UNRCCA

Early Warning on Potential Trans-boundary Water Problem Situations in Central Asia

Seminar Report

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Preface

On 26 September, with financial support from the US Government, the United Nations Regional Centre for Preventative Diplomacy in Central Asia (UNRCCA) held a seminar for representatives from Central Asian states, Afghanistan and international organisations on Early Warning on Potential Trans-boundary Water Problem Situations in Central Asia in Almaty. The seminar was part of a multi-stakeholder process that seeks to bring about timely collection and dissemination of trans-boundary water-related data and information to prevent problems or disputes arising. The quantity, quality and flow regime of trans-boundary waters in the Aral Sea basin are instrumental to peace, stability and prosperity in the region. This process has been recognised as crucial in the recommendations of several regional and international organisations in recent years.

Central Asian states are actively strengthening the capacity of the International Fund for saving the Aral Sea (IFAS) to provide trans-boundary water management services with support from many international organisations. There are currently multiple sources of information and data (indicators) that reflect the changing status of potential trans-boundary water conflicts or issues. While some of these indicators may point to possible exacerbation of potential conflict, other indicators may suggest a reduction in the level of risk.

This information and data resides in different locations and is not easily accessible or regularly consolidated. Bringing this information together at regular intervals would provide all Central Asian states and their international partners with improved capacity to monitor the status of trans-boundary waters, and early warning of potential issues that require attention. The six states in the Aral Sea basin have all expressed their support in principle for such a system in discussions with UNRCCA.

The United Nations is fully supportive of regional efforts to reach a common vision on trans-boundary water issues in the region. Political efforts to address water problems are among the priorities for the UNRCCA, while several other United Nations organisations (including UNDP, UNECE and UNEP) are also working to improve information sharing on trans-boundary water issues in the region. On 3 March 2010, the UNRCCA signed a Memorandum of Understanding with the IFAS Executive Committee to enhance cooperation towards integrated water resource management. In his visit to the region in April 2010 the UN Secretary General raised trans-boundary water management issues at the highest level with Central Asian leaderships.

The Almaty seminar was attended by delegations made up of representatives of several Ministries and Agencies from the five Central Asia states, as well as two officials from Afghanistan's Ministry of Foreign Affairs. All the delegations took active part in the discussions. In particular, Afghanistan's first participation at a regional water event was significant. In addition, representatives of UNDP, UNEP, UNESCO, OCHA, ESCAP, the OSCE, the World Bank, the Eurasian Economic Community, EC IFAS, USAID, the EU and GIZ also took part in the event. A full list of attendees is appended as Annex 1.

Background on water issues in the Aral Sea Basin

The river basin of the Aral Sea is primarily made up of two rivers, the Syr Darya and the Amu Darya, and their tributaries. Long-term average flow is 79 cubic km / year in the Amu Darya and 37 cubic km / year in the Syr Darya.[1] Like many other river basins, the Aral Sea basin is used for several purposes. Hydroelectric dams primarily in the upstream states of Kyrgyzstan and Tajikistan are used to provide **electricity**. Currently, electricity is primarily produced in the winter months, when demand for electricity in these countries is the highest. The three states located in the water generation areas of the major Central Asian rivers, Tajikistan, Kyrgyzstan and Afghanistan, intend to develop their hydropower potential to cover growing domestic energy demand, export energy and decrease their energy dependence on hydrocarbon-rich neighbours and suppliers.[2]

By contrast, downstream areas, largely in Uzbekistan, Turkmenistan and Kazakhstan, but also in the upstream countries need additional water supplies in the summer for **irrigation** purposes. With the current flow regimes, heavy release of water from hydroelectric dams can lead to flooding in winter months[3] and water scarcity in the summer when it is most needed downstream.

Water is also used for **domestic and industrial purposes** in all countries in the region. Meanwhile, demand for upstream water supplies on the Amu Darya will increase as water resource development in northern Afghanistan continues and populations and economies continue to grow in the other Central Asian countries. In the past, little attention has been paid to the role of Afghanistan as a stakeholder and user of the basin's water system.[4]

While water flow in five of the basin states was managed in a unified manner in Soviet times, decisions on water allocations now are made by a melange of regional and national institutions. The **competing demand** for water supplies between states, and the competing requirements for flow have proved difficult to resolve.

Infrastructure safety is another key issue with trans-boundary implications. Dams and their reservoirs are very important to the economies of the region, contributing to seasonal and long-term regulation of river flow, irrigation, hydropower generation and water supply. They can also prevent floods, mudslides and droughts. However, these large dams concurrently pose a significant potential threat, because breaches or destruction could have disastrous effects, including loss of life, often in downstream countries. The natural ageing of the dams, many of which were built several decades ago, requires close supervision of their technical condition, and adequate repair and rehabilitation work.[5] Other infrastructure, including canals and pumping stations, is also facing maintenance and deterioration problems.[6] On top of this, some of the dams are located in areas susceptible to natural disasters such as earthquakes and

[1] http://blogs.ei.columbia.edu/2009/08/18/water-and-energy-conflict-in-central-asia/
[2] http://www.envsec.org/publications/AmuDarya-EN-Web.pdf, p25
[3] See the map at http://www.envsec.org/maps/16-water.jpg for indications of the areas susceptible to flooding in the Syr Darya river basin
[4] http://www.envsec.org/publications/AmuDarya-EN-Web.pdf, p43
[5] http://www.unece.org/publications/oes/WaterSeriesNo.5_E.pdf. The map at http://www.envsec.org/maps/16-water.jpg shows the locations of some of the dams in the Syr Darya basin deemed to be possibly under threat of collapse
[6] http://www.envsec.org/publications/AmuDarya-EN-Web.pdf, p7

mudslides, which can make poorly maintained dams particularly vulnerable. The status of infrastructure, and potential threats to their safety, should be carefully monitored as part of an early warning system.

Another key concern is the level of **pollution** in the Amu Darya and Syr Darya rivers. In the course of their flow, both rivers accumulate agricultural runoff – such as pesticides, fertilisers, industrial waste and other contaminants – that can cause serious health problems among those who drink water downstream, and eat crops that have been irrigated by it.[7] They can also be polluted by untreated waste from cities and other settlements in their paths.[8] Meanwhile, the Syr Darya basin also has been suffering on-going low-level radioactive pollution from uranium tailings left at the end of the Soviet Union in upstream areas of Kyrgyzstan, Tajikistan and Uzbekistan. The location of these tailings in areas susceptible to natural hazards increases the danger of an accident. If an accident occurred, several of these sites would be likely to release radioactive substances downstream into neighbouring countries.[9]

The **Aral Sea** has been shrinking since Soviet times, because of large scale irrigation developments made to stimulate agricultural production; primarily cotton. By 2007 the surface of the lake had fallen to 10 per cent of its original size, and the salinity in the remaining southern part is now three times that of normal seawater.[10] Over the decades, large quantities of pesticide residue from agriculture production ended up on the Aral Sea floor. With the drying of the lake, the bed became dry land covered with poisonous dust.[11] One of the ways riparian countries are using to try to address this shrinking is a shift from water-intensive crops, such as cotton and rice, to others that require less water, such as potatoes. In addition, Kazakhstan is working with the World Bank to refill the northern part of the Aral Sea. A dike that has been built has led to an increase in the sea level within the "little Aral", a decrease in salinity and has allowed for the reintroduction of freshwater fish.

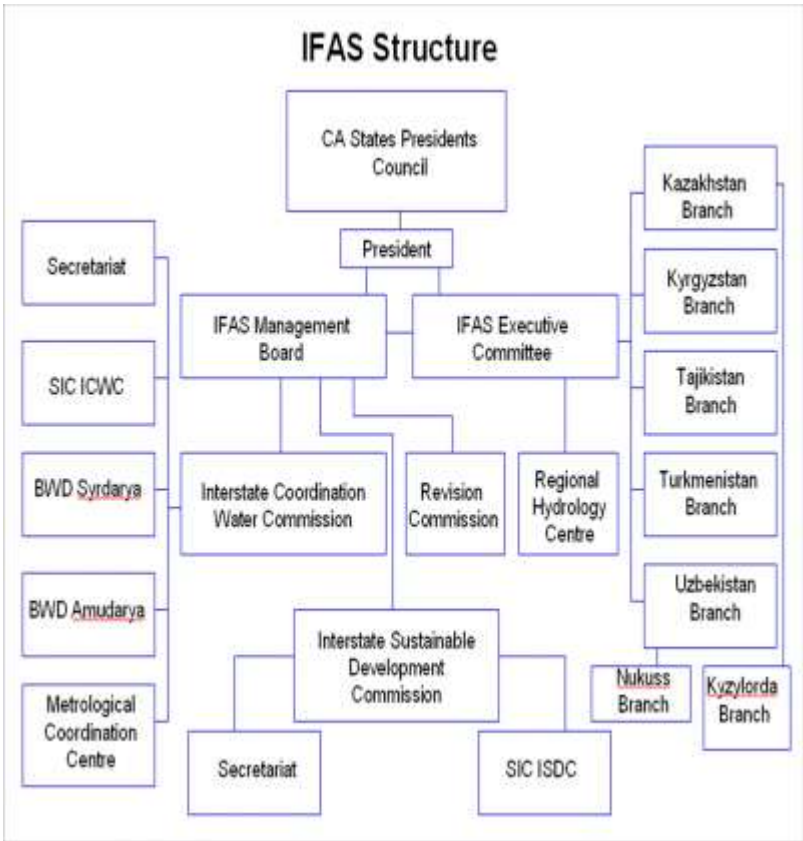
The on-going threat of **climate change** is a further concern. This is particularly because of the expected continuation of glacial contraction, crucial for the Aral basin, the water in which primarily comes from snow and glacial melt. The melting is occurring at a rate that is twice as fast as global trends. Models suggest that this is currently leading to increasing river flow, which will continue over the next two decades, but then may reduce sharply. It is also forecast that more precipitation will fall as rain in upstream areas, changing seasonal flow patterns. Meanwhile, changes in sediment loads may pose additional problems.[12]

Trans-boundary water disputes can take place both at interstate level and at the **community level**, in areas where rivers cross international boundaries. The local situation is particularly problematic in areas of the Fergana Valley where international boundaries are complicated by enclaves and exclaves and where communications systems, including irrigation and drinking

[7] http://www.cawater-info.net/amudarya/water_e.htm, http://www.rferl.org/content/Water_In_Kazakhstan_Too_Filthy_To_Even_Use_For_Agriculture/1616923.html
[8] See the map at http://www.envsec.org/maps/16-water.jpg for areas in the Syr Darya basin that are particularly susceptible to pollution
[9] See the map at http://www.envsec.org/maps/13-industrial.jpg for graphic representation of areas in the Syr Darya basin susceptible to radiation and other industrial pollution
[10] Aral Sea continues to shrink, August 2009, earthobservatory.nasa.gov
[11] http://www.watergovernance.org/documents/WGF/Reports/Paper-15_RWIR_Aral_Sea.pdf
[12] http://blogs.ei.columbia.edu/2009/08/18/water-and-energy-conflict-in-central-asia/, *mdtf.undp.org/document/download/4150*

water supplies, pass through multiple borders. Disrupting or cutting off water supplies to isolated enclaves or villages across the border has been used at local or district level as a means to exert pressure on neighbouring communities in wider local cross-border disputes though these pressures can be mitigated by traditional community-based structures, that by ensuring dialogue often act to prevent conflict.

Despite all these problems, it is important to note that the states of Central Asia have taken care over the years of independence to prevent trans-boundary water disputes from escalating into violence. After the collapse of the Soviet Union, the Central Asian states had to establish a new framework for management of water resources. On 12 September 1992, the Ministers of Water Resources of the newly independent states made an official statement which declared that joint management of water resources would be carried out under principles of equality and mutual benefit. At this time, an International Commission for Water Coordination Water (ICWC) was created.[13] Within a couple of years, several other interstate organizations were established with international support: the International Fund for saving the Aral Sea (IFAS), which was primarily intended to generate funds; the Interstate Commission for the Aral Sea (ICAS) to coordinate the Aral Sea Basin Programme (ASBP); and the Interstate Commission for Sustainable Development (ICSD), which was established in 1993 primarily to protect the region's environment.[14] The ways the structures currently relate to each other are reflected in the diagram below:



[15]

[13] http://www.icwc-aral.uz/
[14] http://www.ec-ifas.org/about/
[15] http://waterwiki.net/index.php/Image:IFAS_Structure.jpg

Currently, negotiations, introduction of water-saving technologies and data sharing are all being used by states the Aral Sea basin and their international partners to find collaborative solutions for the problems of all parties in the Aral Sea basin now and for the future. The introduction of a consolidated platform for data and information sharing on all the issues of concern would be another step towards this goal.

Morning session

Welcoming remarks to the seminar were made by Mr. Fedor Klimtchouk, Deputy Head of UNRCCA, Mr. Saghit Ibatullin, Head of the Executive Committee of IFAS, and Ms. Janat Zakiyeva, Advisor of the Ministry of Foreign Affairs of Kazakhstan, representing the host state.

The seminar began with a series of brief presentations by UNRCCA consultant Mr. Matthew Naumann on:

1. The concept of early warning as applied in the context of trans-boundary water problem situations in Central Asia,
2. international experience of providing early warning on trans-boundary water,
3. existing systems that collect and disseminate information and data in the region, and
4. potential information categories and indicators for the proposed early warning system.

The main points of these presentations are related below.

The concept of early warning as applied in the context of trans-boundary water problem situations in Central Asia

Early warning has been defined by the United Nations' International Strategy for Disaster Reduction (ISDR) as "the provision of timely and effective information, through identified institutions, that allows individuals exposed to a hazard to take action to avoid or reduce their risk and prepare for effective response". Early warning is the integration of four components:[16]

- Risk Knowledge: Risk assessment provides essential information to set priorities for mitigation and prevention strategies and designing early warning systems.

- Monitoring and Predicting: Systems with monitoring and predicting capabilities provide timely estimates of the potential risk faced by communities, economies and the environment.

- Disseminating Information: Communication systems are needed for delivering warning messages to the potentially affected locations to alert local and regional governmental agencies. The messages need to be reliable, synthetic and simple to be understood by authorities and the public.

- Response: Coordination, good governance and appropriate action plans are a key point in effective early warning. Likewise, public awareness and education are critical aspects of disaster mitigation.

The planned system for Central Asia would address natural, socioeconomic and institutional issues affecting or with the potential to affect:

- Water quantity (the possibility of causing flooding or drought)

- Water flow (ensuring that water is available at the right time for its uses), and

- Water quality (pollution).

[16] http://www.unisdr.org/eng/terminology/terminology-2004-eng.html

The system envisaged for Central Asia would encompass a range of quantitative and qualitative information.

International experience of providing early warning on trans-boundary water

Mekong River Commission

The *Mekong River Commission* (MRC) is an intergovernmental body created in 1995 by an agreement between the governments of Cambodia, the Lao People's Democratic Republic, Thailand and Vietnam. Its mandate, as agreed on 5 April 1995, is "to cooperate in all fields of sustainable development, utilisation, management and conservation of the water and related resources of the Mekong River Basin." Since this Agreement, the MRC has focused on issues affecting more than one country. Specifically, the MRC is developing "rules" for water-sharing, monitoring the quality of water resources, and supporting a joint planning process called the Basin Development Plan. The MRC is also involved in fisheries management, promotion of safe navigation, agricultural development, flood mitigation and hydropower planning within an overall framework of renewable resources management.[17]

Co-operation in collection of hydrological information began in the Lower Mekong basin in the late 1950s and has continued for 50 years, culminating in the establishment of the *Regional Flood Management and Mitigation Centre*. This Centre collects hydrological and meteorological information from its member countries, while China supplies data on water discharges from a hydrological station in the Upper Mekong. The processed information is used for producing flood and drought forecasts thus allowing the countries affected to take mitigation measures in a timely manner and defuse potential conflicts over water management in extreme situations.

The MRC's *Flood Management and Mitigation Programme* (FMMP) monitors river levels throughout the flood season. With the assistance of hydrometeorological data from China, this allows for early warning forecasting and mid- to long-term forecasts of river levels. In a recent severe flood, the forecasting system was reasonably accurate and was instrumental in supporting provinces and governments to put in place emergency measures which mitigated much of the damage the flood could otherwise have caused.[18]

The MRC also hosts *MekongInfo*, an interactive web portal for sharing information and experiences in natural resources management in the Mekong River Basin, including flood reports from the FMMP. The site is open access. For the purposes of the Central Asia early warning bulletins, it is useful to note that the Mekonginfo portal contains links to articles and reports about hydroelectric and other developments that affect trans-boundary water on the river and the differing perspectives of riparian states on these developments.[19]

The European Flood Alert System

After disastrous floods in the Elbe and Danube river basins in August 2002, European states realised that flood forecasting needs to bridge communication between different authorities across the borders. It was also recognised that trans-national floods may need longer warning times to be efficiently addressed. Therefore, the European Commission launched the

[17] http://www.mrcmekong.org/
[18] http://www.mrcmekong.org/faq.htm
[19] See http://www.mekonginfo.org/

European Flood Alert System (EFAS), which it is developing in close collaboration with national flood forecasting centres in the member states as well as several meteorological services. The system provides flood warning information up to 10 days in advance. The information is designed to be complementary to national operational flood forecasting information and is distributed to the EFAS partner network twice a day through a password protected webpage.[20]

Early warning of pollution on the Rhine

The *International Commission for the Protection of the Rhine against Pollution* (ICPR) was founded in 1950. ICPR co-operates with states, other intergovernmental organisations and non-governmental organisations. With a new Convention on the Protection of the Rhine in 1999, the Governments of the five countries bordering the Rhine (France, Germany, Luxembourg, the Netherlands and Switzerland), and the representative of the European Community formally confirmed their determination to reinforce their co-operation for continued protection of the Rhine basin, its banks and its flood plains. The Convention entered into force in 2003.[21]

In addition to supporting preventative measures, the ICPR also facilitate the Warning and Alarm Plan Rhine (WAP), under which seven international main warning stations warn all users downstream if an accident occurs or great amounts of hazardous substances flow into the Rhine, if the amounts or concentrations concerned may detrimentally impact the water quality of the Rhine or drinking water supply along the Rhine and/or are liable to raise great public interest. Apart from warnings, which are only issued during large-scale water pollution events, the WAP is increasingly being used as an instrument for exchanging reliable information on water pollution measured by monitoring stations along the rivers Rhine and Neckar. [22]

The Senegal River Basin Development Authority

The *Organisation pour la mise en valeur du fleuve Sénégal* (OMVS; in English *Senegal River Basin Development Authority*) is an organisation created by Guinea, Mali, Mauritania and Senegal to manage the Senegal River and its drainage basin. The area has a total population of 35 million inhabitants, of whom 12 million live in the river basin. The OMVS aims to:

- Reduce riparian states' economic vulnerability to hydrological and climatic risks;
- Ensure conditions for food security for basin populations;
- Enhance economic development by fostering cooperative use of basin opportunities;
- Preserve the overall balance of the hydrological system; and
- Secure and enhance the incomes of local populations.[23]

In order to try to fill some data gaps in assessing the impact of new dams and other modifications to the Senegal River, in 2000 the OMVS created an Observatory to monitor the environment and natural resources in the basin, to provide Member States with necessary

[20] http://efas-is.jrc.ec.europa.eu/
[21] http://www.grid.unep.ch/product/publication/freshwater_europe/rhine.php
[22] http://www.iksr.org/index.php?id=86&L=3
[23] http://books.nap.edu/openbook.php?record_id=10546&page=6;
http://www.worldwaterweek.org/documents/WWW_PDF/2010/thursday/T6/Tamsir_OMVS.pdf

information on the impact of infrastructure developments on the environment and act to limit this impact. The Observatory:

- Organises data collection and processing for systematic environment monitoring, mobilising data producers;
- Processes the information collected and produces relevant indicators;
- Ensures dissemination of the information;
- Analyses the information and detects situations requiring actions by competent authorities and decision makers; and
- Proposes a framework for participation and consensus building in order to contribute to the elaboration of measures required to counter-balance the negative impacts

Indicators covered in the OMVS system include the following:

- Water resources and physical descriptors: (climatology, surface water (quantity), ground water (quantity), and soil degradation)
- Biodiversity and ecosystems: (wetlands, vegetation cover, invasive species, terrestrial and aquatic fauna, and bank degradation
- Population and economy: (human water-borne diseases, animal water-borne diseases, fishing activities, cropping, breeding)
- Water quality: (surface water (quality), ground water (quality), pesticides and nutrients, and mining).

Lessons learned

All these systems have been developed because of recognition that sharing information and data in timely fashion is key for addressing potential concerns with regard to water flow, quantity or quality. Early warning systems can cover both water quantity and flow (the Mekong and European Flood Alert system examples above) and quality (the Rhine and the Senegal). Countries at all income levels have needed to improve trans-boundary water early warning systems in recent years (European Flood Alert System, Senegal). The Mekong experience gives an example of how early warning systems can combine quantitative and qualitative data. Meanwhile, some early warning systems, such as that for the Senegal River, include an element of analysis.

Existing systems that collect and disseminate information and data in the region

At the national level, the key actors for collecting data are the national hydrometeorological (***hydromet***) services of the five post-Soviet countries. These are responsible for collecting, analysing and distributing the weather, stream flow and water quality data necessary to effectively manage water resources. The hydromet services provide weather and stream flow forecasts for crop planting, irrigation scheduling and harvesting in the agricultural sector. Stream flow forecasts are also used to allocate water resources for hydropower and irrigation and to help develop annual international water allocation agreements.

Within the current interstate governance structure, a key potential early warning tool is managed by the **Scientific Information Centre of the ICWC** (SIC ICWC). This is **cawater-info.net**, a web portal that brings together data covering water levels, allocation of this water,

forecasts for water levels and trends in water use over a twenty year period. The data, which covers rivers and reservoirs on the Amu Darya and Syr Darya (though not other major trans-boundary rivers such as the Zarafshan from Tajikistan to Uzbekistan or the Chuy and Talas rivers from Kyrgyzstan to Kazakhstan), is updated every 10 days and would form a very useful part of a consolidated early warning system. The site also contains legal, operational and thematic information on water management and use in the region. The portal was created in the framework of the Swiss Agency for Development and Cooperation's CAREWIB project with support from UNECE and Zoi Environment Network with the active participation of the IFAS Executive Committee (EC IFAS) and the ICSD.

EC IFAS and its partners, however, are clear that improvements need to be made to regional information management. The first section of the first component of the **EC IFAS' Aral Sea Basin Program 3** document for 2011-15 is dedicated to improvement of information systems. This section includes projects on development of a web-based trans-boundary water resource information management system (that would cost an estimated $1.5 million); improving and strengthening the management and hardware capacity for water resources (budget to be determined); modernisation of hydromets (TBD) and rehabilitation of the monitoring system for irrigated land ($1.1 million). These activities would all help to improve the quality of data in the early warning system.

In addition to these regional initiatives, there are several other initiatives underway in Central Asia that could feed data and information into a consolidated early warning system. The **UNDP Senior Economist for Europe and the CIS** compiles monthly and quarterly official economic data from several countries, including Kyrgyzstan, Kazakhstan and Tajikistan, to facilitate the monitoring of socio-economic trends. The data relevant for the early warning system includes that on electricity generation and consumption (from which inferences can be drawn for hydroelectric production and consumption trends) and that on food prices (which may be useful in relation to irrigation issues). In addition, the Office of the Senior Economist also produces frequent analytical pieces on socioeconomic issues in Central Asia, many of which are very pertinent to trans-boundary water issues.

Meanwhile, UN country offices in Kyrgyzstan and Tajikistan also produce monthly briefings on a range of socioeconomic topics. **Monitoring and Early Warning Monthly Reports** have been published by **UNDP in Tajikistan** since 2009. The aim of the Tajikistan Monthly Risk Monitoring Reports is to provide regular monthly information and succinct analysis on the evolution of natural, socioeconomic, food-related, energy-related and other risk factors in Tajikistan. Data and information in this report are provided by different sources and compiled by a Government Group of Experts and UN Agencies in Tajikistan. The reports contain a "general trends" overview, and other sections on hazardous events, weather conditions, energy, food security, health and economic trends. Regular quantitative data given covers forecasts for temperature and precipitation around the country, total electricity production, average daily electricity consumption, and graphs showing planned and actual volume, inflow and outflow at the Nurek Hydroelectric Plant reservoir. This is supplemented by qualitative information and some analysis. The project is financed by UKAid.

Kyrgyzstan's **Risk Monitoring Update** is produced with similar aims to those of the system in Tajikistan. Based on the recommendations of the Central Asia Regional Risk Assessment (CARRA), and building on regular updates on the November 2008 Flash Appeal, the **Resident Coordinator's Office** (RCO) in the Kyrgyz Republic has been issuing monthly

socio-economic risk monitoring updates since October 2009. These updates monitor various parameters including energy, water and food insecurity in the country. The updates are developed by RCO in consultation with the office of the UNDP Senior Economist. Data and information for these updates are sourced from various quarters, including Ministries, UN organisations and the print media.

As part of the **Regional Dialogue and Cooperation on Water Resources Management in Central Asia** project funded by **GIZ**, **UNECE** has initiated analysis of water information on the regional level in Central Asia. The objective is to support regional institutions and representatives of the five Central Asian states to improve data exchange on water and environment issues and to identify synergies between various projects and initiatives.

The **European Union's Office of the Special Representative for Central Asia** produces a **Central Asia Water Update**, which provides a summary of publicly available media reports and press releases across a range of issues concerning water and the environment in the region. The Update also contains information about new reports and publications, as well as upcoming water-related events. It does not analyse the stories it covers, but carries a summary of the key points to begin each issue.

The **German Federal Foreign Office**-funded **Water in Central Asia project** intends to contribute to creating a sound scientific and a reliable regional data basis for the development of sustainable water management strategies in Central Asia. As part of the project, up-to-date sophisticated monitoring stations will be installed providing reliable regional hydrometeorological and GPS data in real-time via satellite communication. The data received from the monitoring stations, as well as the data obtained from sampling campaigns and from remote sensing, is intended to be part of a reliable database shared among all participating states. In close cooperation, German and Central Asian partners are assessing scenarios of climate change impact, estimating future water availability, studying the role of groundwater and investigating irrigation efficiencies. The scientific methods developed and applied within the project will be passed on in training courses to Central Asian professionals and implemented into programmes for tertiary education.

The **Regional Environmental Centre for Central Asia** and **UNECE**-supported **Water Quality in Central Asia** project has been guided by the UNECE Convention on the Protection and Use of Trans-boundary Watercourses and International Lakes and its Protocol on Water and Health, and the EU Water Framework Directive. The objective of the project is to contribute to the development of efficient and coordinated national policies with regard to water-quality aspects of integrated water resources management in Central Asia. It is expected that the project will support development of coordinated national policies on water-quality aspects of integrated water resources management in Central Asia, improved capacity among water experts and officials in the field of water-quality aspects of integrated water resources management, and improved coordination of joint assessments, monitoring and information exchange with regard to water quality. A pilot trans-boundary surface water monitoring programme is being implemented in summer-autumn 2011, covering the Talas (Kyrgyzstan-Kazakhstan) and Vakhsh (Kyrgyzstan-Tajikistan) rivers.

UNDP's Climate Risk Management in Central Asia programme is working closely with national partners – at central, sub-national and local levels – to strengthen their capacities for managing climate risks and opportunities. This includes supporting the five Central Asian

countries as they adjust or develop their national processes, strategies and legislation to address risks posed by current and future climate change. As they carry out national climate adaptation activities, countries will be able to access expertise in analysing and sharing climate change information, and project coordination from a multi-country network of specialists in climate change including climatologists, agronomists, hydrologists, economists and sociologists.

Potential information categories and indicators for the proposed early warning system

The final part of the presentation laid out initial proposals for information categories and indicators for the proposed early warning system. The information categories proposed were as follows:

- Water levels and flow
- Precipitation and climate
- Natural events and river basin safety
- Hydroelectricity and energy
- Irrigation, agriculture and food security
- Environment and pollution
- Local level relationships
- Institutional development
- Diplomacy and agreements

Within each of these information categories, several quantitative and/or qualitative indicators were proposed. The initial list of proposed indicators was as follows:

Section	**Quantitative indicators**	**Qualitative indicators**
Water levels and flow	Significant reservoir levels Significant river levels River flow Forecasts for water levels	
Precipitation and climate	Air temperature figures Precipitation figures Snow melt and cover	Trends and updated information about glacial cover and melt
Natural events and river basin safety	Number of natural events of various types that have taken place in the reporting period Levels in naturally dammed lakes	Details about significant natural events in the reporting period Common natural events for the next reporting period Any news on safety of dams and other hydraulic equipment, including Improvement or deterioration of their condition and the impact of natural hazards Status of nuclear waste facilities
Hydroelectricity and energy	Data from the Aral Sea basin about electricity production (disaggregated by	information about energy / electricity shortages progress on hydroelectric and

	hydroelectric and other) and consumption	transmission line construction
Irrigation, agriculture and food security	Data about agricultural output and food security Changes in the amount of irrigated land Expansion of drip irrigation and alternatives that reduce water consumption	Measures taken by governments that impact on their own and neighbours' food security (export bans, trade liberalisation and so on) major irrigation construction Crop selection and substitution issues increased trade; institutional developments Implications for agricultural water demand Expansion of agricultural trade implications for water demand; institutional developments
Environment and pollution	Levels of salinity, heavy metals, organic pollutants and so on in selected waterways. Data on river radiation levels	Significant reports on environmental issues
Local level relationships		Reports of local level disputes that involved disruption of water supplies or tension over water issues Reports of cross-border cooperation at local level concerning water
Institutional development		Reports of development of law, policy and organisations to better manage water supplies.
Diplomacy and agreements		Updates on cooperation and negotiations between states on water-related issues Agreements between states

Discussion of information categories and indicators

Following the presentations, the participants broke into their delegations (with separate English- and Russian-language groups for participants from international organisations) to review the proposed indicators, and highlight which they considered most important, and what else should be monitored. All the delegations came back with useful and constructive comments on the indicators. These are summarised in the table below:

Section	**Comments**
General comments	• Chuy-Talas Basin Commission between Kyrgyzstan and Kazakhstan should be included in the list of best practice, but the Commission's work is only made possible by the support of international donors • Engagement by Afghanistan in the process is crucial for its success, as Afghanistan's development is changing the water balance in the region • International organisations, including the Central Asian Centre for Disaster Risk Reduction, should be integrated into the process. The Central Asian Centre for Disaster Risk Reduction is a joint project of Kazakhstan, Kyrgyzstan and Tajikistan, and the Centre could coordinate an early warning system. • Large-scale satellite imagery from NASA and USGS is free to use, and may be useful when monitoring trans-boundary water in Central Asia (it is already being used in other parts of the world). Smaller scale imagery and analysis, however, would have to be paid for.
System as a whole	• Much of the information to be included is already being collected. Many *hydromet* services are collecting a wide range of indicators including, for example, on chemical composition in water. There is a unified observation system that produces daily national hydromet reports. National hydromets have good information, and make very good prognoses. However, the issue is how to ensure exchange of information at the regional level. Ensuring reliability of data requires cooperation and a strong methodology. • The system should be hosted by the Executive Committee of the International Fund for saving the Aral Sea, as the key regional body with a mandate in this area. Its structures (including the IFAS Executive Committee, the Amu Darya and Syr Darya River Basin Organisations, the Interstate Coordination Water Commission and the Interstate Sustainable Development Commission) should also be involved. • The sources of all data should be objective, and the scope and timings for the project need to be better defined • There needs to be a common understanding of what the system is, whom it is for, and whether it is to address long-term or short-term issues. • There needs to be more clarity about follow-up activities, and

	what will be done with the information collected. • Fewer indicators may be useful, choosing those in line with national priorities in the region. This could lead to a regular and practical bulletin linked to pressure points and conflict points. • Tipping points or thresholds for further action could be included in the system. • An analytical part may be required for the bulletins. • Some information should be made available on bad practice – what mistakes have been made with previous early warning systems that have to be avoided in the current one. Collection of data in all of these groups would be useful for trans-boundary water management. • It is important that the system of indicators follows the SMART principles (Specific, Measurable, Achievable, Relevant and Time-bound) • Media sources should not be used for the bulletins, as these may be unreliable • The bulletins could be used as part of a training programme for journalists, and an important tool for them to better understand the real issues involved in trans-boundary water. • Bulletins should be released quarterly, and should contain operative information • Ministries of Foreign Affairs should be responsible for collecting information from each country • Should include just those indicators which have a trans-boundary character. It is unacceptable to use indicators that relate to the internal affairs of states, in particular production and consumption of electricity, food export bans, changes to and choices made in agriculture, agricultural trade and some others. • In order to build trust in the data, it is essential to create a mechanism that includes joint monitoring of the proposed indicators with the participation of the relevant agencies of the parties involved. • Bearing in mind the fact the exchange of information at the trans-boundary level is also one of the main principles of the UNECE Water Convention, and taking into account the experience of the Secretariat of this Convention in this field, it is proposed to involve the Secretariat in the implementation of the mechanism. • In order to properly implement this mechanism, it is proposed to secure donor support to provide technical assistance. In particular, assistance is require to rebuild and construct border monitoring posts to monitor the quality and quantity of water, and to conduct joint monitoring of sources of flow from the air, including snow cover, glacial lakes and so on.
Indicators	
Water levels and	• Very important (5/5)

flow	• It is important to closely monitor water levels, volume and speed. • As well as surface water, ground water is also of concern. • The quality, level and movement of trans-boundary aquifers would be a useful indicator to add, to take account of over-pumping, for example. • However, an opinion was expressed that the system should just be limited to surface water. • Include information on uses of water and prognoses for domestic and other consumption. • A water balance indicator could be used that would assess how much water is available, how much is demanded and the difference • Quantitative and qualitative indicators on water resources should be measured at border monitoring stations
Precipitation and climate	• Very important (5/5) • Meteorological information is important for making prognoses • Specific indicators should be included on the condition of glaciers, including the size of these glaciers, and trends in their size
Natural events and river basin safety	• Important (4/5) • The natural events category should be expanded to also include manmade disasters. • Information on natural and manmade emergencies should be readily available • Natural events section should be widened to include manmade events that affect basin safety • In addition to natural events the system should include technological and manmade influences • High mountain lake levels should be closely monitored • Include joint monitoring of large hydraulic works that have a trans-boundary impact.
Hydroelectricity and energy	• Important (4/5) • Should be exchange of information on hydropower stations • Could add monitoring of use of renewable energy sources • Include plans for development of energy systems and use of water resources. • One state proposes to exclude section 4, as production, consumption and deficit of electricity are internal policy matters for every state. It proposes to move the qualitative indicator under this point to section 3.
Irrigation, agriculture and food security	• Very important (5/5) • Information on limits on water use should be added • All irrigation infrastructure development to be monitored, rather than just major development, as proposed • Introduction of water-saving technology is very important, and should be closely monitored • Developments regarding water infrastructure should be

	included • Development of irrigation capacity should be monitored • Add deficit of water for irrigation and other needs
Environment and pollution	• Very important (5/5) • Need regular reporting of water safety • National hydromet services should be able to provide useful information about sources of pollution • Water quality of reservoirs should be included – this is collected by Ministries of Emergency Situations • Results of monitoring of the Chuy and Talas rivers, carried out with international support, should be reported in the bulletins • Cover the extent to which waste water is treated and reused • Cover the quality of water in the basin's catchment area • Measuring radiation levels in water • Monitor river bank erosion, particularly as Afghanistan's border with Central Asian states largely follows the Amu Darya River.
Local level relationships	• Very important (5/5) • The early warning system should cover both local level and basin level activity. • Information about agreements that have been made, and the work of basin councils at local level
Institutional development	• Important (4/5) • Report on capacity building and educational activities for water management.
Diplomacy and agreements	• Very important (5/5) • Information to be added about developments in the international legislative base for trans-boundary water management • The CIS and EurAsEC have several information exchange agreements in place. These can be analysed to determine how to improve cooperation, to ensure that agreements will work properly. • Add observation of the norms and principles of international water law.

Summary of conclusions on indicators

There was general agreement that the proposed system would be useful in different ways to exchange data and facilitate future cooperation. All indicators should be SMART. In addition, new technologies, including satellite mapping, should be used as part of the system.

With regard to the information categories, there was general agreement that **Natural events and river basin safety** should be widened to **Natural and manmade events and river basin safety.** In addition, one state proposed that **Hydroelectricity and energy** be removed, with the qualitative section moved to the category **Natural and manmade events and river basin safety**. The following indicators additional to those proposed were recommended:

- **Water levels and flow:** groundwater levels and trends in trans-boundary aquifers, plans for use of water resources**;** prognoses for domestic consumption, quantitative need, supply and surplus/deficit
- **Precipitation and climate:** sizes of glaciers and trends
- **Natural and manmade events and river basin safety:** Manmade events; level of high mountain lakes
- **Hydroelectricity and energy:** alternative energy development; plans for development of energy.
- **Irrigation, agriculture and food security:** Qualitative updates on all irrigation construction (not just major, not fully agreed);
- **Environment and pollution:** Sources of pollution, water quality in reservoirs (information from Emergencies Ministries), water quality in trans-boundary aquifers, use of waste water (quantitative), environmental conditions of water catchment area; river bank erosion as it affects international borders.
- **Local level relationships:** The role of basin councils at local level
- **Institutional development:** capacity building and educational activities related to water management
- **Diplomacy and agreements**: Development of regional and international law on trans-boundary water management.

These additional indicators have been reflected in a revised list of potential indicators which appear as Appendix 2 to this report.

Scope and implementation

The afternoon session began with a brief presentation by UNRCCA consultant Alex Grzybowski on issues of scope and implementation of the Bulletins. The issues covered included the following:

1. *Utility of bulletins*: The frequency of the bulletins will initially be a product of the resources available to generate them and their complexity. It may be possible to update different indicators at different times if the Bulletin is web based. In addition, the audience for the bulletins should be clarified – who will they be produced for?
2. *Objective:* The discussions raised questions about whether the primary aim of the bulletins is more political – the prevention of problem situations concerning trans-boundary water problems – or technical – reducing the risk of disasters occurring.
3. *Provision of information:* As indicated above, the system will be based on information and data provided by states and international organisations. It will have no resources to measure water quantity, quality and flow itself. While some of this information and data is already in the public domain, other information is not published, while other data is not yet being collected. In order to make the system effective, states will have to share information and data on the various indicators which may have implications for internal capacity. To what extent are the basin states willing and able to share information on the various indicators?
4. *Access to the Bulletins:* It is envisaged that the Bulletin would be open to access, but also provided directly to decision makers in the states and international organisations concerned about the issues at hand. Would there be any merits to a non-public access Bulletin, if this would make some organisations less reluctant to share information?
5. *Reliability of information:* It is important to ensure as much as possible that data and information are reliable. States are clear that they want only official data and information to be included, and not to rely on media or other sources. How can the reliability of the information provided by the bulletin be further strengthened?
6. *Level of analysis:* How much analysis should be included in the bulletins? Should they simply report on changes to the indicators? Should they attempt to compare the status of indicators to any known thresholds? Should they go further and provide analysis of the implications of changes in indicators?
7. *Sustainability:* While UNRCCA is prepared to support development of the bulletin in the short term in partnership with other international agencies and the Central Asian states, in the longer term it likely needs to be hosted by a relevant regional organisation. Where should the bulletin be based in the short term and the longer term?

Participants then divided for a second time into break-out groups made up of three delegations each (with representatives of international organisations free to join groups as they chose) to address these questions. On 14 October, one of the states made a written submission to reiterate its position. This has also been included in the table.

The results can be summarised as follows:

	Group 1	**Group 2**	**One state's written submission**
Utility of bulletins	The bulletins are necessary and relevant. Each indicator should be	Agree that the bulletins are important. They should be produced	The bulletin in general is useful. Each indicator, depending

	reported at a relevant frequency for it – this could be monthly, quarterly, bi-annually or annually. Some indicators may be updated electronically. The audience in general should be unlimited, though some data may be intended for experts on specific issues	once a quarter.	on possibilities for updates and importance, should be updated at its own frequency.
Objective	The objective of the bulletin should be to prevent potential conflicts or disputes. The information provided can be analysed so that parties are better informed on issues that may lead to problems.	The bulletins will be produced to facilitate preventative action.	The aim of the publication is prevention.
Provision of information	The appropriate provider should be determined for each item. This may be a government body or a regional entity. Information should then be compiled (perhaps by Ministries of Foreign Affairs) and forwarded to the publisher, within EC-IFAS. In the near term, this should be done with support from UNRCCA.	ICWC and IFAS already produce some data. This should be supplemented with more indicators and more data. There should be some analysis to check what different organisations can already provide for the bulletins. Data should be sourced from official data provided by state structures, not internet, experts and so on. The final list of indicators should be agreed later.	Every indicator should be set by a responsible national or regional body, and they should be collated by IFAS regional organisations.
Access to the Bulletins	In general, they should be open, but not necessarily all information. (On this point one state stated that open access is better, as information that is kept classified will in any case leak to the media).	Not everything should be fully accessible – the bulletin should be part open and part limited access.	In general, the main information on the indicators should be open, but access to certain indicators should be limited in order to prevent inaccurate analysis and interpretation.

Reliability of information	All organisations are responsible for providing reliable information, but information will need to be balanced. There is a case for joint monitoring of some indicators.	If the data is provided by states, it should be reliable. It would be useful to have a standard form that all states can use to collect information. A model for this could be the eurowaternet forms, which facilitate reporting on pollution in EU countries.	The reliability of information will be facilitated by the agencies responsible for collecting it. In addition, information can be verified by: 1) analysis by means of comparison of indicators and looking at the balance, 2) carrying out joint spot visits, with the participation of interested parties.
Level of analysis	There should be a reflection of trends in the reports, and indicators should have "red lines" or thresholds. However, deeper analysis of the data should be left to the capitals.	Analysis should only be carried out as part of the bulletins if there are clear reasons for it. There may be a case for minimal analysis on some issues, but in general, analysed data is less useful than raw data.	The level of analysis should be based on the real indicators. Every indicator should have a threshold, past which problem situations may increase.
Sustainability	In order to make the system sustainable, it should be housed with a regional organisation such as EC IFAS. UNRCCA can play a role in the initial bulletins, but this is an interim step to IFAS and its bodies taking over.	Sustainability requires ownership at national, regional and international level. EC IFAS should take the lead, but work closely in partnership with all interested organisations. If the CA DRR Centre is collecting data on similar issues for prognoses and monitoring, perhaps standardised forms can be used for the two systems.	In order to achieve sustainability of the system in the short-term, work should be carried out in the framework of IFAS with the support of UNRCCA. In the future, this function should be fully transferred to IFAS and its regional organisations.

Following these discussions, the delegation of Tajikistan made a short presentation on the risk monitoring system that the Government has developed in partnership with UNDP with the support of USAID. The system offers some useful background on how international organisations can work in coordination with a range of government bodies to compile regular early warning bulletins.

Next steps

The seminar ended with a session on next steps. The following were agreed:

When	What	Who
By end October	Dissemination of seminar report	UNRCCA
November	Consultations covering procedure for developing bulletins	UNRCCA, government partners in Central Asia
Early 2012	Production of a prototype bulletin	EC IFAS, with support from UNRCCA and other interested international organisations

Closing remarks

Afghanistan expressed its desire to collaborate more closely with other Amu Darya riparian states on trans-boundary water issues through the early warning system and other activities. The other five countries also reiterated their support for the proposed system.

It was also agreed to make contact with the Regional Centre for Disaster Risk Reduction established by Kazakhstan, Kyrgyzstan and Tajikistan with UNDP support in Almaty, with which there may be opportunities for collaboration on data collection in areas of mutual interest.

Appendix 1: List of participants

Central Asian representatives	
Kazakhstan	Ms. Janat Zakiyeva – Advisor of the Ministry of Foreign Affairs of Kazakhstan
Kazakhstan	Mr. Serikaly Mukataev – Head of the Balkhash-Alakol basin inspection to regulate and protect water resources, Ministry of Agriculture of Kazakhstan
Kazakhstan	Mr. Zeinulla Kaztoganov - Head of the state control of the Aral-Syr Darya river basin management inspection and protection of water resources, the Ministry of Agriculture of Kazakhstan
Kyrgyzstan	Mr. Jambulbek Jumagulov – Head of the Talas Region's department of the Ministry of Emergency Situation of Kyrgyzstan
Kyrgyzstan	Ms. Jyrdyzkhan Ashimbaeva – Chief Specialist of the technical policy and investment, State Committee for Water Management and Reclamation of Kyrgyzstan
Kyrgyzstan	Mr. Azat Biymyrzaev – Expert of the department of foreign economic cooperation, MFA of Kyrgyzstan
Tajikistan	Mr. Anvar Zoirov – Deputy Minister of Water Resources and Melioration of Kyrgyzstan
Tajikistan	Mr. Bozor Rahmonov – Head Specialist of the hydro meteorological department under the Committee of Environmental Protection under the Government of Tajikistan
Tajikistan	Mr. Murat Aminjonov – Expert of the Scientific-Analysis Institute under the Ministry of Water Resources and Melioration of Tajikistan
Tajikistan	Mr. S. Shafiev – 3rd Secretary of the Department of Information, MFA of Tajikistan
Tajikistan	Mr. Sodik Khisainov – Head of the main department of the development of real sector of the economy, Ministry of Economic development and trade of Tajikistan
Tajikistan	Mr. Abdullo Ismatov – Assistant of the Centre " Monitoring and early warning" under the Ministry of Economic development and trade of Tajikistan
Turkmenistan	Mr. Yanow Pashiev – Senior hydraulic control operation of the Ministry of Water Resources of Turkmenistan
Turkmenistan	Mr. Mohammed Nepesov - Head of the department of the National Institute of Deserts, Ministry of Nature Protection of Turkmenistan
Turkmenistan	Mr. Shiri Shiriyev – Representative of MFA of Turkmenistan
Uzbekistan	Mr. Vokhidjon Akhmadjonov – Deputy head of Department of the balance of water resources and development of water saving technologies, Ministry of Water Resources of Uzbekistan
Uzbekistan	Mr. Kurshid Sadirov – Deputy head of the Centre for Crisis Management, Ministry of Emergency Situation of Uzbekistan
Uzbekistan	Mr. Sergey Klimov – Acting head of hydro-meteorological works, Uzbek Meteorological Service

Uzbekistan	Mr. Ulugbek Abdullaev – 2nd Secretary, MFA of Uzbekistan
Other countries	
Afghanistan	Mr. Mohammad Ibrahim Ghafoori – Deputy director of the department of UN and international conferences, MFA of Afghanistan
Afghanistan	Mr. Mohammad Ibrahim Barakzay – Deputy head of border affairs department, MFA of Afghanistan
International and regional organizations	
CSTO	Mr. Victor Sytkin – Head of department of political cooperation, CSTO Secretariat
EurAsEC	Mr. Murat Musatayev - Deputy Secretary-General of EurAsEC
EurAsEC	Mr. Abaibek Alymkulov - Head of the Department of the Energy Policy and Environmental Affairs
IFAS	Mr. Saghit Ibatullin – Head Executive Committee of IFAS
	Mr. Marat Narbayev – Representative of Kazakhstan in EC IFAS
IFAS	Mr. Murat Bekniyazov - Representative of Kazakhstan in EC IFAS
IFAS	Mr. Mavlon Kazakov - Representative of Tajikistan in EC IFAS
IFAS	Mr. Sanoi Boev - Representative of Tajikistan in EC IFAS
IFAS	Mr. Normukhammad Sheraliev – Representative of Uzbekistan in EC IFAS
USAID	Mr. Michael Trainor - Senior Energy Policy Specialist, USAID Mission for Central Asia
USAID	Mr. Andrei Barannik - Regional Environmental Advisor for Asia
GIZ	Mr. Alexander Nikolayenko - Regional Advisor, « Policy Dialogue, Sustainability and Environment»
EU	Mr. Norbert Jousten - Ambassador, Head of EU Delegation to Kazakhstan
OSCE	Ms. Madina Ibrasheva – National Program Coordinator, Department of economy and ecology, OSCE in Kazakhstan
EDB	Mr. Tulegen Sarsembekov - Deputy head of Technical Assistance Division, Kazakhstan
WB	Mr. Simon Croxton - Senior Natural Resources Specialist
UN agencies	
UN DPI	Mr. Vlastimil Samek – Representative of the UN Department on Political Information in Kazakhstan
UN DPI	Ms. Nazerke Sailaubekova - Public Information Assistant, UN Department on Political Information in Kazakhstan
UNDP	Ms. Natalia Alexeeva – Water program coordinator for Central Asia, UNDP office in Almaty, Kazakhstan
UNDP	Mr. Alexandr Kravchuk - Chief Technical Advisor UNDP/EC Project, UNDP in Kazakhstan
UNWomen	Ms. Damira Sartbaeva - Regional Program Director UN Women Sub-regional office for Eastern Europe and Central Asia
UNEP	Ms. Laura Rio – Environment & Security Initiative Senior Programme Manager ENVSEC, UNEP, Geneva
UNEP	Ms. Ingunn Lindeman – ENVSEC Junior Professional Officer, UNEP, Geneva
UNESCO	Mr. Sergey Lazarev - Director of UNESCO Almaty Cluster Office
UNESCO	Mr. Simon Sargsyan – Program Specialist in Natural Science
UN OCHA	Mr. Mohammad Hamayoon – Information Management Officer

Organizer	
UNRCCA	Mr. Fedor Klimtchouk – Deputy head of UNRCCA, Senior Political Officer
UNRCCA	Mr. Matthew Naumann – UNRCCA consultant
UNRCCA	Mr. Alex Grzybowski – UNRCCA consultant
UNRCCA	Ms. Guncha Muhieva – Water project Assistant
UNRCCA	Ms. Bahargul Rahmanova – Public Information Specialist
UNRCCA	Ms. Bakhit Abdildina - UNRCCA Representative in Kazakhstan
UNRCCA	Mr. Jomart Ormonbekov - UNRCCA Representative in Kyrgyzstan
UNRCCA	Mr. Nodir Khudayberganov - UNRCCA Representative in Uzbekistan

Appendix 2 : Revised draft list of indicators[24]

Section	Quantitative indicators	Qualitative indicators	Source
Water levels and flow	Significant reservoir levels Significant river levels River flow Forecasts for water levels Groundwater levels and trends in trans-boundary aquifers Prognoses for domestic consumption Need, supply and surplus/deficit	Plans for use of water resources	Cawater.info National hydromets
Precipitation and climate	Air temperature figures Precipitation figures Snow melt and cover Sizes of glaciers and trends	Trends and updated information about glacial cover and melt	Hydromets UNDP "Climate risk management in Central Asia" programme
Natural and manmade events and river basin safety	Number of natural and manmade events of various types that have taken place in the reporting period Levels in naturally dammed and high-mountain lakes	Details about significant natural and manmade events in the reporting period Common natural events for the next reporting period Any news on safety of dams and other hydraulic equipment, including Improvement or deterioration of their condition and the impact of natural hazards Status of nuclear waste facilities	Ministries of Emergency Situations Ministries of Water Resources UNECE project?
Hydroelectricity and energy[25]	Data from the Aral Sea basin about electricity production (disaggregated by hydroelectric, renewable and other)	information about energy / electricity shortages progress on hydroelectric infrastructure and transmission line construction	National Statistical Committee Reports Energy Ministries Electricity companies

[24] This is not a definitive list of indicators for the system and will be developed during the on-going process of putting together the prototype and subsequent bulletins.

[25] There was a proposal from one state for this section to be removed, with the qualitative section moved to the Natural and Manmade Events and River Basin Safety information category.

	and consumption	Plans for development of energy	UNDP senior economist website
Irrigation, agriculture and food security	Data about agricultural output and food security Limits on agricultural water use Changes in the amount of irrigated land Expansion of drip irrigation and alternatives that reduce water consumption	Measures taken by governments that impact on their own and neighbours' food security (e.g. export bans, trade liberalisation)[26] Irrigation construction Crop selection and substitution changes.[27] Increased agricultural trade with implications for agricultural water demand.[28]	National Statistical Committee reports Agriculture Ministry reports UNDP Senior Economist reports
Environment and pollution	Levels of salinity, heavy metals, organic pollutants in selected waterways, reservoirs and trans-boundary aquifers. Use of waste water Data on river radiation levels	Sources of pollution Environmental conditions of water catchment areas River bank erosion as it affects international borders	Environment and Water Resource Ministries UNECE-supported "Water Quality in Central Asia" project IAEA "Regional Water Quality Monitoring System" project (as and when it begins)
Local level relationships		Reports of local level disputes that involved disruption of water supplies or tension over water issues Reports of cross-border cooperation at local level concerning water, including the role of basin councils	Government sources Implementing partner sources
Institutional development		Capacity building and educational activities related to water management Reports of development of law, policy and organisations to better	Government sources Implementing partner sources

[26] One state proposes removing this indicator
[27] One state proposes removing this indicator
[28] One state proposes removing this indicator

	manage water supplies.	
Diplomacy and agreements	Updates on cooperation and negotiations between states on water-related issues Agreements between states Development of regional and international law on trans-boundary water management	Government sources