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Collective Action in the Irrigation Sector of Uzbekistan: A Case Study of Water Consumers' Associations (WCAs) in the Karshi Steppe

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Front cover photograph: Karshi main canal (*photo:* Kakhramon Djumaboev, IWMI).

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Contents

Introduction

Water Management Reforms in Kashkadarya Province

Kashkadarya Province plays an important role in the economy of the Republic of Uzbekistan (hereafter referred as Uzbekistan). The province produces natural gas, agricultural products (cotton, wheat, fodder crops, and fruits and vegetables) and raw materials for construction. About 75% of water is supplied by Amudarya River through the cascade of pumping stations. The remaining water comes from Zarafshan River (5%) through Eskianhor canal and 20% from Kashkadarya River and other internal rivers.[1] Prior to the Soviet occupation, the local population in Kashkadarya was primarily engaged in cultivating grain crops and some gardening (Khodjaev and Avazov 2011). Since the late 1920s and early 1930s, due to the overarching political objective of boosting the Soviet Union's economy, the Ministry of Land Reclamation and Water Resources of the Union of Soviet Socialist Republics (USSR) became involved in the expansion of irrigated areas, concentrating on more effective use of machinery and the engineering or rebuilding of different types of irrigation systems. Furthermore, the existing water supply infrastructure and large-scale irrigation systems were developed and improved (Tolstov 1962). As a result of this expansive policy, the irrigated land in the province increased from 63,000 hectares (ha) in 1915 to 514,000 ha in 2010 (Khodjaev and Avazov 2011). This increase was due to a gigantic Soviet hydraulic program through the construction of dams, irrigation canals, pumping stations and various hydraulic facilities and in particular, with Mega project – Karshi Steppe Reclamation Program. The Karshi Steppe is characterized by harsh climatic conditions with frequent water shortages (ibid.).

The process of agricultural water sector reform began with Decree No.320 of the Cabinet Ministries of Uzbekistan in July 21, 2003 "Improvement in the Organization of Water Resources Management". A key element of the reform was to create a two-level system for managing waters – the establishment of Basin Irrigation System Authority (BISA) and the creation of Water Consumers' Associations (WCAs). Annex 1 shows an organizational structure of national water management institutions in Uzbekistan. The Department of Water Resources was established in the Ministry of Agriculture and Water Resources (MAWR) to manage water resources in the country. Under it, 10 BISAs were established, and under each BISA, irrigation system authorities (ISAs) were set up. There are several ISAs in each province and each basin, and there are altogether 63 ISAs.

In place of the previous Kashkadarya Provincial Water Department, which had managed water resources in accordance with the territorial principles, Amu-Kashkadarya BISA was established in 2003 to manage water resources based on the hydrographic (basin) principles. Under Amu-Kashkadarya BISA, five ISAs were established (Figure 1). An organizational structure of Amu-Kashkadarya BISA is provided in Annex 2. As a result of this structural change in water management, some parts of Kamashi, Shahrisabz and Chirokchi districts of Kashkadarya Province were added to the jurisdiction of Zarafshan BISA.

Main responsibilities of Amu-Kashkadarya BISA, which is funded through the Government budget, include: i) operation and maintenance (O&M) of all large-scale water infrastructures; ii) rational use of water resources at the basin; iii) implementation of unified technical policy in the water management sector; and iv) provide reliable water use measurements.

[1] Communication with Amu-Kashkadarya BISA official, June 16, 2016.

In the meantime, main tasks of the ISAs in Amu-Kashkadarya BISA are: i) maintain main canals; ii) prepare water delivery plans to WCAs; iii) ensure rational use of water resources; and iv) provide reliable water measurement tools.

Figure 1. Territories of Irrigation System Authorities (ISAs) in study sites.

Source: Amu-Kashkadarya BISA.

Current Challenges with Water Consumers' Associations

Many Uzbek farmers involved in irrigated agriculture face similar problems that are common to irrigation areas around the world: shortage of water resources, poor management of water, outdated physical assets, high soil and groundwater salinity, lack of effective institutional setup, and imbalance of financial revenues and expenditures. Soon after the independence in 1991, the state could not provide adequate capital to maintain secondary and tertiary water infrastructures. This resulted in low yields and subsequently low incomes for farmers. Meanwhile, the distribution of irrigation water became severely unequal, especially for downstream farmers. Disputes among farmers over water increased. These became a main driving force behind the irrigation reform and forced the Government of Uzbekistan (GoU) to develop new organizations for water management and O&M of irrigation and drainage infrastructures at the on-farm level, in order to sustain irrigated agriculture.

The idea of the collective use of natural resources has been a well-known concept in Uzbekistan for a long time. But it was only in 2000 that the management of irrigation and drainage systems was handed over to farmers within the framework of structural adjustment. In the same year WCAs were established in several provinces of Uzbekistan. WCAs were founded as nongovernmental and nonprofit organizations.

The establishment of WCAs in Kashkadarya Province occurred as early as 2001 in place of liquidated *shirkats* (cooperative farms). The mobilization of farms into WCAs was led by the

Ministry of Agriculture and Water Resources (MAWR), local *shirkat* committees, local mayors' office (*Khokimiyat*), and Amu-Kashkadarya BISA and ISA directorates. By June 2016, about 152 WCAs had been established in Kashkadarya Province, which serve nearly 9,908 farmers, covering 515.34 thousand ha. The largest number of WCAs located in Koson District was 21. Table 1 shows the districts of Guzor, Karshi, Kasbi, and Chirokchi have an equal representation (13 WCAs each).

Table 1. Total number of WCAs and irrigated areas in Kashkadarya Province.

Districts	# of WCAs	Total irrigated area (ha)	Cotton (ha)	Wheat (ha)	Other crops (ha)
Guzor	13	35,092	10,000	9,000	16,092
Dehkonobod	1	2,915	0	0	2,915
Karshi	13	50,736	16,300	14,500	19,936
Koson	21	74,096	24,500	18,500	31,096
Kamashi	8	34,979	8,800	10,500	15,679
Kitob	2	20,244	0	4,000	16,244
Mirishkor	15	62,736	22,300	22,700	17,736
Muborak	9	35,078	9,950	9,00	15,628
Nishon	19	57,549	21,400	18,700	17,449
Kasbi	13	50,563	21,900	14,500	14,163
Chirokchi	13	30,555	10,000	8,800	11,755
Shahrisabz	10	26,156	5,050	6,100	15,006
Yakkabog	15	34,649	7,000	8,200	19,449
Total	152	515,348	157,200	145,000	213,148

Source: Amu-Kashkadarya BISA, June 2016.

The main responsibilities of WCAs in Kashkadarya Province include: i) ensuring reliable water distribution among farmers; ii) determining and collecting Irrigation Service Fees (ISF); iii) resolving disputes that concern water use and management of irrigation and drainage systems in an appropriate, transparent, and democratic manner; iv) maintaining, rehabilitating and improving irrigation and drainage system in the WCA operational area; and v) monitoring water use based on the agreed-upon delivery schedule.

According to the statistics received from the Amu-Kashkadarya BISA in 2016, on average each WCA covers 3,300 ha, varying significantly among WCAs (Table 2). For instance, the largest

WCA in Kashkadarya Province covers 20,000 ha, located in Kitob District. In contrast, the smallest WCA covering 50 ha is located in Nishon District.

Table 2. Distribution of the numbers of WCAs in Kashkadarya based on their sizes.

# of WCAs	Small (<2,000 ha)	Mid (2,000-4,000 ha)	Big (>4,000 ha)
152 (100%)	41 (≈27%)	74 (≈49%)	37 (≈24%)

Despite the fact that the establishment of WCAs in Kashkadarya was introduced about a decade ago, they are still not well accepted by the resource users (e.g., individual farmers) and are in a weak condition. There is not yet a comprehensive law specifically to cover WCAs. Furthermore, the WCA statute highlights the importance of maintaining on-farm irrigation and drainage systems through ISF collection. However, most WCAs are still not able to take full responsibility, organize collective action, and generate sufficient investment for the maintenance of irrigation systems. Outdated and dysfunctional canals caused farmers to abandon their agricultural fields, eventually leading to the increase of rural poverty. Improper condition of drainage systems severely affected agricultural production and resulted in the secondary soil and water salinity. This has caused health problems in the province.

Study Objectives and Hypotheses

The Government of Uzbekistan is highly interested in improving water resources in the southern provinces of Uzbekistan, especially in the Karshi Steppe, where irrigation water is lifted up to 130-140 m using pumps. Electricity cost is thus an additional burden for the Uzbek government. The main aim of this study is to describe the problems of WCAs and farmers, living in Karshi Steppe of Kashkadarya Province with regard to water resources management and learn about their opinions on which actions need to be taken for better water management at WCA level. As such, the study plans to contribute to reducing electricity cost for the government and local farmers.

The specific study objectives include:

- to describe existing main problems and causes related to water resources management on the WCA and farm level;
- to determine social and institutional problems of WCAs and their members in selected WCAs of Karshi Steppe;

Since the main objective of this study is to learn water resources challenges and potential solutions for better collective action among WCA members in Karshi Steppe of Kashkadarya Province, the study includes the following hypotheses:

- A WCA chairman with a high level of educational background in agricultural and water management has good technical and professional skills to overcome any challenges related to water management in the territories of the WCA; and
- Closeness to the location of common pool resources (i.e., irrigation canals) to the main canals allows better access to irrigation water and creates satisfaction among WCA members, which improves overall collective action among farmers and thus, leads to better water management.

Theoretical Background

In her book "*Governing the Commons*", Ostrom (1990) emphasizes that most natural resource systems used by multiple individuals are classified as common pool resources (CPRs). CPRs (e.g., irrigation systems, groundwater basins, grazing lands, and forests) are natural or human-created resource systems. CPRs generate finite quantities of resource units (such as water) and one individual's use of the units reduces its availability to others (irrigation water consumed by one farmer's field cannot be consumed by someone else) but there is difficulty in excluding access (irrigation water flows through many farmers' fields). In other words, nonexcludability and rivalry concepts are applied to gain a better understanding of the use of the CPR concept. Here, she specifies that it is difficult to restrain people living in the society to limit benefits from using the system but when multiple users are involved, there begins rivalry. Table 3 provides characteristics of different goods.

Table 3. Characteristics of goods or resources.

	Excludability	Nonexcludability
Rivalry	Private goods (e.g., food, private cars)	Common goods (common pool resources) (irrigation systems, groundwater basins)
Nonrivalry	Club goods (golf courses, cinemas)	Public goods (knowledge, fresh air)

Source: Adapted from Theesfeld (2005: 46).

Meanwhile, Hardin (1968) described how each user of the commons would act to maximize their benefits from the open access while the costs of their use were shared between all users. As a result, the commons would be subject to overuse, overexploitation, and this would eventually lead to resource degradation. However, the CPRs are not always open to access. There exists a common property regime where shared ownership and rules dictate about each resource, user's access and use of the resource (Quinn et al. 2007). When rules are adequately enforced through common property regimes, CPRs are not always subject to open access and degradation (Cousins 2000; Quinn et al. 2007). In response to some suggestions that private property is the most efficient form of ownership (Simmons et al. 1996; Demsetz 1967) or state property is the best form of property regimes (Ophuls 1973), Ostrom (2000) investigated the possibility of appropriators (resource users) to organize themselves in a group and act collectively. When rules are created in the group which specifies rights and duties of participants, the group can effectively provide a public good for those involved. Anyone who may be involved in the group can effectively benefit from this public good (ibid.). This theoretical assumption was applied in many different countries (such as India, Nepal, Bulgaria, Uzbekistan).

In the case of this study, for instance, strong push by the government and donors to establish user groups and collectively manage the CPR (i.e., irrigation systems) at the farm level took place soon after the dissolution of the Soviet Union. Growing problems with on-farm irrigation water management were considered to be a major reason for initiating the establishment of WCAs to manage the system through collective action (Abdullaev et al. 2010). During 1990 and 2000, the government experienced difficulty in providing adequate funding to maintain on-farm irrigation systems and thus, significant deterioration of the system took place. In the initial stage, the

government and donor community helped with mobilization and provided some financial support. However, despite the fact that most WCAs received these initial supports in the setup of WCAs, they were not able to provide sufficient support to develop WCAs into effective governance that can provide local public goods. WCAs were not able to ensure equal water distribution for numerous members and generate sufficient budget to maintain on-farm irrigation systems. As a result, most WCAs at present are not able to mobilize sufficient cash for maintaining the system, have difficulties of managing water within their boundaries and are suffering from weak management and governance structures, which are notorious issues attributed to the top-down approach to collective action (Olson 1965; Hardin 1968).

Skills of WCA Chairman

After a wide range of discourse that took place among scholars for sustainable CPR management, each set out conditions and factors that they believed to be decisive in sustaining the CPR. These theoretical assumptions were derived from different research findings across the globe. For instance, Wade (1987) determined sets of factors - *the resources, the technology, relationship between resources and user group, user group, noticeability, relationship between users and the state group size, clear boundaries, and ease in monitoring and enforcement* – that may lead to successful management of shared natural systems.

Ostrom (1992) suggests the attributes of the resource (i.e. *feasible improvement, indicators, predictability, and spatial extern*) and of the appropriators (i.e., *salience, common understanding, low discount rate, trust and reciprocity, autonomy, and prior organizational experience and local leadership*) that can increase the likelihood that self-governing associations will form and survive for a longer period. Achievement of sustainable resource use requires that one draws on cultural endowments and their knowledge of local resources to find innovative solutions that fit local conditions (ibid).

Given this theoretical assumption and the findings from Zavgorodnyaya (2006) who carried out research on WCAs in Uzbekistan, the most appropriate factor that influences the success of WCA is leadership skills of a WCA chairman. She concluded that when the chairman is educated and has vast experience in the area of irrigated agriculture, its success is most probable (ibid.). This was also confirmed by the research findings of Hamidov et al. (2015). Therefore, this study employs the hypothesis that when a WCA chairman has a high educational background in the area of agriculture and water resources, then there is a great chance that the WCA becomes successful. The selection of WCAs for conducting qualitative interviews included this hypothesis.

Importance of Canal Location

In the meantime, additional research conducted by Baland and Platteau (1996) showed that achieving successful cooperation among a group of members for CPR management is possible under the following conditions: *external provision of appropriate economic incentives, smaller user groups, closeness of CPR location to the main resource source and the group, homogenous groups, well-defined external sanctioning system, past experience of successful cooperation, and good leaders.*

It should be noted that proximity of common pool resources to the main water source and the group seems to have a positive impact on improving cooperation among WCA members. This improvement may eradicate the problem of water shortage as well as any potential conflicts over water allocation. In the condition of Kashkadarya Province, where water is scarce, WCAs located at the beginning of the canal tend to enjoy water abundance and have less contribution to the downstream users. As a result, downstream users are usually prone to water shortages

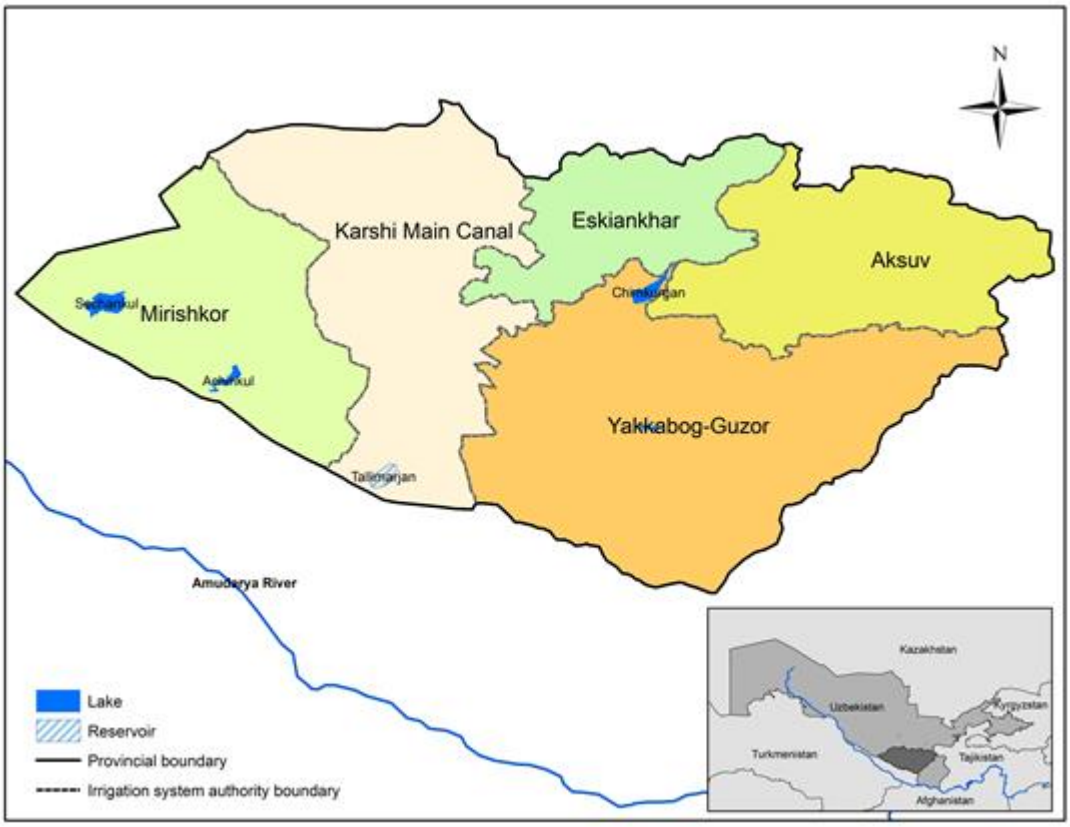
and experience disputes over water allocation. The study employed this hypothesis and tested it in the field condition, meaning that the selection criteria included WCAs located at the beginning of the canal as well as at its tail.

Methodology of the Study

Location and Climatic Conditions of Kashkadarya Province

In order to conduct qualitative group interviews with WCA members, the field visit took place during the period of June 16-18, 2016. The study areas are located in Karshi, Kasbi, Koson, Nishon, Mirishkor, Muborak districts of Kashkadarya Province, southeastern part of Uzbekistan, in the lower reaches of Amudarya River, which supplies irrigation water to the entire Karshi Steppe (Figure 2). In the east it borders with the Republic of Tajikistan, in the south with the Republic of Turkmenistan, in the north with Samarkand Province, in the west with Bukhara and Navoi Provinces, and in the southeast with Surkhandarya Province of Uzbekistan. The province covers an area of about 28,570 km^2 and approximately 700 km south of what is left of the Aral Sea. Total irrigated area of the province is estimated at 514.9 thousand ha. The total population is about 3 million of which about 60% live in rural areas and depend on irrigated agriculture. The province consists of 13 districts plus the city of Karshi as an administrative center.

Figure 2. Location of the study province and its irrigated areas.



Source: Zafar Gafurov, IWMI

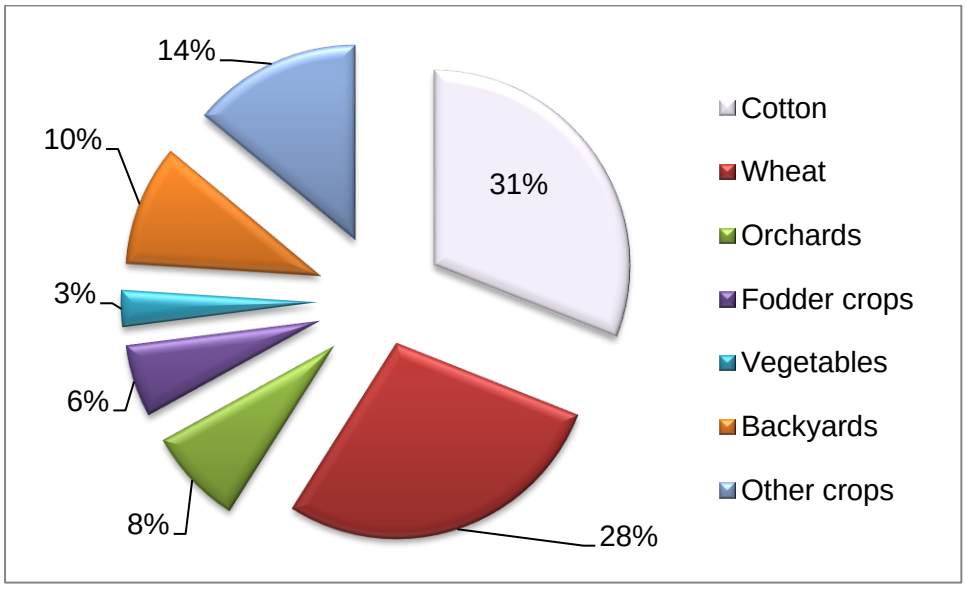
The Kashkadarya Province is characterized by diverse ethnic population (e.g., Uzbeks, Tajiks, Turkmens, Russians, Tatars, etc.), frequent water shortage, salinized soil and groundwater, and geographical proximity to the Aral Sea. The province has a typical arid continental climate with cold dry winters and very hot summers. The average annual temperatures range from 1 to 30 ^{o}C. The coldest month is January (-2 ^{o}C). The hottest month is July with an average temperature above 30 ^{o}C (Khodjaev and Avazov 2011). The mean annual precipitation is about 245 mm whereas the evaporation is over 1,240 mm, i.e., the deficit of about 1,000 mm. Annual

wind conditions of the area are characterized by dominating northwestern winds. However, in the cold period (October to March) southeastern winds predominate. The total annual duration of snow-free period is about 210 days; only 16 days are reported to be snow-covered (ibid.). Thus, large-scale irrigation for cultivated crops is essential for this area.

Current Conditions of Irrigated Agriculture in Kashkadarya Province

The major water consumer in Kashkadarya Province is agriculture. Annually, more than 514,000 ha of land are irrigated in the area. The major crops in the province are cotton, winter wheat, orchards, and fodder crops. Based on the data received from Amu-Kashkadarya BISA on the 2016 crop allocation plans for agricultural fields, around 31% of cultivated land in Kashkadarya Province is to be devoted for cotton, about 28% for wheat, 8% for orchards (various fruit trees, grapes, and mulberry), around 6% for fodder crops (e.g., alfalfa, barley, maize), and the remainder for vegetables, household backyards and other crops (Figure 3). There are two crop-growing periods in Kashkadarya Province: vegetation period (April to September) and non-vegetation period (October to March). The major irrigation practices take place during the vegetation period, and light irrigation and large-scale maintenance of water infrastructure are carried out during the non-vegetation period.

Figure 3. Distribution of crop pattern in irrigated areas of Kashkadarya.



Source: Amu-Kashkadarya BISA

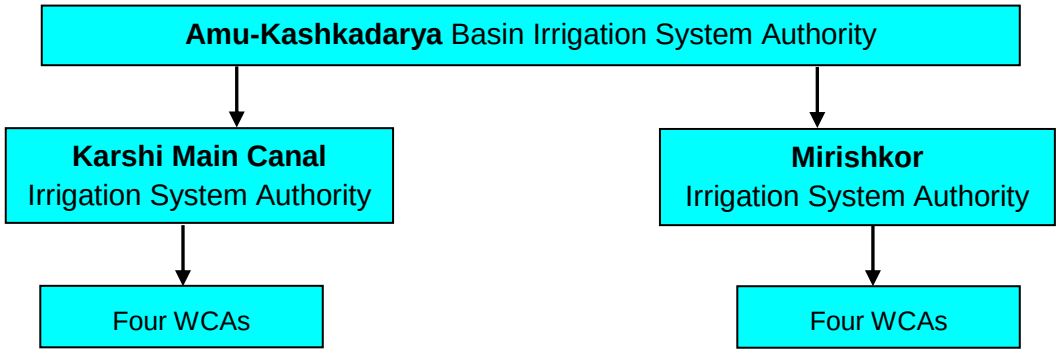
As mentioned earlier, water from the Amudarya River is lifted over a height of 130-140 m by seven pumping stations and discharged into the Talimarjan water reservoir. The conveyance capacity of pumping stations is estimated to be 175-195 m^3/sec (Khodjaev and Avazov 2011).

Selection of Study Cases

Selecting WCA cases from a large collection is an integral task. Most people from the social science field suggest different strategies on how the scholar can decide picking a “good” case (or cases) out of large-N cross-cases. Here, “good” means those that best help us understand the cases. In this study, the main strategy included the most similar cases design (MSCD). This

approach basically assumes that selected cases share similar characteristics across all background conditions that might be relevant to the outcome of interest but vary in explanatory conditions and in their outcome. The approach is very helpful and is rather easier in selecting cases because it compares similar objects, keeping many irrelevant and confusing variables in the investigation as constant. Basically, it seeks to answer why the outcome is different between the subjects in spite of sharing similar characteristics. Note that all selected WCAs are located within the Amu-Kashkadarya BISA in Karshi Steppe (Figure 4).

Figure 4. Organizational structure of the selected WCA cases.



Given some theoretical considerations (such as educational background of a WCA chairman and proximity of CPR to the main water source, and the review of various literature (Theesfeld 2005; Zavgorodnyaya 2006), the study team tried to cover these aspects in choosing WCA cases in Karshi Main Kanal ISA and Mirishkor ISA, representing six districts (Karshi, Kasbi, Koson, Nishon, Mirishkor, Muborak) of Karshi Steppe. Secondary data obtained from the Amu-Kashkadarya BISA are used during WCA selection for carrying out qualitative interviews.

Each WCA chairman's literacy and his/her work experiences are reflected in the selection criteria. To be specific, we randomly selected one WCA with the chairman who completed the higher degree with water management specialty and another with the secondary degree with no water management background. We assumed that the chairman with water management specialty, using his/her knowledge and experiences, can overcome any challenges with regard to water management at the WCA.

The following steps were followed to select eight WCAs for this study: In the first step, using an MSCD approach, two Irrigation System Authorities (ISAs) subordinated to the Amu-Kashkadarya BISA were selected which share geographic borders with each other (i.e., Karshi Main Canal and Mirishkor ISAs) as well as sharing relatively similar climatic characteristics. In accordance with the skills of a WCA chairman, we selected all WCAs as chairmen that had higher education with a background on water management. Here, we randomly selected one WCA from each ISA to conduct detailed interviews (Zargar Tong Yulduzi WCA from Karshi Main Canal ISA and Turkiston WCA from Mirishkor ISA). We again randomly selected one WCA from each ISA whose chairmen had no higher education background (M.Murot WCA from Karshi Main Canal and Olovhon Farhod WCA from Mirishkor). In the last step, the team obtained irrigation system schemes from Amu-Kashkadarya BISA for both ISAs in order to identify WCAs located at the head and tail of main canals (Annexes 3a and 3b). With the help of local Amu-Kashkadarya BISA officials, the team selected appropriate WCAs that respect the criteria. Thus, Kuhnasoy Kashkadarya and Muglon Obi Hayoti WCAs were selected from

Main Karshi Canal, and Chashmai Mirob and Tuychi Ogli Mamurjon WCAs represented the Mirishkor ISA. All selected WCAs are located in the Karshi Steppe and represent six districts of Kashkadarya Province. The list of selected cases is presented in Annex 4.

Empirical Methods: FGDs and Expert Interviews

The empirical work was based on the qualitative interviews. A semi-structured interview format was developed for conducting qualitative study (see Annex 5 for the semi-structured interview format). Selected WCAs were invited for the Focus Group Discussion (FGD), a method used as part of the group interview. Altogether, eight WCAs from two ISAs of Kashkadarya Province were subjected for the FGD (Annex 6). During the selection of group participants (i.e., WCA members), the following basic criteria were respected: i) the average number of participants in the group was between 4 and 6[2]; ii) a moderator had an assistant for recording the discussions and keeping notes; and iii) the group was relatively homogenous (age, education, profession). Annex 7 provides selected photos from the fieldwork.

Analytical Tools for Data Analysis

This work was carried out by a WCA expert with support from a local WCA specialist. During the FGDs and individual expert interviews, audio recording was used when respondents agreed. These FGDs and interviews were then transcribed and, similar to the field notes, were entered into a computer-assisted qualitative data analysis software. Atlas.ti scientific software (version 6.2) was used for coding and interpreting the results. A coding structure was developed based on the empirical findings and was interpreted to make sense of the data. Table 4 shows the category (taxonomy of activities) that was coded.

Table 4. List of categories extrapolated using Atlas.ti software.

Coding scheme	Code definitions
Household|backyard|community	No support by households
Canals|lotok|	Irrigation canals in poor condition
Conflict|dispute|clash	Frequent conflicts over water use
Drainage|waterlogging|salinity|fertility	Improper drainage system
Tap|drinking|health	Absence of drinking water sources
Scarce|shortage	Acute water shortage
WCA|excavator|crane|machinery	Lack of agricultural machinery
Electricity|pumps|UNS	High pumping cost
Debts|salary|ISF	Lack of funding to pay WCA staff

[2] Some WCAs had more participants during the FGD than anticipated.

Description of Study Findings

This chapter begins with an illustration of the existing challenges and opportunities facing the selected WCAs; a case study of two WCAs (Muglon Obi Hayoti and Chashmai Mirob) will be presented here, focusing on a detailed review of their performance. Moreover, the discussion on existing problems related to water resources management on the WCA and farm levels, derived from qualitative interviews will also be analyzed. The description about potential causes behind these problems in the investigated eight WCAs is presented.

Characteristics of Selected WCAs

As described earlier, four WCAs from each Karshi Main Canal and Mirishkor ISAs, subordinated by the Amu-Kashkadarya BISA, were selected as part of this study to undertake a detailed review. Altogether, eight WCAs were chosen. All selected WCAs were invited for the Focus Group Discussion (FGD). A brief introduction and existing challenges of the two selected WCA cases (one from each ISA) are discussed in detail in the following section. Attributes of all eight WCAs in the study province are presented in Tables 5a and 5b.

An example of Muglon Obi Hayoti WCA

Muglon Obi Hayoti water consumers' association is located in Kasbi District and was established in February 2007. In 2010, the WCA was reestablished on the basis of hydrographic principles and registered at the Ministry of Justice of Uzbekistan as a nongovernmental organization (NGO)[3].

According to the data received from the Amu-Kashkadarya BISA, by 2007, the WCA comprised 310 members mostly oriented to cotton-wheat agricultural practices. Due to the government's 2008, 2009 and 2010 land consolidation policies to benefit from an economies-of-scale, the number of members has sharply declined and as of June 2016, the WCA contains 127 members. The WCA has 16 members of staff: a chairman, an accountant, an inspector, three water masters (*mirab*), and 10 pump controllers.

This particular WCA has 4,887 ha of irrigated land, of which 58% are devoted to cotton production, about 34% for cultivating wheat, and the remaining lands are dedicated to other crops (such as orchard and fodder). According to the chairman, the WCA decided to charge ISF on a per ha basis. The total amount of expected costs to distribute water to individual farm's territories was divided into the total number of ha that WCA serves. Since it is yet to install individual metering for each farm, the decision was made on a per ha basis and amounted at 36,000 UZB Soum[4] per ha. The WCA also provides irrigation water for 16,000 households' backyards for no charge. Households receive water every Sunday and mainly contribute labor for undertaking canal maintenance activities.

In accordance with WCA annual expenditure, which was calculated in the beginning of 2016, WCA members are supposed to contribute about 197 million UZB Soum for irrigation services until the end of that calendar year. As of June 2016, about 22.5 million UZB Soum (approximately 12%) have been collected either in the form of cash or in-kind contribution.

[3] In accordance with the law on NGO, the association's aims should not be targeted towards profit maximizing; instead all incomes or benefits need to be distributed among its members. Most importantly, the association needs to manage its activities independently, without external interventions (Article 2 Law on NGO). Upon the official registration at the Ministry of Justice, NGOs are exempted from certain taxes for three years. This also holds true for farmers within the WUA operational area (Article 90 of the Tax Code).

[4] Local currency in Uzbekistan is called Uzbek Soum (or UZS). 1 USD ≈ 3,000 UZS

Nevertheless, the WCA chairman was rather optimistic for improving the collection rate when WCA members receive their monetary shares[5]. As such, the chairman is adamant that the full amount will be collected.

An example of Chashmai Mirob WCA

Chashmai Mirob WCA is located in Mirishkor District of Kashkadarya Province and was established on 1 February 2006. As was the case with the previous WCA, this WCA was reestablished in 2010 on the basis of hydrographic principles and was registered at the Ministry of Justice of Uzbekistan.

The WCA provides irrigation services to 60 members and has 3,150 ha of irrigated land, mainly oriented to cotton-wheat cultivation. About 45% of total land is used by cotton plantations and a further 45% for cultivating wheat. A small parcel (only 10%) is devoted to other crops, such as gardening and fodder for livestock. Meanwhile, WCA provides water for backyards of 17,000 households.

Despite serving for a big group of farmers, the WCA has only seven employers: a chairman, an accountant, a cleaner, and four *mirabs*. The chairman graduated from the Agrarian University with a higher education degree on agronomy. What is interesting in this WCA is that it hugely benefitted from donor support. According to the chairman, all WCAs located in Mirishkor District received financial, technical and institutional support from the Rural Enterprise Support Project Phase (RESP) II project, funded by World Bank during 2008-2016. As a result of this support, WCAs were able to obtain a motorcycle for the chairman, bicycles for *mirabs*, an electric motor generator, computer, and clothes for WCA staff. Moreover, a demonstration farm has been established where farmers can obtain knowledge with regard to different techniques for achieving water use efficiency. According to the group of farmers, the most important benefit was to receive the WCA office. Farmers praised that they have an office where they can meet and discuss issues related to CPR management.

In spite of the WCA chairman's technical and professional skills, the WCA was not able to improve ISF collection rate, which was estimated at 40%. The chairman noted that five farmers lift water with pumps. Electricity costs are thus an additional burden to those farmers. In order to overcome these challenges, the General Assembly of the WCA decided to calculate ISFs separately from those members using pumps. As such, 34,000 UZB Soum/ha were declared to be for members who do not use pumps and 16,500 UZB Soum/ha for members using pumps. Despite this privilege, out of the estimated 120 million UZB Soum only 48 million UZB Soum were received by June 2016 (about 40%).

Most canals in the territories of this association were of satisfactory quality. However, most of the canals were built during the 1970s and require reconstruction. Generally, the *khashar*[6] method is used to collectively clean irrigation canals. With regard to households, the WCA chairman decides how many km should be maintained by the farmer and by local households. Once the area is divided, a representative of the households regulates canal maintenance activity within the households. The *khashar* is carried out at the same period by both farmers

[5] After harvesting and delivering cotton product to the state, which is usually done during October and November, it may take up to two to three months until all farmers receive their monetary shares for the delivered products through local banks.

[6] *Khashar* means social labor and it is an action that calls on the local community to collectively construct, repair, and clean canals and structures. This institution has survived to date and many communities still practice it throughout Uzbekistan. Even though it is on a voluntary basis, in practice *khashar* is obligatory for all water consumers and those who refrain from participation are generally charged or denied access to water (Rakhmatullaev et al. 2003).

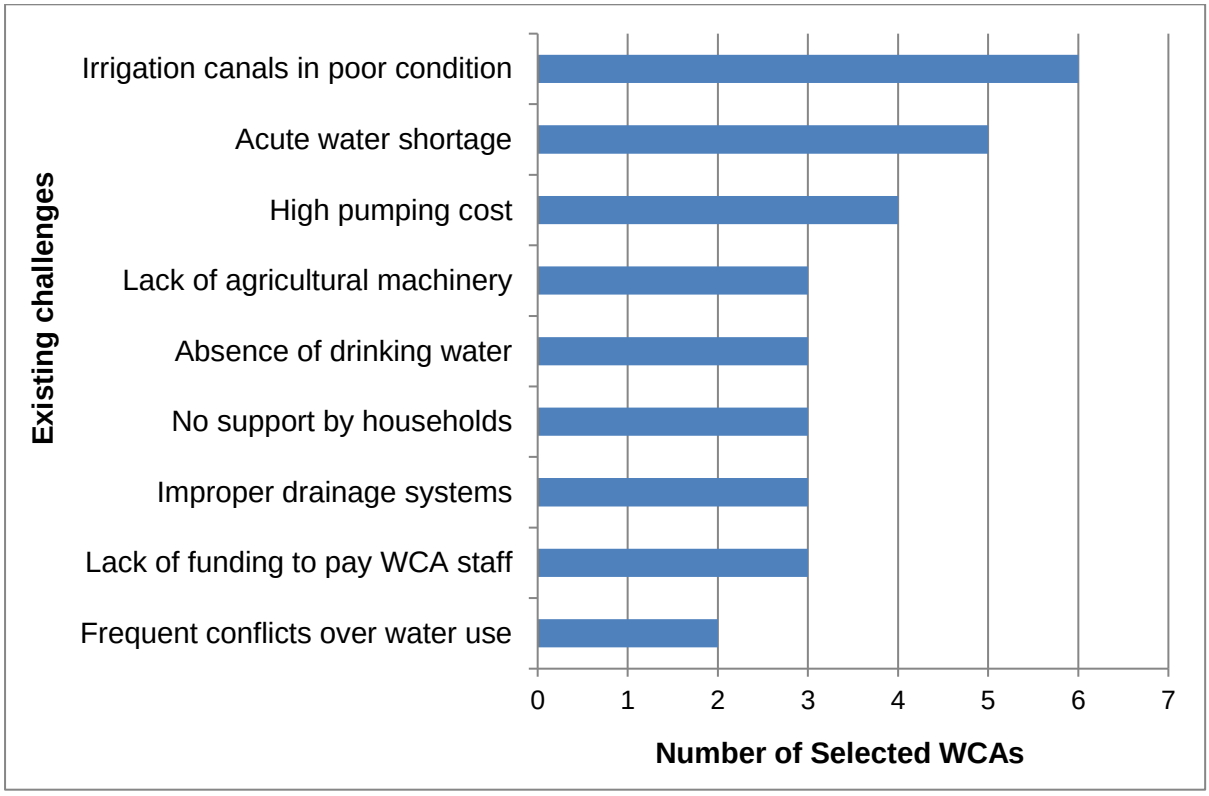
and households. Households do not contribute to the ISF and are thus obliged to mobilize the labor forces for maintenance. According to the discussion with the WCA officials, most households and farmers are rooted in the area and thus, collective action for CPR management is easier. Almost 70-75% of households can be considered as relatives. Thus, trust is also very high in the WCA command area.

Existing Main Challenges in the Selected WCAs

The empirical findings reveal that WCAs are currently in the period of transition facing numerous challenges. The focus group discussion and individual interviews with WCA members emphasize the importance of maintaining irrigation and drainage canals (Figure 5). In particular, irrigation canals are found to be in poor condition as the canals were built during the 1970s. Excessive water losses, low irrigation efficiencies, waterlogging and soil salinization, and declining crop yields are consequences of deteriorating water infrastructure. For instance, a recent UNDP (2007) study assessed the maintenance level of the irrigation and drainage infrastructure throughout Uzbekistan and concluded that more than 50% of canals require reconstruction or repair. This study reaffirmed that water loss in the system of the selected WCAs amounted to 40-45% due mainly to unmaintained water facilities.

In the case of drainage canals, this problem was found to be less problematic due to the ongoing government project to systematically clean on-farm and off-farm drainage networks. Participants mentioned about a state Amelioration Fund as a cleaning agency. Box 1 below provides information about this Fund.

Figure 5. Number of existing challenges in the selected WCAs, derived from Atlas.ti software analysis.



The Kashkadarya Province generally faces an acute water shortage due to its reliance on an international water source: the Amudarya River. Presently, about 75% of irrigated areas of the province receive water from this river. Due to the transboundary tensions, the province is experiencing unreliable and unevenly distributed water resources. This has a major externality affecting local farmers located in the province who are fully dependent on irrigation water for crop production. There were concerns that due to mismanagement of water resources, tail-end farmers may suffer from lack of water. Participants suggested that WCAs shall actively engage in water management and impose tough sanctions against rule-breaking individuals. During the FGD, it was found that in the 2016 vegetation period, a member of Tuychi Ogli Mamurjon WCA irrigated his wheat field once only. As a result, provision of the quota of wheat was not fulfilled. The main reason for him to blame the area is located in the tail end and the desert zone. The discussion also indicated that water availability was an important factor for improving the ISF collection rate. When farmers achieve high yields that are fully dependent on water availability, then they seem to be willing to contribute to ISF payment, which subsequently increases funding for canal maintenance.

Furthermore, the absence of agricultural machinery in the WCAs for undertaking canal repairs was also frequently noted by WCA members, who believed this to be an important factor currently constraining successful cooperation.

Meanwhile, the absence of access to proper drinking water was also brought forward by WCA members. This issue was raised in three WCAs out of eight. Even though drinking water is not directly related to farm management activities, participants were highly concerned about the deterioration of human health in their territories. Lack of access to basic human needs has led to widespread diseases in the community. Participants emphasized the fact that villagers need to travel 3-4 km every day to bring drinkable water.

Analysis of the focus group discussions further revealed that involvement of households in CPR management was also a commonly discussed topic among the WCAs. Many farmers have been unsatisfied with the ways most local households have behaved when it comes to water withdrawal and canal maintenance. Each rural household might have up to 0.25 ha of household plot (*tomorka*) to use for subsistence agriculture (Veldwisch and Bock 2011). Each local WCA is in charge of providing water to these households for irrigation. But, unfortunately, most households do not support collective action, and they have tried to close water gates serving the entire system and open the gates to their plots. Some of them have been inclined to participate in *khashars*. There was no legal mechanism of forcing households to pay ISFs until the introduction of a new sanctioning mechanism through the Cabinet Ministers' Decree No. 82 of 19 March 2013, which provides more authority for WCAs with respect to legal punishments for cases of free riders among various water consumers (including local households) within the territory of a WCA. However, some WCA members and the chairmen commented, "WCAs or farmers who are in charge of the group of households with water delivery and mobilization of canal maintenance are generally pleased not to impose any monetary charges on local households if they establish an internal discipline for water access and contributions to canal maintenance".

Box 1: Procedure with Amelioration Fund.

The government took the first step of improving the drainage systems with the Cabinet of Ministers' Decree No. 3932 dated October 29, 2007 through the establishment of the Republican Irrigated Land Amelioration Fund, which is allocated to the Ministry of Finance for maintaining and rebuilding large-scale inter-farm drainage systems (big canals, big drainage systems and big pumps) as well as pilot-testing in some provinces to clean, maintain and rehabilitate drainage canals managed by WCAs. In accordance with the Decree, the main source of channeling money should come from: i) the single land tax paid by the rural individuals producing agricultural products; ii) state funds; iii) privileged credits from international financial organizations and international banks; and, iv) various national and international grants. The total amount of the fund exceeded UZS 750 billion (or more than US$ 400 million) for the period of 2008-2012 (data received from MAWR in 2013). Within this timeframe: 1) amelioration conditions of about 1.2 million ha of irrigated lands were improved; 2) severely and moderately salinized irrigated lands were reduced by 81,000 ha; and 3) contaminated groundwater tables were reduced to an acceptable level in 0.8 million ha of irrigated land throughout the country.

The follow-up program on the improvement of irrigated agricultural fields with reference to drainage systems was approved on 19 April 2013 with the President's Decree No. 1958 for the period of 2013-2017. Moreover, the Cabinet of Ministers' Decree No. 39, approved on 24 February 2014, provides specific tasks to be undertaken during the program implementation. Using its centralized budget, the state is active in investing funds in the maintenance and rebuilding of drainage systems, including at the on-farm level.

As can be seen from Figure 5, another major discussion point was lack of funding to pay WCA staff. WCA employers in the field stressed that, when one discusses CPR management in the province, particularly at the on-farm level, it is important to recognize the essence of ISFs as part of the long-term survival strategy of WCAs. For instance, three WCAs asserted that the main reason for impeded WCA development has been lack of payment for irrigation services by the members. In theory, these members (i.e., resource users) should not receive water in due time if they do not contribute such payments. However, according to the WCAs, the social structure is constructed in such a way that, when farmers do not receive water in required amounts to cultivate the quota of state production crops (i.e., cotton and wheat), they directly communicate with higher authorities. As a result of external interventions from these higher authorities, WCAs are then forced to provide water without respecting their own internal rules requiring payment before water is delivered. So, unless legal mechanisms towards rule-breaking individuals are properly enforced, it will be difficult to achieve long-term functioning of WCAs.

Potential Causes for the Problems

Based on the previous section, it can be concluded that the roots of the problem lie in three sections: technical, institutional, and financial.

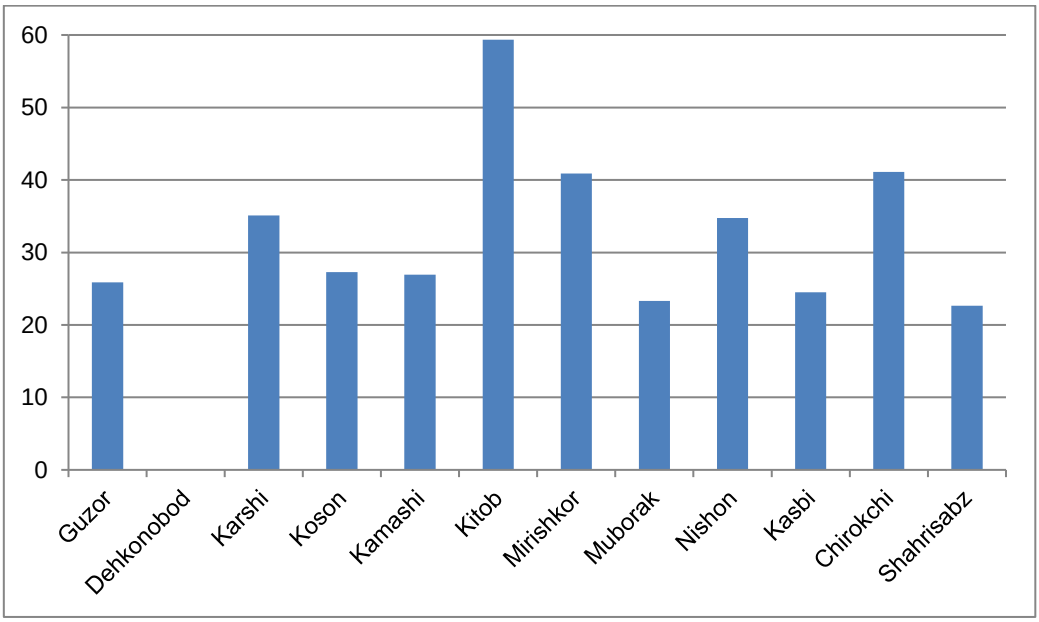
After the breakup of the Soviet Union, the Government of Uzbekistan could no longer invest in the maintenance of irrigation and drainage canals. Most canals were built during the Soviet era but needed regular investments in the maintenance. This lack of attention left many infrastructures in critical conditions. As a result, frequent water shortage and increase of

salinity are currently notorious phenomena that are hampering crop productivity in Kashkadarya Province. Bucknall et al. (2003) reported high silt content in the Amudarya River (up to 6 kg of silt and sand per 1 m^3 of water), which requires constant canal maintenance. However, many water facilities in the basin are currently silted up. In Kashkadarya conditions, on average, 3-4 times of canal maintenance activities are needed compared to 1-2 times a year in other provinces of Uzbekistan. About 40-45% of water from on-farm irrigation channels is lost each year due to poor conditions of irrigation and drainage systems.[7] Rehabilitation of these canals requires significant investments and most importantly, ownership rights for these canals will be clearly defined.

Added to what was stated by experts, the study shows that most WCAs lack a proper institutional background to improve farm management and achieve good governance. The WCA officials have limited authority and knowledge with respect to water distribution. Internal meetings with WCA members are held infrequently. They literally do nothing and are incapable of collecting ISFs. Most participants propose to support WCAs by means of purchasing agricultural machinery (such as excavator and crane) but are silent when it comes to invest in spare parts. It is important to keep investing into capacity-building activities and pushing for a comprehensive legal and regulatory framework for WCAs.

Financial sustainability of a WCA is the cornerstone for improving farm management in Kashkadarya Province. The official numbers for ISF collection rate by districts show less promising (Figure 6). Most farmers have least interest to contribute to WCAs and keep this institutional structure. This can be seen from Tables 5a and 5b.

Figure 6. Percentage of ISF collection rate in all districts of Kashkadarya Province by June 2016.



Source: Amu-Kashkadarya BISA, 2016.

[7] Discussion with Amu-Kashkadarya BISA official (2016).

Table 5a. Attributes of selected WCAs in Karshi Main Canal ISA.

Attributes of WCAs	Kuhnasoy Kashkadarya	Muglon Obi Hayoti	Zargar Tong Yulduzi	M.Murot
Date of establishment	01.01.2005	01.02.2007	01.01.2004	01.01.2005
Name of WCA manager	Tirkash Rajabov	Tura Orziev	Abdulla Umidov	Utkir Usmonov
Background of WCA manager	Irrigation University (hydro-technician)	Irrigation University (land user)	Irrigation University (hydro-technician)	Vocational School
Canal location	Head	Tail	Tail	Head
Number of members	72	127	46	37
Membership fee (UZS per ha) – without pump	20,000	36,000	19,000	30,000
Membership fee (UZS per ha) – with pump	20,000	36,000	19,000	30,000
Irrigated area (ha) - cotton - wheat - other crops (orchard, fodder, backyard, etc.)	4,006 1,400 (35%) 1,200 (30%) 1,406 (35%)	4,887 2,861 (58%) 1,657 (34%) 369 (8%)	3,789 1,400 (37%) 1,200 (32%) 1,189 (31%)	2,588 1300 (50%) 1288 (50%)
Total ISF for 2016 (UZS)	52 million	197 million	54 million	53 million
Collected amount by June 2016 (UZS)	21 million	22.5 million	Not available	24.8 million
ISF collection rate	40 c%	12 %	Not available	47 %

Table 5b. Attributes of selected WCAs in Mirishkor ISA.

Attributes of WCAs	Chashmai Mirob	Tuychi Ogli Mamurjon	Turkiston	Olovhon Farhod
Date of establishment	01.02.2006	01.04.2006	01.01.2001	01.01.2005
Name of WCA manager	Imom Avazov	Tuychi Nazarov	Hasan Ruziboev	Akmal Holikov
Background of WCA manager	Agricultural university (agronomist)	Agricultural vocational school	Irrigation university (hydrotechnic)	Vocational school
Location of canal	Head	Tail	Tail	Tail
Number of members	60	84	68	58
Membership fee (UZS per ha) – without pump	34,000	25,000	15,000	22,000
Membership fee (UZS per ha) – with pump	16,500	25,000	12,000	11,000
Irrigated area (ha) - Cotton - Wheat - Other crops (orchard, fodder, backyard, etc.)	3,150 1,400 (45%) 1,400 (45%) 350 (10%)	3,200 1,520 (48%) 1,200 (38%) 480 (14%)	6,461 1,800 (28%) 1,740 (27%) 2,921 (45%)	3,000 1,372 (46%) 1,276 (43%) 352 (11%)
Total ISF for 2016 (UZS)	120 million	56 million	42 million	71 million
Collected amount by June 2016 (UZS)	48 million	19 million	13 million	6.4 million
Collection rate of ISF	40%	34%	31%	9%

Conclusion and Recommendations

This study shows that the development of WCAs is an integral step in the reform of the irrigation management transfer program that is currently underway in Kashkadarya Province. With a decade passed since the initial reforms which reorganized irrigation structure in Kashkadarya, a number of lessons can be learned from the experience:

- Maintaining on-farm irrigation and drainage canals are the foundation for improving land quality and achieving sustainable irrigated agriculture. Particularly, irrigation canals were built during the Soviet period and require massive reconstruction;
- Financing for system rehabilitation to make irrigation networks reasonably functional plays a critical role in increasing farm productivity and thus, farmer income;
- Collecting an adequate amount of irrigation service fees to sustain agriculture is necessary for long-term existence of WCAs;
- Availability of important agricultural machinery and canal cleaning equipment, as a part of the rehabilitation effort, contribute to creating a good environment for profitable agricultural production;
- Trust and communication within WCA play an important role for successful collective action for CPR management. When households and local farmers have been living together and practice irrigated agriculture for a long time, the success is apparent.

Based on the lessons learned from the experience of Kashkadarya Province, the study provides the following recommendations:

1. It is known that Kashkadarya Province faces a daunting challenge with poor conditions of irrigation and drainage systems, specifically at the on-farm level, which exacerbate the existing problem. Irrigation canals are particularly in the stage of collapse. Thus, large-scale investment is needed to improve and reconstruct irrigation canals in the WCA operational area.
2. Despite their positive views about the potential success of any future projects with regard to rehabilitation and reconstruction, participants raised concerns about the carrying capacity of on-farm irrigation canals. These canals are filled up with silts, and high water flow from main canals may result in downstream floods. Most canals were built during the Soviet era and have limited water carrying capacity.
3. Financial sustainability of local WCAs is questionable. WCA employers have not received their salaries for months and chairmen are unable to improve the ISF rate. Having said that, though, chairmen are adamant that the full amount will be collected and salaries of WCA employers paid back.
4. Access to basic drinking water is a prerequisite for human development. The absence of clean tap water has led to various health problems of local people in the study areas. Local communities travel long distances in accessing clean water and spend huge investments. Poor households have given up and use polluted canal water for drinking purposes. It is essential that future investment programs address people's concerns about safe drinking water.
5. Participants were unaware of good agricultural practices and showed reluctance for ISF contribution. The latter was stated particularly in the areas where water was abundant. It is necessary that future projects improve people's views through various workshops and capacity-building activities to improve WCA performances.

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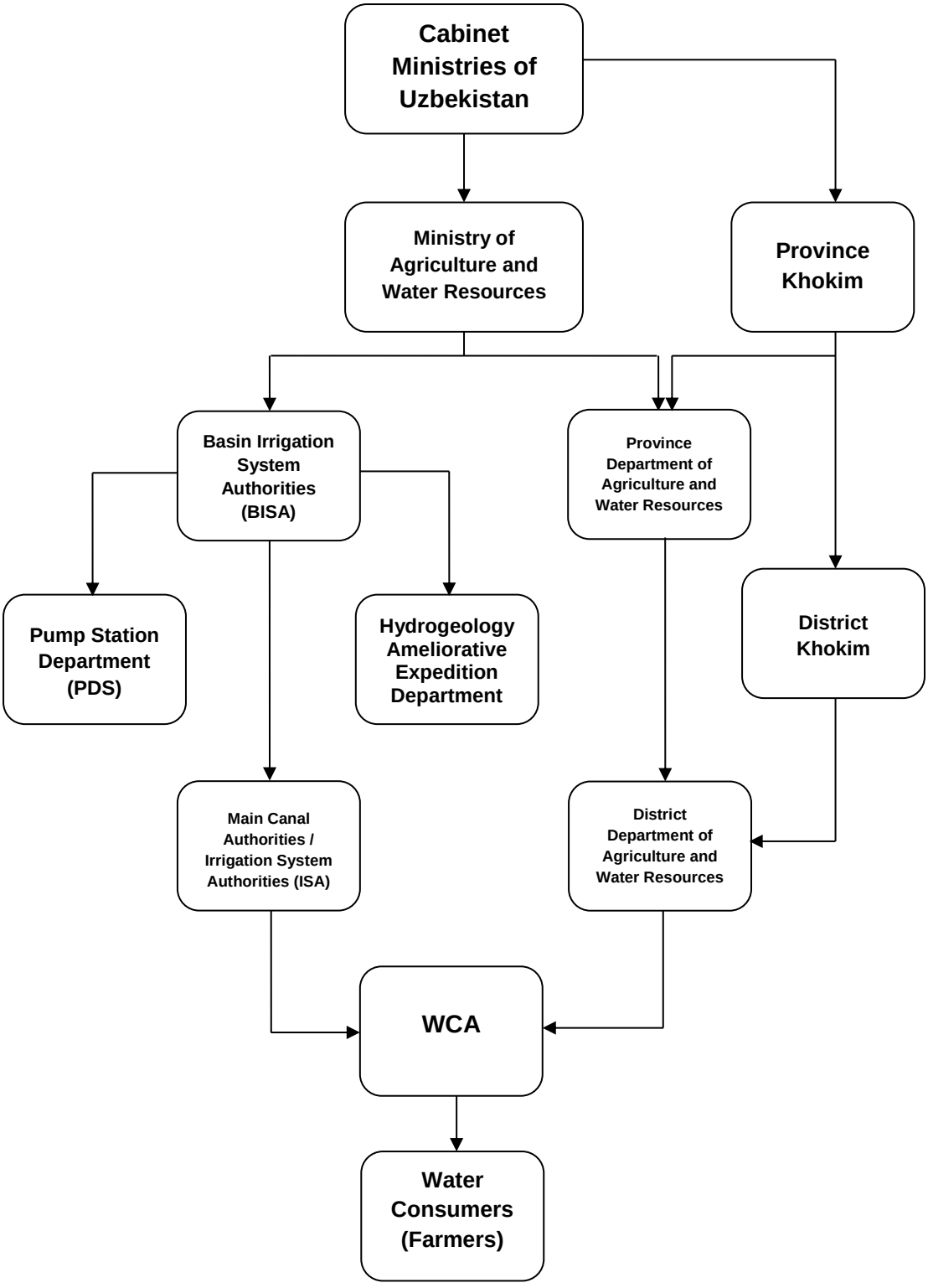
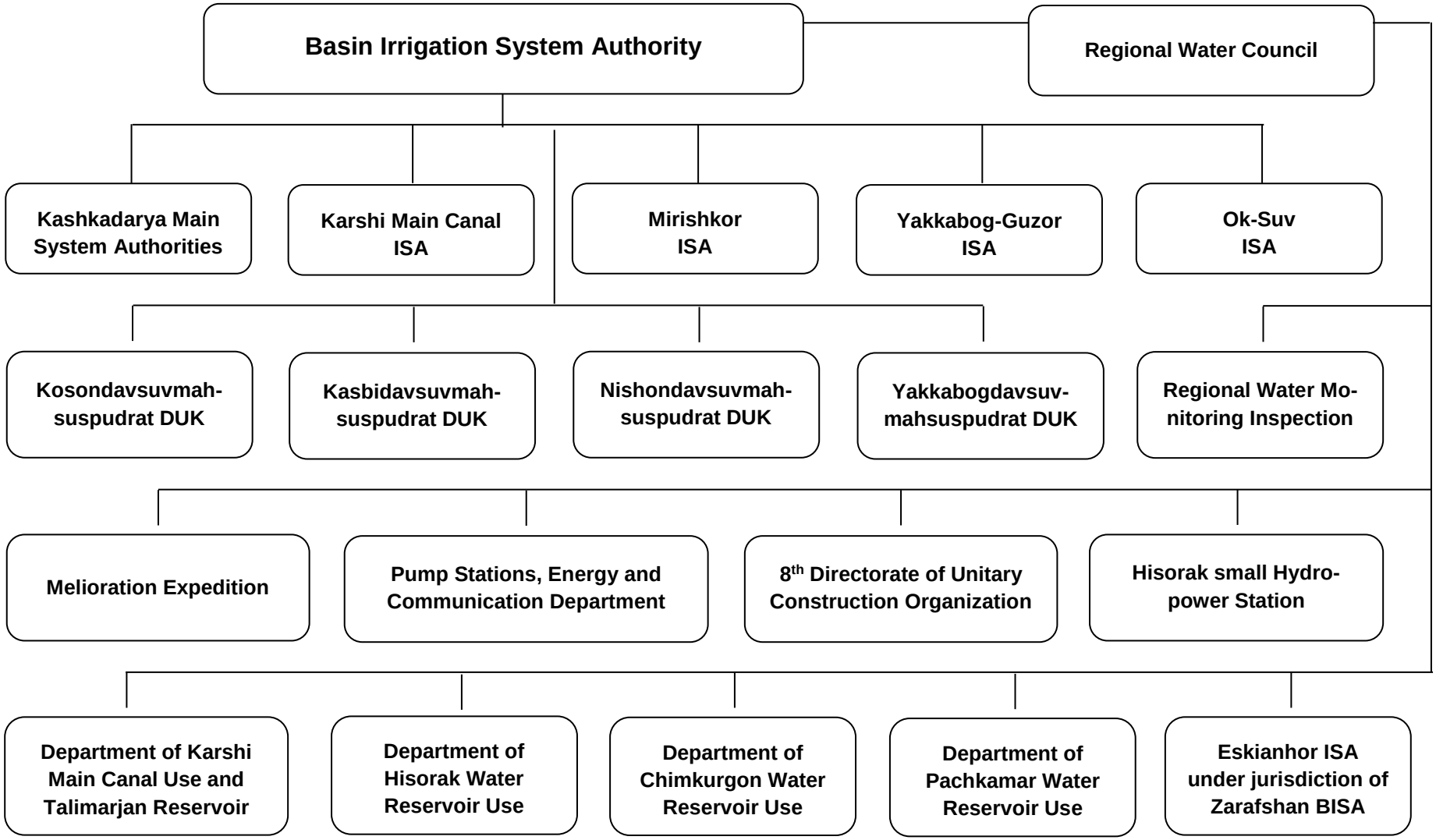
Annexes

Annex 1. Organizational structure of national water management institutions.



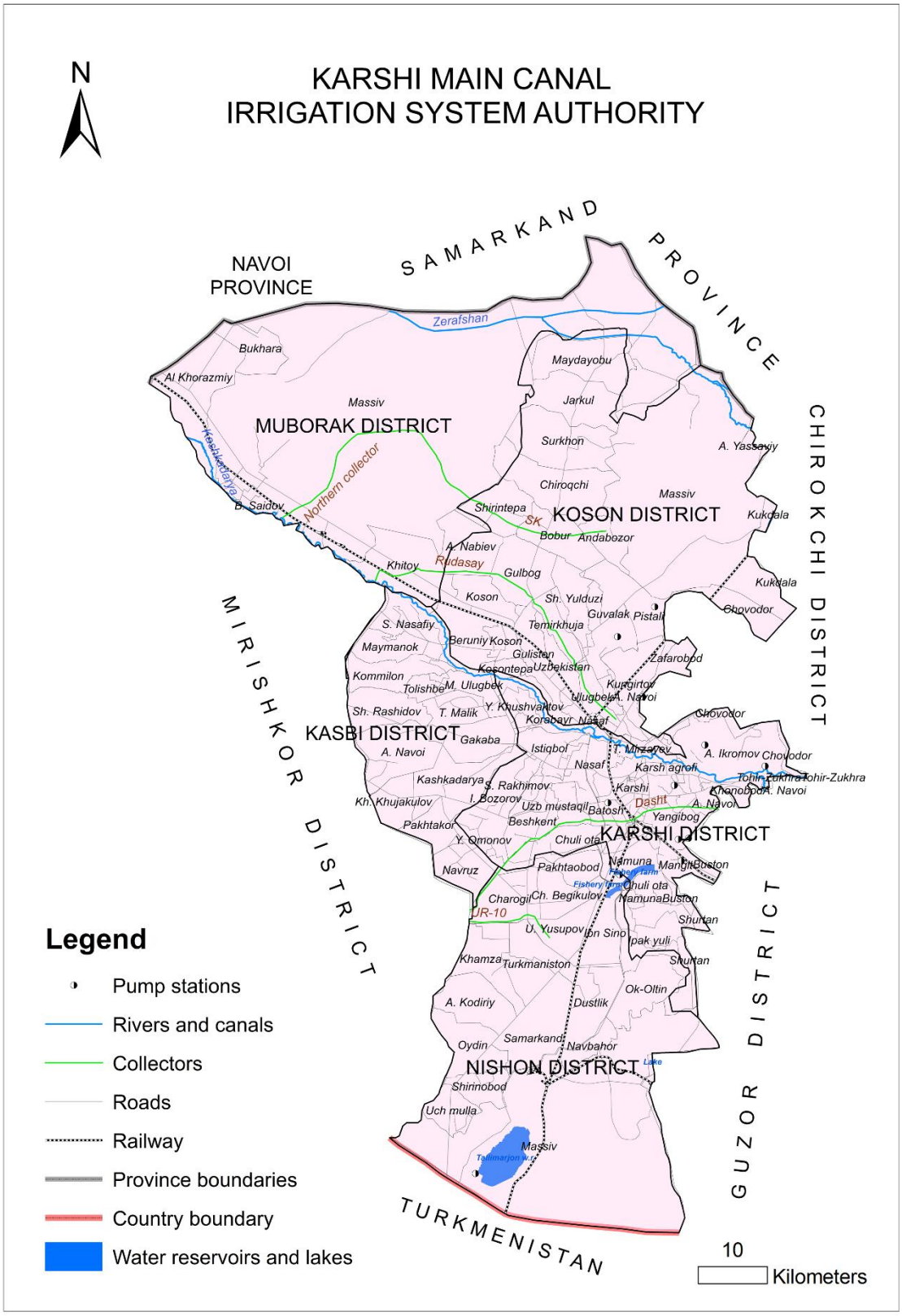
Source: World Bank 2012.

Annex 2. Organizational structure of Amu-Kashkadarya, BISA.



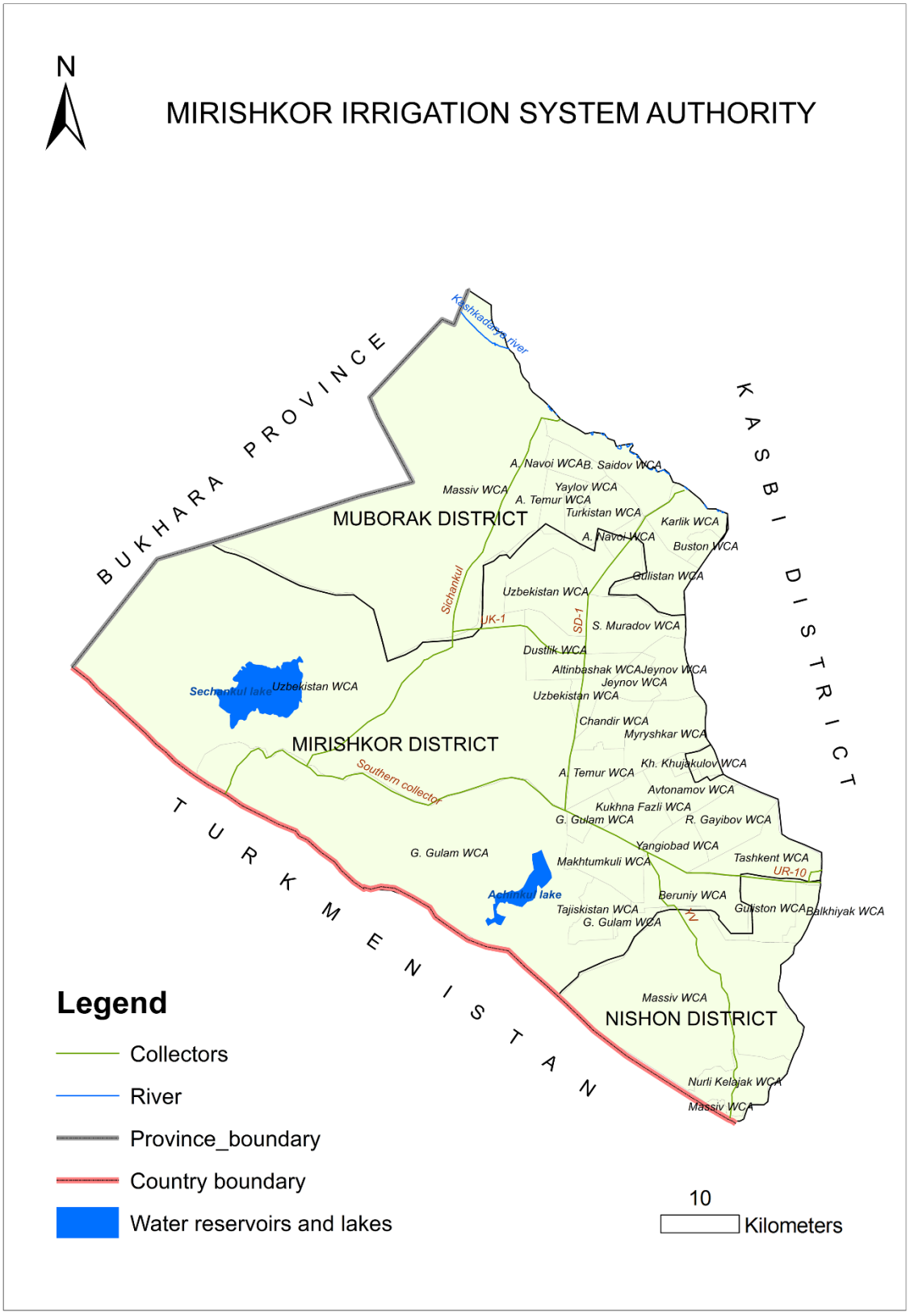
Source: Amu-Kashkadarya, BISA.

Annex 3a. Irrigation system schemes of Karshi Main Canal, ISA.



Source: Amu-Kashkadarya Basin Irrigation System Authority.

Annex 3b. Irrigation system schemes of Mirishkor, ISA.



Source: Amu-Kashkadarya Basin Irrigation System Authority.

Annex 4. Selection criteria and timeline for conducting focus group discussions (FGDs) in Kashkadarya Province.

Name of WCA	Selection Criteria		FGD date
Karshi Main Canal ISA			
Kuhnasoy Kashkadarya	Canal location	Head	16.06.2016
Muglon Obi Hayoti	Canal location	Tail	16.06.2016
Zargar Tong Yulduzi	Chairman's education background	High Education (Irrigation Specialty)	17.06.2016
M. Murot	Chairman's education background	Vocational School	17.06.2016
Mirishkor ISA			
Chashmai Mirob	Canal location	Head	16.06.2016
Tuychi Ogli Mamurjon	Canal location	Tail	16.06.2016
Turkiston	Chairman's education background	High Education (Irrigation Specialty)	17.06.2016
Olovhon Farhod	Chairman's education background	Vocational School	17.06.2016

Annex 5. A semi-structured interview format for conducting FGD.

Focus Group Discussion[8]
for the analysis of water resources management challenges in selected WCAs of Karshi Steppe in the Republic of Uzbekistan

Date and time of interview _____
Name of WCA _____
Name of farm _____
Ethnicity _____
Gender: Male ____ Female _____

Personal Information

1. What is the size of your farm _____ ha

   Cotton _____ ha Other crops: _____ ha
   Wheat _____ ha Other crops: _____ ha

2. Are you a member of the WCA since its establishment?
   ☐ Yes ☐ No

3. Have you worked at the same farm or community before your WCA was created?
   ☐ Yes ☐ No

4. What educational background do you have?

   ☐ High school ☐ Vocational school ☐ University
   ☐ Agricultural ☐ Nonagricultural

5. What is the average number of permanent workers by gender on your farms?
   _____ male
   _____ female

6. How far away is the field located relative to your house? _____ km

7. Apart from direct farming income, what additional income sources do you have?
   ☐ Private business
   ☐ Livestock
   ☐ Other (please, specify) _____
   ☐ None

8. In your opinion, can farmers replace the WCA chairman if he/she does not support members' farming activities?
   ☐ Yes ☐ No

[8] This page will be distributed to each participant to fill it out

Agricultural and Water Reforms

1. During *kolkhoz/shirkat* periods, who was responsible for rehabilitation of water infrastructure (I&D canals, pump stations, wells, etc.)? Who were influential actors for deciding which infrastructure needs to be rehabilitated?

2. How about during the WCA period? Who is currently involved in the decision-making process regarding the infrastructure rehabilitation?

3. Generally speaking, how is the current system functioning when compared to previous *kolkhoz/shirkat* in regard to water infrastructure? What were the problems that you encountered during this transition?

Rehabilitation of Water Infrastructure

4. What is the condition of the degree of water infrastructure in your WCA? Is it satisfactory? If WCA does not deliver its work with respect to infrastructure rehabilitation, where should farmers go for complaints?

5. Who participates in the rehabilitation process at your WCA? Do representatives from basin, irrigation system, or local authorities participate? How does the general structure with infrastructure rehabilitation function?

6. In your view, what are principal problems with rehabilitation of on-farm infrastructure? What roles do ISAs have? Has rehabilitation become a greater problem since reforms?

Challenges with Water Allocation

7. In regard to location, do you consider your WCA at the head of canal or at its end?

8. How was water allocation last season? What happened? Did you get sufficient water? What did you do to get water?

    a. Who is deciding on how much water to deliver? Is it fair? Do farmers have a say?

9. In general, do you think farmers get adequate amounts of water to their farms? What could be major reasons for not getting an adequate amount?

    a. When there's a water shortage, how is the structure designed?

b. In case of violations (i.e., water not supplied) where do users go for complaints? Do they trust courts?

10. In Kashkadarya's condition, how often cab water shortages be observed? In this situation, what do farmers usually do to get water to their farms? Whose decision is decisive when and which farmer gets water first?

Irrigation Service Fee

11. Do farmers pay a WCA membership fee? On what basis is the fee determined?

12. What is the current amount of the payment? Those who use pumps or artificial water streams: do they also have to pay the same amount?

13. Is the fee paid in-cash or in-kind (money value) contributions?

Households, Social Capital, and WCA Chairman

14. What is your general opinion about households? Do they also contribute to the water payment? How about canal rehabilitation?

15. In your WCA territory, approximately how many households exist? How many of them are women-headed households?

16. In case of water shortage, what happens with households? Do they also entitle equal distribution of water as farmers?

17. Do household farms participate in the canal cleaning procedure? How is their participation organized?

18. Do users trust/distrust the chairman/state?

19. In general, what do you think of the chairman? He/she changes frequently? How does trust influence cooperation?

20. How is the chairman elected? Are his/her actions discussed or acknowledged in public? To whom does he/she accountable to?

Annex 6. List of selected cases in Kashkadarya Province.

Name of WCA	District	Total no. of Interviewees
Kuhnasoy Kashkadarya	Karshi	3
Muglon Obi Hayoti	Kasbi	4
Zargar Tong Yulduzi	Koson	9
M.Murot	Nishon	5
Chashmai Mirob	Mirishkor	5
Tuychi Ogli Mamurjon		13
Turkiston	Muborak	4
Olovhon Farhod		6

Annex 7. Selected photos from the fieldwork in the Karshi Steppe.

An active member of Kuhnasoy Kashkadarya WCA (located in Karshi district) has been keen to share his issues on agricultural water management and discuss them among the group of members (*photo:* Kakhramon Djumaboev, IWMI).

Muglon Obi Hayoti WCA (Kasbi district): Farmers were delighted to describe about their concerns and demonstrate how challenging irrigated agriculture in the desert areas (*photo:* Kakhramon Djumaboev, IWMI).

A group of Zargar Tong Yulduzi WCA (Koson district) is discussing the issue of water deficit within their neighborhoods and complaining poor conditions of their irrigation and drainage networks (*photo:* Ahmad Hamidov, IWMI).

M.Murot WCA (Nishon district) members requested to provide more detailed information about the planned future support activities with emphasize to potential benefits for this particular WCA (*photo:* Ahmad Hamidov, IWMI).

Members of Chashmai Mirob WCA (Mirishkor district) showing their activities and existing informational materials on the wall as part of donor support they had received (*photo:* Kakhramon Djumaboev, IWMI).

Farmers belonging to Tuychi Ogli Mamurjon WCA (Mirishkor district) preferred to have Focus Group Discussion outside the WCA office (*photo:* Kakhramon Djumaboev, IWMI).

Discussion with Turkiston WCA (Muborak district) members located in the desert area of Karshi Steppe where water is found to be highly problematic and water lost at on-farm canals are enormous (*photo:* Rashid Toshev, IWMI).

Salinization and poorly-designed irrigation canals in the territories of Olovhon Farhod WCA (Muborak district) caused dissatisfaction among farmers. Tail-end location further limits potential collective action in the WCA (*photo:* Rashid Toshev, IWMI).

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