate bilaterally with the countries of the Aral Sea Basin, including on the Syr Darya. With the support of the Asian Development Bank, a draft agreement on the Syr Darya was developed in 2005, but its finalization and adoption are still pending.

16. In some cases, the implementation of agreements signed by the Soviet Union has continued after the break-up; for example, Turkmenistan has continued implementing the agreements on the Tejen/Harirud with Iran. Only fairly recently, in 1999, a new agreement was signed for the construction and management of the Dosti Dam on the Tejen/Harirud River.

17. The most recently signed bilateral agreements in the subregion are the one concerning the rational use and protection of transboundary waters between the Russian Federation and China (2008), and the one on the protection of water quality of transboundary rivers between Kazakhstan and China (2011). Even though it is positive that attention is paid to water quality issues, it is not ideal that these issues are separated from other water management issues under a separate Kazakh-Chinese agreement.

18. The main institutions at the regional level are the International Fund for Saving the Aral Sea (IFAS), where the Presidents of the five Central Asian countries are members; the Executive Committee of the International Fund for Saving the Aral Sea (EC-IFAS; established 1993); the Inter-State Commission for Water Coordination (ICWC); established in 1992); and the Inter-State Commission for Sustainable Development (ICSD; established 1994); which operate relatively independently of each other although they are all part of IFAS. The Amu Darya and Syr Darya Basin Water Organizations (BWOs) were established as executive bodies of the ICWC, but their influence in terms of water management does not cover the upper part of the respective basins.

19. Kazakhstan and Uzbekistan as well as the Russian Federation are Parties to the UNECE Water Convention. Until the entry into force of the amendments to articles 25 and 26 to open the Convention to countries outside the UNECE region, Afghanistan, China, Iran and Mongolia cannot accede to the Convention. Kazakhstan, the Russian Federation and Turkmenistan have ratified the Framework Convention for the Protection of the Marine Environment of the Caspian Sea. The situation with regard to the ratification of selected international agreements is shown in annex III. In general, however, the countries do not have a common legal framework and show a different understanding of international water law, its principles and obligations.

20. The Framework Convention for the Protection of the Environment for Sustainable Development in Central Asia is an attempt to provide a legal basis for cooperation between Central Asian States on a broad range of environmental issues — among them sustainable use of water resources. The Convention has not been ratified by all the Central Asian countries. Once the Convention enters into force, a secretariat will be set up to support the implementation of the Convention, but it is not clear how it would interact with other regional organizations such as IFAS and ICWC.

21. Kazakhstan and the Russian Federation, China and the Russian Federation, Kazakhstan and China, as well as Mongolia and the Russian Federation, have established joint commissions on transboundary waters. The Commission of the Republic of Kazakhstan and the Kyrgyz Republic on the Use of Water Management Facilities of Intergovernmental Status on the Rivers Chu and Talas (Chu-Talas Commission; established in 2006) is an example of a functioning joint body under a bilateral agreement. According to this agreement, Kyrgyzstan has a right to compensation from Kazakhstan for a share of expenses incurred to ensure the safe and reliable exploitation of specified water management facilities. Over the years, the cooperation in the framework of the Chu-Talas Commission has expanded; in 2009, it was extended to cover more facilities (the

ratification by the countries is still pending). Such a model has been evoked as a means for downstream countries to participate in managing dams and other hydraulic facilities, the operation regime of which is commonly a source of tension.

22. At the present time a holistic, rational and equitable approach to the use of transboundary water resources supported by all countries is lacking. This has resulted not only in tensions and suspicions over water allocation and energy generation, but also in social and economic problems, as well as environmental degradation.

23. With regard to the Ili and the Irtysh, it is as a shortcoming that there is no permanent executive body of the Kazakh-Chinese or Kazakh-Russian Joint Commission. The Working Groups of the Joint Commission are composed mainly of representatives of State structures, which do not allow them to engage in the work of the Joint Commission on a more continuous basis.

24. During the past decade, national water legislation and organization of water resources management have been reformed in many countries of the region and this development continues. For example, the 2003 Water Code of Kazakhstan introduced the principle of water basin management and opened up the possibility for the various governmental and non-governmental entities involved in water management or water use, such as water users' associations or water-related NGOs, to be consulted before decisions are taken.

25. The Water Code of Kyrgyzstan of 2005 also establishes principles for an integrated approach to water resources management and includes basin management plans for the development, use and protection of water resources. A National Water Council with the task of coordinating activities on the water sector was established in 2006 in accordance with the Water Code, however it has not met yet. Moreover, the switch to a parliamentary form of government has led to a review of the earlier plans.

26. Mongolia established Basin Councils for the Eroo River in 2007 and for the Tuul River in 2010, with the support of a project for strengthening IWRM in the country. It is expected that as an outcome of the reform of the water sector in Tajikistan, water management will be transferred from administrative units to river basin authorities, which should be created during 2011–2013. Afghanistan is also taking initial steps towards the basin approach, with the establishment of River Basin and Sub-Basin Agencies. The Water High Council of Afghanistan and its secretariat is reviewing the Water Law and working on a transboundary water policy.

27. Even though progress has been made in adopting the basin approach, this has not been put into practice properly; despite the legal developments and policy reform, implementation remains limited or has progressed slowly, affected by, e.g., lack of resources, weakness of institutions and a lack of inter-agency cooperation or, in some cases, an unclear division of responsibilities between the new institutions. The sensitivity of the topic is shown by the tendency for ministries of foreign affairs to be increasingly involved in transboundary water issues in Central Asian countries.

28. More progress is needed in setting up basin councils to facilitate participation of all the concerned stakeholders. Where these have been established at the national level, they need strengthening to function properly. At the national level, advisory basin councils have been set up already in Kazakhstan and on the Talas in 2009 in Kyrgyzstan (Kyrgyzstan is expecting to complete the establishment of river basin management authorities and basin councils required by the Water Code in 2011). Establishment of an Inter-State Chu Talas Basin Council has been proposed and a concept for it developed.

29. Water users' associations have been established in many countries of the region, in particular, in Kyrgyzstan, Tajikistan and Uzbekistan, with the responsibility for the

maintenance and operation of irrigation networks, but also for water supply in rural communities. Afghanistan is also making preparations for their establishment. The emergence of the water user cooperatives illustrates an important shift to more local operation of irrigation facilities, an important step in reforming the irrigation and agriculture sectors. However, a shortage of financial resources for renovation and maintenance persist.

30. In practice, in natural resources (including water) management, the local administrative units like *akims* in Kazakhstan may not be consistent in their approach and may lack resources for inspection, etc.

31. The low attention to groundwater in overall water management is partly explained by the responsibility for aquifer resources and their identification lying with the agencies for geology and mineral resources. It may also reflect a low awareness about the role played by groundwater resources, even though groundwater is locally very important in some areas. In Kazakhstan, positively, a comprehensive review of transboundary aquifers has been carried out.

32. Strengthening or even maintaining the capacity of personnel in water-related administration and services is a challenge, as many qualified experts seek to work in the private sector due to the low level of remuneration of public officers.

IV. Monitoring of transboundary rivers, lakes and groundwaters

33. Limited monitoring and assessment data, data which is often not reliable and lack of data on uses and needs are common problems in Central Asian countries. The situation is particularly severe in Afghanistan.

34. Exchange of data is also very limited. The Central Asian Regional Water Information Base Project (CAREWIB)[5] database is a recent effort to make information on water resources openly and readily accessible to all the countries in Central Asia. However, not all countries are comfortable with this information system being developed and centrally situated in another country.

35. Flow data up to 1990 is commonly quoted for rivers, indicating a lack of recent data. With the break-up of the Soviet Union, hydrological monitoring drastically decreased. For example, on the Chu and its tributaries, the number of hydrological monitoring stations has decreased by more than two thirds since the 1970s. Similarly, of some 100 hydrological monitoring stations on Kyrgyz territory within the Syr Darya Basin in 1980, currently 28 are operational. A lack of material and equipment, and the not infrequently poor condition of the existing monitoring stations, also poses problems. Such reduction of flow monitoring complicates evaluating the impact of withdrawals and diversions, and the lack of continuity is also a constraint to assessing long-term change — i.e., climatic variability and change.

36. Nevertheless, the situation has been improved in, for example, Kazakhstan over the past seven years. This includes the establishment of new monitoring stations on the rivers shared by Kazakhstan and China. In its national Water Resources Development Plan Afghanistan gives a special priority to rehabilitation of its hydrometric network. Use of satellite remote sensing is to some degree a means of compensating for reduced in situ monitoring, but still requires ground truth observations for validation.

[5] CAREWIB, implemented by the Scientific Information Centre of ICWC, aims at improving the availability and exchange of information in the water and environmental sectors in Central Asia.

37. Bilateral and multilateral donors — among others, the World Bank and Switzerland — have supported monitoring and assessment projects and data/information management, at regional and national levels. The challenge is how to sustain the monitoring beyond the life of the projects.

38. Data and information exchange needs improvement; more regularity, continuity, transparency and structure are needed. Nevertheless, there is regular joint water quality monitoring at least between the Russian Federation and China and the Russian Federation and Kazakhstan. Between the national hydrometeorological services of the Central Asian Republics data exchange (also on water quality) is working, but a wider dissemination is needed. Where a bilateral commission functions, like the Joint Commission of Transboundary Waters between Mongolia and the Russian Federation, an appropriate framework for data exchange exists: information on discharge, regime, quality monitoring results and flood and emergency situations is exchanged in the joint Mongolian and Russian Working Group. An important task of the work in the Chu-Talas Commission is to make improved water quantity measurements available to Kyrgyzstan as well as Kazakhstan.

39. Water quality is monitored less than water quantity. Monitoring of suspended solids is limited, despite its relevance considering erosion problems and accumulation of sediment in reservoirs. The overall water quality is reported in the Russian Federation and Central Asian Republics using a water pollution index which is defined on the basis of the ratios of measured values and the maximum allowable concentration of the water-quality parameters.

40. A lack of effective, sustainable groundwater monitoring programmes in most countries in the region is an obstacle to the assessment of the quality and quantity of groundwater resources in the transboundary aquifers. Data on transboundary aquifers is not exchanged, and in many of the countries knowledge in this area is at a relatively low level.

41. Monitoring of glaciers and snow cover — the source of most of Central Asia's rivers — is quite fragmented in the subregion as it is carried out by different organizations in different countries. The costly expeditions that have been important for glacier volume estimations have been drastically reduced and attempts are made to fill gaps through other means such a remote sensing.[6]

V. Main problems, impacts and status

42. The major challenge in Central Asia is to agree on how to use the available water resources taking into account the interest of all countries and of the water-dependent ecosystems. The main issue is the conflict between water use for hydropower generation and for irrigation. While upstream countries like Kyrgyzstan and Tajikistan prioritize water use for energy production, therefore mainly in winter when it is most needed, the peak of water demand in the downstream countries for irrigation and agricultural production is in summer, during the height of the growing season. Release of water from reservoirs on the Syr Darya has increasingly shifted from the growing season to winter.

43. The subregion's critical dependence on water resources is illustrated by the 2008 crisis: a very dry year was followed by an extremely cold winter; energy needs in Tajikistan and Kyrgyzstan could not be met due to low water levels in reservoirs, causing terrible

[6] As an example of such efforts, the GLIMS (Global Land Ice Measurements from Space) project can be mentioned, which is for monitoring the world's glaciers primarily using data from optical satellite instruments.

distress among the populations and the economies in the subregion. Degraded energy infrastructure and shortcomings of energy regulation add to the problems.

44. The importance of hydropower is obvious. For example, in Kyrgyzstan hydropower energy covers more than 90% of the domestic electricity needs and is also and export commodity. Construction of a number of new dams, mainly for hydropower but also to collect irrigation water, was initiated in the late 2000s. This includes Kambarata 2 on the Naryn; Sangtuda 1 and 2 on the Vakhsh; Koksarai on the Syr Darya; and Kara-Burinsky on the Talas River. Afghanistan was obliged to suspend a number of construction projects for multiple-use reservoirs because of war and instability. Dam infrastructure helps to mitigate impacts of flooding, but also disrupts water flow, with consequences for other uses and ecosystems. The hydraulic system of the Argun River changed with the realization of major water transfer schemes in China.

45. Concerns over the safety of more than 100 large dams and other water control facilities, located mostly on transboundary rivers, have grown in recent years in the subregion. Ageing dams and their inadequate maintenance, coupled with population growth in flood plains downstream from the dams, have resulted in increased risks, as demonstrated by the failure of the Kyzyl-Agash Dam in Kazakhstan in 2010. Another consequence of the ageing of water reservoirs is the increased volume of sediments, decreasing the operational volumes.

46. The agricultural sector is the biggest consumptive water user in the subregion, notably in the Aral Sea Basin. Agriculture represents almost 99%[7] of water withdrawal in the Chu Basin, 94% in the Bolshoy Uzen, 90% in the Atrek, 89% in the Syr Darya, 85% in the Ili and 73% in the Talas Basin, just to mention a few examples outside the heavily affected downstream part of the Amu Darya and Syr Darya.

47. The population in most of the countries is heavily dependent on agriculture, up to 80% in Afghanistan. This underlines the importance that water for agriculture currently has. There is a pressing need to improve water use efficiency. In Afghanistan, for example, where the aridity of the climate limits rain-fed agriculture, 90% of the irrigation systems are traditional, with an efficiency of the irrigation network of about 25%–30%. Lack of maintenance and damage is a common problem for the water irrigation infrastructure in the subregion. Specific water use is high because of losses, evaporation and overwatering. Some change of crops has occurred in the past decades, with crop diversification — including increasing the share of food crops like cereals at the expense of cotton — reducing water requirements. Limited/local pressure from livestock also occurs, for example, in the Ili, Naryn and Chu Basins.

48. The dependency on agriculture increases vulnerability to extreme hydrological events such as floods and droughts. Afghanistan is particularly vulnerable to flooding because it lacks flood protection infrastructure; elsewhere, such infrastructure is in need of rehabilitation. In the mountainous part of the subregion, for example in Kyrgyzstan, sudden flooding is occasionally caused by overflow of glacier lakes. Release of water from reservoirs in winter for hydropower generation may cause winter flooding in downstream countries. On the Syr Darya this is less of an issue now that Kazakhstan has developed reservoir capacity downstream. The Ussuri and the Sujfun, for instance, are heavily affected by flooding. In some basins, an additional concern related to flooding is the surface pollution it mobilizes.

[7] Situation in 2006.

49. Leaking networks and irrigation canals, adding to recharge, may cause rising of the groundwater level and affect its quality negatively. As a result of water-logging, arable land is being lost or its quality degraded, limiting its uses. Irrigation return waters affect groundwater quality negatively, for example in the Tejen/Harirud Basin. Substantial stretches of irrigated area require draining, but the nutrients and agrochemicals that the waters from collectors carry degrade the environment where released. Notably in the Amu Darya, irrigation return waters affect the quality negatively with salinity and major ion concentrations increasing downstream. In areas with high evaporation, evaporation from shallow groundwater and surface water contribute to salinization of soil and groundwater. Land salinization from mineralized drainage water leads to increased water use as the salts in the fields need to be washed out before the growing season.

50. Water deficit downstream in the major rivers, the Amu Darya and Syr Darya, is pressing, resulting from the combined effect of extensively developed irrigation and ineffective management. Among the reasons for reduction of flows is the extensive, largely outdated and inefficient irrigation infrastructure, the maintenance and replacement of which is a big financial challenge for the countries. Little flow in the Syr Darya reaches the delta because of all the withdrawals. Also, in smaller basins like the Malyi Uzen, scarcity is experienced. The increased mineralization with reduced flow limits the use of the water. In addition to nutrient and pesticide pollution of irrigation return waters, anthropogenic pressures on water quality include discharges of untreated or insufficiently treated wastewater.

51. The Aral Sea catastrophe is the clearest example of the negative impacts on human health and ecosystems of overabstraction, land degradation and desertification. From 1960 to 2008, the Aral Sea Basin lost 80% of its volume, the surface area was reduced by more than two thirds, the water level dropped by 22 m, and water salinity increased 6 to 12 times. The rivers that feed it have been intensively used for irrigation. This has created tremendous ecological problems both for the lake and for the surrounding area. The lake is badly polluted, largely as a result of fertilizer run-off and industrial pollution. The ecosystem of the Aral Sea has been nearly destroyed: fish disappeared from the lake, and a significant number of waterfowl and water-related birds moved to other regions. Moreover, the receding lake has left huge plains covered with salt and toxic chemicals, which are picked up and carried away by the wind as toxic dust and thereby spread to the surrounding area. As a result, the land around the Aral Sea has become heavily polluted, and people living in the area are suffering from a lack of freshwater, as well as from a number of health problems, such as certain forms of cancer and lung disease. These processes result in the deteriorating drinking water quality and health of the population, in decreasing land productivity and crop yields, and in the growth of poverty, unemployment and migration.

52. In the Ili Delta, water-dependent ecosystems are also negatively affected by flow regulation and diversion. This site is under pressure from pollution and desertification too. It is crucial to establish adequate protection of this area so as to maintain its ecological balance and biodiversity and avoid another catastrophe like the Aral Sea.

53. In the mountainous upstream part of the major rivers, soil stability problems such as landslides and mudflows are reported in several basins, among them the Naryn and Kara Darya. Problems related to erosion are not limited to the arid/semi-arid part of the subregion, but are an issue even in basins such as the Irtysh, Malyi Uzen and the Tumen. High sediment loads due to erosion add to the silting of reservoirs. In the Chirchik, as well as Atrek and the tributary Sombar, sediment loads are a problem. Diverse factors related to land management can aggravate erosion problems, including, for example, expansion of settlements (the Surkhan Darya), deforestation (the Naryn, the Amu Darya) and overgrazing (the Selenga).

54. Groundwater level decrease has been observed, for example, in the Pre-Irtysh (transboundary between Kazakhstan and the Russian Federation) and Pre-Tashkent aquifers (transboundary between Kazakhstan and Uzbekistan) as a result of heavy abstraction. Rising groundwater tables pose problems locally, e.g., in the Chu Basin.

55. Towards the north, the importance of industry as a water user increases, and so do pressures related to it. In the basins of the Ural as well as the Ob with its tributary the Irtysh, withdrawals for industry are significant. Discharges of industrial wastewater are seen as a pressure factor in the Syr Darya, Naryn, Ural, Selenga, Atrek, Irtysh, Tobol, Ishim and Tumen, among others. On the Argun, pollution events of the river due to industry have a severe (but local) impact, and the Amur has been seriously affected by industrial accidents on the Sungari tributary. The upper Argun is highly polluted from industry.

56. Discharges of untreated or insufficiently treated urban/municipal wastewaters are a pressure factor in a number of basins: the Atrek, Bolshoy Uzen and Malyi Uzen, Chatkal, Chu, Ili, Ishim, Kafirnigan, Naryn, Surkhan Darya, Talas, Tumen and Ural. Wastewater collection is often lacking, or where facilities exist the treatment is often limited to mechanical treatment or hampered by technical problems or their degraded state, or by the insufficient capacity of the network.

57. A number of ecological problems are inherited from the past and are legacies from industrial and radioactive pollution. Unmonitored storage or dumping of pesticides and other hazardous chemicals is a problem in specific locations, for example, in the Vakhsh sub-basin. Remnants of mining activities include extensive uranium tailings areas in the Naryn and Kara Darya sub-basins of the Syr Darya. Their gradual degradation releases hazardous substances to the environment and accidental failures of tailings or flooding could have severe impacts. Mining also affects water quality in the basins of the Chu, Irtysh, Selenga, Tobol, Tumen and Vakhsh. Mining adds to erosion of slopes and triggering of landslides locally, which through sediment transport affect water quality downstream. In the Ural and Ob basins, oil or gas exploration are potential pressure factors.

58. Sectoral and economic interests dominate over environmental concerns. In a subregion where poverty is widespread, countries give priority to economic development with serious threats for sustainability. Fragmented responsibilities and institutions are a serious weakness for policy development and implementation.

VI. Climate change and its impacts on water resources[8]

59. In Central Asia, the contribution of snow and ice melt to the formation of renewable water resources is decisive. The glaciers have a stabilizing effect on the stream-flow and add to the water flow during the important irrigation season after the melting of snow. The mean snow-water equivalent in the Northern and Western Tien Shan has remained relatively stable over the past few decades, but several studies have concluded that the glacial systems of the Central Asian mountains are decreasing in size and volume. A compensating mechanism such as meltwater contribution from thawing underground ice in areas of perennial permafrost area may delay the impact on the observed run-off. The reliability of assessments of climate variability and related changes in water flow is affected

[8] For this section, some replies by Caucasian countries to a survey conducted by the Water Convention's Task Force on Water and Climate in 2008, which explored countries' adaptation needs and the measures already undertaken, was used as complementary information.

by degradation of monitoring in the past 20 years and complicated by the human-induced changes in land use and in the river systems.[9]

60. Observations of climate change over many decades in Uzbekistan include a statistically significant increase in air temperature. The number of days of high air temperature (>40° C) has increased from the 1950s to 2000s. The number of days with low temperatures (below either -15° C or -20° C) has decreased, for example, in Tashkent since the late 1870s. In Tashkent, variability of precipitation has increased from the 1880s to the early 2000s, as has the number of days with heavy precipitation (>15 mm/day). A tendency towards decreasing snow cover has been observed, and glaciers continue to shrink at rates ranging from 0.2%–1% by area. According to scenario A2,[10] no significant changes in water resources of the Amu Darya or Syr Darya by 2030 are predicted. By 2050, the reduction of water resources by 10%–15% in the basin of the Amu Darya and by 2%–5% in the basin of the Syr Darya is possible. In general, the zone where the total precipitation is less than 100 mm (arid) is predicted to decrease and zones with precipitation ranging from 100 to 200 mm/year (arid, 200 mm/year is low precipitation limit of semi-arid) will increase. According to scenario B2,[11] an increase of 5%–15% in precipitation in Uzbekistan compared with the 1961–1990 reference period is assessed as a possibility by 2030 and 2050. Due to the high level of zoning in the processes of formation of precipitation, this can result in a decrease or even an increase in flow compared with the current situation in the shared rivers. Beyond 2030, the predicted increase in air temperature is expected to lead to reduced river flows.

61. Uzbekistan assesses the Amu Darya and small rivers of the region to be most vulnerable to climate change. The predicted increased aridity and evapotranspiration in the region are expected to be reflected in increased irrigation requirements (to be assessed) in the region. Among the implications of predicted changes is aggravated desertification. Frequency of drought events in the Pre-Aral area (around the former Aral Sea) is predicted to increase with warming of the climate.

62. Options for adaptation to climate change in Uzbekistan include reconstruction of irrigation systems and introduction of drought-resistant crops. Socio-economic scenarios, plans for long-term development of the agriculture sector and the development of a methodological basis for assessment of water losses, as well as the study of possible approaches to their reduction, are needed. The application of the basin approach in the solution of problems of water resources assessment and regional monitoring of the status of water resources is also needed.

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[9] See Severskiy, I, "Current and projected changes of glaciation in Central Asia and their probable impact on water resources", in *Assessment of Snow, Glacier and Water Resources in Asia: Selected papers from the Workshop in Almaty, Kazakhstan, 2006*. Braun, L. N., Hagg, W., Severskiy, I., Young, G, eds. (UNESCO-IHP and German IHP/HWRP National Committee, Koblenz, Germany, 2009).

[10] This refers to the scenarios described in the Intergovernmental Panel on Climate Change (IPCC) Special Report on Emissions Scenarios (SRES) (IPCC, Nakicenovic, N. and Swart, R., eds., Cambridge University Press, United Kingdom, 2000; available from http://www.ipcc.ch/ipccreports/sres/emission/index.htm). The SRES scenarios are grouped into four scenario families (A1, A2, B1 and B2) that explore alternative development pathways, covering a wide range of demographic, economic and technological driving forces and resulting greenhouse gas emissions. Scenario A2 describes a very heterogeneous world with high population growth, slow economic development and slow technological change.

[11] For explanation, please see the previous footnote. Scenario B2 describes a world with intermediate population and economic growth, emphasizing local solutions to economic, social, and environmental sustainability.

63. Tajikistan is the pilot country in a World Bank project to study the impact of climate change on glaciers and the development of adaptation measures. During the past 60 years the air temperature on average increased by 1° C. By 2030, a further increase of 1.5 C is predicted. Glaciers in Tajikistan are decreasing both in surface area and volume. The volume of glaciers is predicted to decrease by 30% in the coming 50 years. At the same time, the flow in large snow- or glacier-fed rivers is predicted to increase for 5 to 7 years and then to gradually decrease by 5%–15% over the next 30 years.[12] The frequency of years with extremely low or high flows is expected to increase. By 2030, the flow of the Amu Darya is predicted by Tajikistan to decrease by 21%–40% and of the Syr Darya by 15%–28%.

64. Recommended adaptation measures in Tajikistan include renovation and modernization of water infrastructure to reduce water losses, improvement of productivity in water use through, e.g., better irrigation technology; construction of reservoirs in the mountains to compensate for the diminishing glaciers; increase in the level of regulation of national and transboundary rivers; use of brackish groundwaters and desalinization; a switch to less water-demanding crops in agriculture; application of economic tools in water management; and improvement of water management effectiveness through introduction of an IWRM approach.

65. In Kyrgyzstan, a slight increase in run-off due to an increase in the proportion of glacial run-off is predicted by 2025–2030. In the subsequent years, run-off is expected to decrease. At the same time, the number of glacial lakes is predicted to increase, which may increase the risk of flooding events.

66. Vulnerability assessments for the glaciers and the amount of surface run-off in major hydrological basins have been carried out in Kyrgyzstan using digital elevation models and moisture conditions of Kyrgyzstan's land area developed at the Institute of Water Problems and Hydropower of the National Academy of Sciences of Kyrgyzstan. The more systematically collected data on the glaciers in Kyrgyzstan is from the 1960s. With preparation of a national climate change adaptation strategy and its adoption by the Government, Kyrgyzstan expects to gradually take related measures in the coming two years.

67. In Kazakhstan, the following are considered as priorities with regard to climate change adaptation: development of low-water technologies adapted to more arid conditions; increase in the proportion of groundwater use; and inter-basin transfer and integration of water management issues in the instruments related to other sectors, such as agriculture, energy and industry.

68. Adaptation measures in the Russian Federation include implementation of flood protection; regulation of run-off and redistribution of water resources; improvement of water management, including water-saving technologies; and introduction of insurance against natural disasters.

69. Strategies of the Islamic Republic of Iran to adapt to climate change include the following:

(a) Development of agriculture and aquaculture activities based on brackish water use and increasing water use efficiency;

[12] It should be noted that even with annual flow unchanged or with minor changes, if the distribution of flow over the seasons changes this can have important impacts on the ecosystems and human water uses.

(b) Development and implementation of national response strategies utilizing innovative technology and engineering solutions for installation of flood and drought warning systems;

(c) Construction of water resources facilities such as dams, aqueducts, well fields, levees, banks and drainage channels;

(d) Non-structural measures including water conservation, integrated ground and surface water management and improved water supply;

(e) Drought control, improved operation of reservoirs, water saving policy and water recycling and reuse.

70. The problems associated with climate change are generally recognized in the subregion, but the scientific basis is still weak and, due to this, the basis for adaptation measures in the water sector is poor. There is a need for training in this area and for a methodological basis for addressing the issue. In particular, there is a need for studying the probable impacts and application of the results to adapt river basin management. In some countries, efforts have been made to assess the likely impact climate change will have on water resources in the major river basins. However, the limited results show a significant spread in predictions. Clearly, cooperation between countries on information is needed.

VII. Responses

71. Water allocation and water sharing are transboundary problems, but efforts can be made nationally in, for example, reducing water use and increasing water efficiency. Nevertheless, national water saving needs to be complemented by bilateral and multilateral cooperation based on agreements and institutions, as well as technical cooperation like joint monitoring and assessment. Participation and commitment to cooperation by riparian countries is crucial.

72. Plans for development, use and protection of water resources have been developed in Kyrgyzstan for some basins, including the Talas, which will be adopted for implementation after consideration by the National Council on Water. In the implementation of the national water resources development plan, which has started in Afghanistan, priority is given to projects that reduce the likelihood of damage by drought and floods, create job opportunities, increase irrigation and power supply and provide access to safe drinking water.

73. There has been some cooperation in the development of hydraulic infrastructure on transboundary rivers of the subregion. For example, in 2004 the Islamic Republic of Iran and Turkmenistan completed the construction of the Dosti Dam on the Tejen/Harirud. On the Chu and Talas Rivers, Kazakhstan and Kyrgyzstan cooperate on the operation and maintenance of flow regulation infrastructure. Turkmenistan and Uzbekistan cooperate in jointly operating the Tyuyamuyunsk Dam.

74. Some repair work on the aged hydraulic infrastructure (dams, irrigation systems, etc.) has been carried out here and there, but more effort is needed to improve efficiency by reducing water losses, and in the case of dams also the risk of failure. Legislation and procedures for assessing, monitoring and communicating about dam safety need improvement. Kyrgyz authorities have agreed to develop cooperation to jointly review and assess the safety of the Kirov Dam on the Talas in response to Kazakhstan's concerns. Kyrgyzstan has gradually increased Government funding, been involved in borrowing funds for rehabilitation work on structures such as the Kirov, Orto-Tokoi and Papan Dams and on the Big Chu Canals.

75. A third phase of the Aral Sea Basin Programme has been prepared. It seeks to improve the socio-economic and environmental situation by applying the principles of IWRM to develop a mutually acceptable mechanism for a multipurpose use of water resources and to protect the environment in Central Asia, taking into account the interests of all the States in the region. Donor funding is sought for the projects identified for this Programme, prepared by the Executive Committee of IFAS at the request of the Heads of the Central Asian States.

76. Countries report reduced pressure from wastewater discharges in a few basins, the Irtysh among them, where both the total sewage discharge and the untreated part have decreased. In the area of the basins of the Malyi Uzen and the Bolshoy Uzen in Saratov oblast in the Russian Federation a number of wastewater treatment plants have been constructed. Measures have also been taken elsewhere: In the Islamic Republic of Iran, wastewater treatment plants have been constructed in Mashhad (Tejen/Harirud Basin), but use of treated wastewater in agriculture is also foreseen.

77. Mongolia is limiting mining companies' activities in the proximity of water bodies through the enforcement of a law adopted in 2009.

VIII. The way ahead

78. Noting the number of problems that Central Asia faces, the region has to work out its priorities within the limits of its resources, taking into account the limitations fixed by the history of environmental degradation and infrastructural set-up, and to orient water management accordingly. Countries need to identify and apply best practices in the management of water resources and ecosystems. Guidelines for improving water management based on international experience are called for.

79. Views on the priority uses for the region's water resources differ. Uzbekistan emphasizes the importance of ensuring drinking water for the population and food security, i.e., water for agriculture. Tajikistan has placed development of hydropower high on its agenda. It is important to note that water gains for one sector do not necessarily take away water from another; it is a question of using the reservoir infrastructure to optimally time the releases so that different sectors benefit simultaneously, or for different reservoirs in a cascade to have complementary operating modes. Regional water cooperation should be complemented by other economic sectors, and sustainable benefit-sharing arrangements may be developed that are not limited to water.

80. The water deficit experienced, especially downstream, is to a large degree a result of shortcomings in management of water and inefficient water use rather than physical scarcity. There have been increases in water use due to different reasons which include demographic increase, expanded irrigation, losses and low water efficiency. Improving water use efficiency and introducing water saving technology is necessary to ease the pressure and relieve scarcity by cutting back on use, including more agricultural production per unit of water. With the reduction of flows seriously affecting water quality, it is important to take measures to prevent anthropogenic water pollution.

81. Only assessing reliably the quality and quantity status of water provides the necessary basis for management interventions to limit human impact, including economizing water use, and for decisions about water allocation. This requires taking monitoring water resources seriously — investing in it and improving dissemination of the data where it is needed to support management. More regular and systematic data exchange and harmonization of approaches is needed.

82. With the current prioritization of economic development, it is a serious concern that water-dependent ecosystems get little attention. On the positive side, the Concept of the Development of the Water Sector and Water Management Policy until 2010 and the sectoral Programme on Drinking Water that were approved in Kazakhstan in 2002 encourage an ecosystem approach to water management. Furthermore, Mongolia would like to have special protected areas expanded in a transboundary direction. The operational rules for the joint management of some reservoirs — the Segrejevsk and Petropavlovsk reservoirs on the Ishim shared by the Russian Federation and Kazakhstan — specify a minimum flow at the border section. Signing an agreement on environmental flow and enhancement of the network of protected areas has been suggested for the Argun, which is subject to various development pressures. Groundwater plays a potentially important role in sustaining ecosystems and limiting land degradation; studies of groundwater resources need to be continued to address the current low level of knowledge. Means of sound land management, like limiting deforestation and moving away from unsustainable agricultural and grazing practices, also have potential for limiting erosion problems. In addition, developing small-scale hydropower, which many of the countries have the potential for, could be in some cases an option for energy provision which is less disruptive to the environment by not impounding the water flow.

83. The willingness of all the riparian countries to cooperate, establish an open dialogue and find a consensus between their positions is necessary for agreement. There is concern that without the will to cooperate, knowledge of technical issues will not help. Cooperation on water can pave the way to cooperation in other fields like transport, trade, transit and energy. The limited consultations, or even the lack thereof, among co-riparian countries concerning future development plans with implications for transboundary water resources must be addressed. Joint environmental impact assessments of planned transboundary projects should be carried out. This is particularly relevant considering further flow regulation. The Russian Federation, China, the Islamic Republic of Iran and Turkey have notably been providing financing for the projects in Kyrgyzstan and/or Tajikistan where new hydropower projects are in the pipeline (e.g., the Shurob, Sangtuda 2 and Rogun Dams on the Vakhsh, and Kambarata 1 on the Naryn). On the Tejen/Harirud, the Shirtappeh diversion dam is under construction. There is a need for transparency in the work of the joint commissions and for co-riparian(s) to be better informed about development plans for transboundary rivers that could have a significant impact on their water resources, so that costs and benefits of various development plans can be analysed.

84. Basin management institutions need to be enhanced and transboundary cooperation based on international legal instruments strengthened. The region needs a common overarching legal framework to serve as “rules of the game” for developing agreements and effective institutional arrangements for the management and protection of shared waters. The Water Convention can play such a role and provide a fair, sound and sustainable framework for cooperation on shared water resources. It is positive that Kazakhstan and Uzbekistan are Parties to the Convention, Turkmenistan is in the process of acceding to it and that understanding of the Convention is growing also in the countries which are not Parties to it. It is important that the amendments to articles 25 and 26 of the Water Convention enter into force, opening it to countries outside the UNECE region, so that the region can have a common legal basis for cooperation including also non-UNECE countries such as Afghanistan, China, the Islamic Republic of Iran and Mongolia.

85. The present regional institutional mechanism, based on the international Fund for Saving the Aral Sea (IFAS), is in need of stronger efficiency, coordination and collaboration between its organizations. The recognition by the Heads of Central Asian Governments in April 2009 of the need to improve institutional and legal frameworks for regional cooperation under the umbrella of IFAS initiated an important process to

strengthen the legal frameworks and build the institutional capacity of regional organizations.

86. Sustainability of structures of cooperation is a challenge, and reduction of their dependency on external funding should be aimed at. For example, the secretariat of the Chu-Talas Commission operates with project funding from the Asian Development Bank and the continuation of operation after the end of projects needs to be considered. There is need for assistance but, in the long term, sustaining the water management institutions and the necessary information collection for decision-making will require the countries of the region to take responsibility. International organizations can facilitate transboundary cooperation, and coordination among them to avoid duplication is important.

87. A sustainable solution for cooperation on transboundary rivers requires consideration of all the involved sectors (irrigation, energy, drinking water supply, etc.), including environmental protection. The differing needs of the riparian countries need to be considered.

88. A coherent strategy to address water quality is also needed.

89. The focus on national food sufficiency results in unnecessary production of certain crops using irrigation. Food imports could help to decrease the pressure on water resources.

90. Afghanistan is presently not represented in regional institutions related to water management. As Afghanistan shares waters with the Central Asian Republics and its need for water is increasing — with development of agriculture and irrigation among its national priorities — its participation in regional cooperation efforts would be beneficial. Afghanistan has completed the feasibility studies for and design of a number of irrigation projects, but lack of funding and the political instability is holding up their implementation.

91. Even in the face of the many pressing and immediate problems, not all the countries in the region give priority to climate change-related concerns, despite their awareness that it needs to be taken into account when making plans for water use and management. For example, irrigation requirements remain to be assessed. Moreover, the predictions about the gravity of impacts of climate change — albeit known to be uncertain — vary substantially. This demonstrates that either the downstream and upstream data show a different picture or that very different scenarios are worked on in the countries. In either case, regional cooperation on climate change and variability studies would be beneficial for all countries. Regional strategies for adapting to climate change, and to promote rational and economical use of water and conservation of water bodies are needed.

92. Restoration and development of a monitoring network for water resources is called for, as well as monitoring of the status of glaciers, which will give indications about how water availability will develop. A complete inventory of glaciers of the Pamir-Alaya and Tien Shan with the help of high-resolution remotely sensed data and the development of regional mathematic models of snow cover formation in the mountains and of the glacial flow are all proposed to be carried out.

Annex I

Brief description of the water resources management frameworks in countries in Central Asia

Afghanistan

1. The Supreme Council for Water Management/Water High Council sees to water legislation and policy development in Afghanistan, and has a coordinating role in water management between various ministries. It is supported by a Technical Secretariat. Afghanistan foresees establishment of river basin and sub-basin agencies, as well as basin and sub-basin councils for the involvement of all stakeholders. Other relevant structures include the River Basin Advisory Board and the Sub Basin Coordination group.

China

2. In China, the Ministry of Water Resources is mainly responsible for hydropower development, i.e., construction and management of (large) hydropower projects. The Ministry of Environmental Protection organizes, among others, the development of various environmental protection standards, criteria and technical norms. It develops plans for pollution prevention and control in key regions and river basins, as well as environmental protection plans for drinking water source areas. The Ministry also develops the emission control system and a pollutant discharge licence system for major pollutants, and supervises their implementation. The Ministry of Land and Resources supervises hydrogeological exploration and assessment, as well as monitoring and prevention of the over-abstraction and contamination of groundwater. The Ministry of Foreign Affairs is responsible for issues related to transboundary waters.

Islamic Republic of Iran

3. For a description of the water resources management framework in the Islamic Republic of Iran, see document ECE/MP.WAT/WG.2/2011/5–ECE/MP.WAT/WG.1/2011/5 (major findings of the assessment for the Caucasus).

Kazakhstan

4. The Committee for Water Resources of the Ministry of Agriculture is the national body responsible for the use and protection of water resources in Kazakhstan. It delivers approvals and permits for the use of surface water and groundwater resources. It is also responsible for the management of the water network. Through the eight River Basin Organizations, which have an advisory mandate, its work is extended to basin level management. The Ministry of Environmental Protection issues permits and monitors surface water. The national hydrometeorological institute, Kazhydromet, monitors both water quantity and quality. The Territorial Environmental Protection Offices oversee environmental inspection and ensure the monitoring of wastewater discharges at the oblast level. Through the Committee on Geology and Mineral Resources Use, the Ministry of Energy and Mineral Resources is responsible for the monitoring of groundwater, including its quality. The Ministry of Health monitors the situation of access to drinking water and its quality. The Ministry of Emergencies responds to floods, droughts and protection of water

bodies against accidental pollution. It also deals with the issues of security and safety of hydraulic works.

Kyrgyzstan

5. The National Council on Water of Kyrgyzstan was established in 2006, headed by the Prime Minister and comprising the heads of all ministries and departments, as well as the governors of all the regions, to coordinate the activities of ministries and other State bodies related to management of water resources, their use and protection. In addition, the Council's tasks include development of a proposal for the boundaries of major basins; the preparation of the National Water Strategy for the approval of the President; the preparation of draft laws; and the supervision of the activities of the water administration at national level. In June 2010, the Government established the Committee of Water Resources and Land Reclamation, which will be engaged in the management of water resources in the country — planning, management and ensuring compliance with the legislation. Five Basin Water Management authorities are to be established. The Committee replaced the former Department of Water Resources.

Mongolia

6. The Water Authority, under the Ministry of Environment and Tourism of Mongolia, is in charge of water resources management dealing with all water related issues. The Ministry of Food, Agriculture and Light Industry of Mongolia is responsible for water for livestock and irrigation.

Russian Federation

7. For a description of the water resources management framework in the Russian Federation, see document ECE/MP.WAT/WG.2/2011/5–ECE/MP.WAT/WG1/2011/5.

Tajikistan

8. The Ministry of Land Reclamation and Water Resources is the main authority responsible for water issues in Tajikistan, conducting policy for irrigated land reclamation, and taking decisions on the use and protection of water resources, construction of water facilities, rural water supply and irrigation. The Ministry develops and implements long-term and short-term State programmes related to central irrigation and drainage systems, canal construction and maintenance, reservoirs and rural water supply. It also keeps track of the use and protection of water resources, sets standards, limits water use and maintains the State water inventory (water cadastre). The State-owned "Tajikobdehot", the leading supplier of water, sanitation; irrigation, and drainage in rural areas, is also under the Ministry. The State Committee of Environmental Protection, reformed in 2008, includes the Control of Use and Protection of Water Resources Unit and the Department of State Ecological Expertise. The Department is involved in water management activities such as validation of environmental impact assessments.

9. The State Administration for Hydrometeorology (Tajikhydromet) under the Committee on Environmental Protection is the key organization responsible for environmental monitoring in Tajikistan. The Main Department of Geology under the Government (Tajikgeology) carries out monitoring of groundwater levels.

Turkmenistan[13]

10. In Turkmenistan, the use and protection of water resources is based on a combination of basin-type, territorial and administrative-territorial governance. In accordance with the Water Code, State water resources management and protection is carried out by the Cabinet of Ministers, as well as by a number of specialized governmental water management and environment protection authorities. The Cabinet of Ministers approves the main parameters and programmes related to water resources development; defines and regulates both the delegation of water management and nature protection functions and control over distribution and use of water resources; and regulates and supervises transboundary cooperation with neighbouring countries. The Ministry of Water Resources is the main Government agency in the field of management of water resources, responsible for water intakes, bigger canals (including for drainage) and mains of common use and reservoirs. *Welayat* (oblast) water management departments comprise maintenance, construction and monitoring departments (including chemical-analytical laboratories). There are water management departments also at *etrap* (district) level. The Institute *Turkmensuvylymtaslama* within the Water Ministry is responsible for scientific and research activities, project design and development, specific monitoring (analysis of geological material, soils, water, etc.), as well as some other functions. While performing its functions, the Institute develops measures for the rational use and protection of water resources, as well as the prevention of the deterioration of water quality or the pollution of water. The Ministry of Nature Protection is one of the agencies implementing State policy and intersectoral control in the field of environment protection and use of natural resources. According to its regulations, the Nature Ministry is responsible for the overall control over remedial actions and protection of ecosystems, prevention of deterioration of surface and groundwater resources, monitoring of environmental media and natural resources. Both the Water Ministry and the Nature Ministry have subsidiary offices in the regions.

Uzbekistan

11. State water resources management at the national level is carried out by the Cabinet of Ministers through the Ministry of Agriculture and Water Management, the State Committee for Nature Protection, the State Committee on Geology and Mineral Resources and State local authorities. The responsibility for national water use and protection is shared by corresponding local authorities at the regional and district levels. The Ministry of Agriculture and Water Management is the body responsible for water resources management. It plays the key role in implementing State policy on water management and use, and coordinates the work of the water management bodies. The main tasks of the Ministry include the development of policy in the agricultural and water resources sector; the introduction and development of new technologies; the coordination of the activities of commercial service enterprises and organizations; investments in irrigation and drainage systems; the development of policies and procedures for basin organizations; assistance for the development of water user associations; the introduction of IWRM; the creation of research institutions; and the establishment of training courses for the improvement of on-farm irrigation. The basin administrations of irrigation systems are regional bodies under the Ministry. The State Committee on Irrigation and Drainage coordinates irrigation and drainage activities. It is responsible for the control and improvement of surface water use and compliance with legislation on nature protection. *Uzhydromet* monitors the hydrological regime and water quality of surface watercourses.

[13] See the "Assessment of Water Sector in Turkmenistan" (Final Draft) (United Nations Development Programme Turkmenistan, Ashgabat, February 2010) (available from http://waterwiki.net/images/7/76/TM_Water_Sector_Assessment_Fin_Draft.pdf).

Annex II

Existing agreements related to the management of transboundary water bodies in Central Asia

Countries [a]	*Water body/basin concerned*	*Title key provisions*	*Signed (S) Into force (E)*
KZ, KG, UZ, TJ, TM		Agreement between the Republic of Kazakhstan, the Kyrgyz Republic, the Republic of Uzbekistan, the Republic of Tajikistan and Turkmenistan on Cooperation in Joint Management of Use and Protection of Water Resources of Interstate Sources. Interstate Commission for Water Coordination of Central Asia	1992
KG, KZ, UZ		Agreement between the Kyrgyz Republic, Republic of Kazakhstan and the Republic of Uzbekistan on the use of energy and water resources, construction and operation of the Central Asian region	1996
KG, KZ, UZ		Agreement between the Kyrgyz Republic, the Republic of Kazakhstan and the Republic of Uzbekistan on the use of hydropower resources of the Syr Darya	1998
KG, KZ, UZ		Agreement between the Kyrgyz Republic, the Republic of Kazakhstan and the Republic of Uzbekistan on cooperation in the area of environment and rational nature use	
KZ, CN		Agreement between the Government of the Republic of Kazakhstan and the Government of the People's Republic of China Concerning Cooperation in Use and Protection of Transboundary Rivers. A joint commission operates on this basis.	2001
KZ, CN		Agreement between the Government of the Republic of Kazakhstan and the Government of the People's Republic of China on the protection of the water quality of transboundary rivers	2011
KZ, KG, TJ, UZ		Agreement between the Government of the Republic of Kazakhstan, the Government of Kyrgyz Republic, the Government of the Republic of Tajikistan, and the Government of the Republic of Uzbekistan Concerning Use of Water and Energy Resources in the Syr Darya River Basin	1998
KZ, KG		Agreement between the Government of the Republic of Kazakhstan and the Government of Kyrgyz Republic on the Use of Water Management Facilities of Intergovernmental Status on the Rivers Chu and Talas. A commission was established later on this basis.	2000
RU, CN	Amur and Ussuri Rivers	Agreement between the Government of the Russian Federation and the Government of the People's Republic of China Concerning Protection, Regulation and Reproduction of Living Water Resources in Frontier Waters of the Rivers Amur and Ussuri. A mixed commission established earlier deals with related matters.	1994
RU, CN		Agreement between the Government of the Russian Federation and the Government of the People's Republic of China Concerning Guidance of Joint Economic Use of Separate Islands and Surrounding Water Areas in Frontier Rivers	1997

Countries [a]	*Water body/basin concerned*	*Title key provisions*	*Signed (S) Into force (E)*
RU, CN	Argun	Agreement between the Government of the Russian Federation and the Government of the People's Republic of China on cooperation related to the protection of water quality and the ecological status of the Argun River	2006
RU, CN		Agreement between the Government of the Russian Federation and the Government of the People's Republic of China Concerning Rational Use and Protection of Transboundary Waters. A joint commission operates on this basis.	2008
RU, KZ		Agreement between the Government of the Russian Federation and the Government of the Republic of Kazakhstan Concerning the Joint Use and Protection of Transboundary Waters. A joint commission operates on the basis of the agreement. It includes provisions for regular exchange of information on transboundary water conditions and an emergency notification procedure.	1992
RU, MN	Selenga, Kiran, Minj, Onon, Kira, Ulz, Hyagt and Zelter Rivers	Agreement between the Government of the Russian Federation and the Government of Mongolia on the Protection and Use of Transboundary Waters. Plenipotentiaries are appointed. The scope covers protection and rehabilitation of water resources, as well as exchanging information on transboundary waters.	1995
TM, IR	Tejen/Harirud	Agreement between the Government of Turkmenistan and the Government of the Islamic Republic of Iran on the Planning, Construction and Exploitation of the Common Water Diversion Facility on the River Tejen (Harirud) in the area of the Shirdere Settlement. A joint coordinating commission operates on the basis of the agreement.	2007
USSR/TM,[b] IR	Tejen/Harirud, Dosti Reservoir	Agreement between the Government of the Soviet Union and the Government of the Islamic Republic of Iran for the construction of Dosti Dam	1999
USSR/TM,[b] IR	Tejen/Harirud	Russo-Persian Treaty of Friendship implementation agreement. Article 3: agreement for construction of a dam near Pol-e-Khatoon for using waters of the Harirud River.	1926
USSR/TM,[b] IR	Tejen/Harirud	Russo-Persian Treaty of Friendship between representatives of the Islamic Republic of Iran and the Union of Soviet Socialist Republics	1921
UZ, TM		Agreement between the Government of the Republic of Uzbekistan and the Government of Turkmenistan Concerning Cooperation on Water Management Issues	1996

[a] Country names have been abbreviated as follows: China (CN); Islamic Republic of Iran (IR); Kazakhstan (KZ); Kyrgyzstan (KG); Mongolia (MN); Russian Federation (RU); Tajikistan (TJ); Turkmenistan (TM); Union of Soviet Socialist Republics (USSR); Uzbekistan (UZ).

[b] At the time this agreement was signed, Turkmenistan was part of the Union of Soviet Socialist Republics. After its independence, Turkmenistan became a successor to these agreements.

Annex III

Status of ratification of selected international agreements relevant to transboundary water management by the countries in Central Asia

Treaty	*Countries*									
	AF	CN	IR	KZ	KG	MN	RU	TJ	TM	UZ
Convention on the Protection and Use of Transboundary Watercourses and International Lakes (UNECE Water Convention, Helsinki, 1992)[a]	n/a	n/a	n/a	●			●			●
Protocol on Water and Health (London, 1999, in the framework of the UNECE Water Convention)	n/a	n/a	n/a				●			
Protocol on Civil Liability and Compensation for Damage Caused by the Transboundary Effects of Industrial Accidents on Transboundary Waters (Kyiv, 2003, in the framework of the UNECE Water Convention and Industrial Accidents Convention)	n/a	n/a	n/a							
Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention, 1991)	n/a	n/a	n/a	●	●		S			
Protocol on Strategic Environmental Assessment (SEA Protocol, Kyiv, 2003, to the Espoo Convention)	n/a	n/a	n/a							
Convention on the Transboundary Effects of Industrial Accidents (Industrial Accidents Convention, Helsinki, 1992)	n/a	n/a	n/a	●			●			
Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention, 1998)	n/a	n/a	n/a	●	●			●	●	
Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar Convention, 1971)		●	●	●	●	●	●	●	●	●
Framework Convention for the Protection of the Marine Environment of the Caspian Sea (Tehran, 2003)			●	●			●		●	

Notes: S = signatory only, ● = Party. Country names have been abbreviated as follows: Afghanistan (AF); China (CN); Islamic Republic of Iran (IR); Kazakhstan (KZ); Kyrgyzstan (KG); Mongolia (MN); Russian Federation (RU); Tajikistan (TJ); Turkmenistan (TM), Uzbekistan (UZ).

[a] As the 2003 amendment of the Water Convention is not yet in force, Afghanistan, China, the Islamic Republic of Iran and Mongolia are not eligible at present to become Parties. Similarly, they are not entitled to accede to other UNECE conventions.