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Problems of Rural Drinking Water Supply Management in Central Kyrgyzstan

A Case Study from Kara-Suu Village, Naryn Oblast

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Table of Contents

List of Figures

List of Acronyms

ADB	Asian Development Bank
ARIS	Agency of Development and Investment of Communities
CBISSP	Community-Based Infrastructure Services Sector Project
CDWUU	Community Drinking Water User Union
DFID	Department for International Development
DRWS	Department of Rural Water Supply
EECCA	Eastern Europe, Caucasus, and Central Asia
EUWI	Europe Union Water Initiative
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross Domestic Product
GIS	Geographical Information System
GPS	Global Positioning System
GWP	Global Water Partnership
ICWE	International Conference on Water and the Environment
IHP	International Hydrological Programme
INBO	International Network of Basin Organizations
IOM	International Organization for Migration
IWRM	Integrated Water Resources Management
IWM	Integrated Watershed Management
KNU	Kyrgyz National University
KR	Kyrgyz Republic
KRWM	Kochkor Rayon Water Management
MAWRPI	Ministry of Agriculture, Water Resources, and Processing Industry
MDGs	Millennium Development Goals
MOU	Midwife Obstetric Unit
NALSG	National Agency for Local Self Government
OECD	Organization for Economic Cooperation and Development
QGIS	Quantum Geographical Information System
RWSSP	Rural Water Supply and Sanitation Project
SFK	Soros Foundation–Kyrgyzstan

UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFPA	United Nations Population Fund
UN-HABITAT	United Nations Human Settlements Programme
UNICEF	United Nations Children's Fund
USSR	Union of Socialist Soviet Republics
WASH	Water, Sanitation and Hygiene
WB	World Bank
WHO	World Health Organization
WWAP	World Water Assessment Programme

List of used Kyrgyz and Russian proper Names and their Transcription

Aiyl Aimak	Village Community (Administrative Unit)
Aiyl Kenesh	Community/Village Council
Aiyl Okmotu	Administration of Village Community
Artel	Cooperative Associations
Aryk	Trench or Ditch
Bay	Rich Man
Bulak	Spring
GOST	State Standards (Gosudarstvennyy Standart)
Kolkhoz	Collective Farm in the Soviet Union
Kuduk	Well or Standpipe
Kuduk Zhamaat	Standpipe Committees/Self-help Group
Maynap	Excess of Irrigation Water
Moldo	Mullah (Local Islamic Clerics or Mosque Leaders)
Moncho	Bathhouse/Sauna
Murab	Distributer of Water/Local Irrigation Water Master
Oblast	Province (Administrative Unit)
Ogorod	Backyard Garden Plot
Rayon	District (Administrative Unit)
SanPiN	Sanitary Rules, Norms and Hygienic Standards (Sanitarnyye Pravila i Normy)
Saz	Swamp
Som	Unit of National Currency (KGS)
Sovkhoz	State Farm in the Soviet Union
Vodokanal	Municipal Water Utility

Currency Equivalents

Exchange rate on 10/15/2013: 1 Euro (EUR) = 66.02 Kyrgyz Soms (KGS)

1. Introduction

1.1. Object of Research

Kyrgyzstan, like the other Central Asian republics Kazakhstan, Uzbekistan, Tajikistan and Turkmenistan, gained full national independence after the dissolution of the Soviet Union in 1991. Kyrgyzstan is a landlocked country with a size of 198,500 km² (GLAVNOYE UPRAVLENIYE GEODEZII I KARTOGRAFII SSSR 1987:16) and a population of around 5.7 million people in 2013 (NATSIONAL'NYY STATISTICHESKIY KOMITET KYRGYZSKOY RESPUBLIKI 2014:136). The mountain ranges of the Tian Shan cover most of the country. Almost 90 percent of Kyrgyzstan lies more than 1,500 meters above sea level (NATIONAL STATISTICAL COMMITTEE OF THE KYRGYZ REPUBLIC 2011:4).

The Kyrgyz economy was severely affected by the collapse of the Soviet Union and the resulting loss of its former markets (ADB 1997:71; KUDABAEVA 2010:144). Nowadays, after Tajikistan, Kyrgyzstan is the second poorest state of the former five Soviet republics in Central Asia (ADB 2014:271). The deterioration of the living conditions is mainly caused by the substantial reduction or even elimination of social services. They had been previously guaranteed almost everywhere by the state, the quasi-governmental state and collective farms (SCHMIDT 2006, 2013). The deterioration of public utility systems in the 1990s has resulted in declining living standards and an aggravation of the social situation.

Traditionally, agriculture plays a vital role in the country's economy and almost two-third (or 3,762,900 people) of the total population of Kyrgyzstan lives in rural areas. Most of them live in small villages, with an average population of about 1,500–3,000 inhabitants (NATIONAL STATISTICAL COMMITTEE OF THE KYRGYZ REPUBLIC 2010:13). Many of these villages lack adequate water management systems for drinking as well as irrigation water (NEUMANN 2013; ROST et al. 2014). Some very small or remote villages have no artificial drinking water supply system at all (DEPARTMENT OF WATER MANAGEMENT AND MELIORATION 2013:12).

The accessibility to clean drinking water worsened after the dissolution of the Soviet Union and is today one of the major challenges for Kyrgyzstan (WORLD BANK 2009:1; MURZAEV 2010). Especially the condition of the water supply systems in rural areas deteriorated more and more in some areas (DEPARTMENT OF WATER MANAGEMENT AND MELIORATION 2013:12). Whereas most of the urban inhabitants are more or less sufficiently supplied with drinking water, many rural communities lack adequate access to clean drinking water supply (ARIS 2013:13f.; NATSIONAL'NYY STATISTICHESKIY KOMITET KYRGYZSKOY RESPUBLIKI 2013b:31). According to official statistic data, today only 9 percent of the villagers have access to a centralised water pipeline inside the house, whereas 9.5 percent take water from wells and 10.6 percent get their drinking water from rivers, springs or open irrigation channels. Most villagers (70.9 percent) get their freshwater from standpipes in the streets (NATSIONAL'NYY STATISTICHESKIY KOMITET KYRGYZSKOY

RESPUBLIKI 2013b:32). However, the majority of the water supply systems were built in the Soviet period more than forty years ago and most of the infrastructure today is in strong need of repair or replacement (KARIMOV and ABDRASULOV 2004:56; DEPARTMENT OF WATER MANAGEMENT AND MELIORATION 2013:12). Thereby a physical depreciation of the water infrastructure increases the number of people without proper access to drinking water.

Due to its fiscal woes and rising national debt, the Kyrgyz Republic government has not the financial capability or the institutional arrangements to operate and maintain the drinking water supply systems for the large number of rural communities (WARDLE 2010:3; IVANOV 2013:37; NEUMANN 2013). Much of the drinking water supply infrastructure in rural areas deteriorated due to a lack of funds for operation and maintenance (DEPARTMENT OF WATER MANAGEMENT AND MELIORATION 2013:12). Making clean drinking water accessible to the population in rural areas through an efficient water supply management and a reform of the inherited water management governance became major issues for the Kyrgyz national government.

In consequence of the independence of Kyrgyzstan in 1991, the national government privatized the agricultural land, abolished the collective and state farms and distributed their arable land among the local population (SEHRING 2005, 2007; ROST et al. 2014; SCHMIDT 2006, 2014). Based on the privatization processes initiated in the mid-1990s, ownership and management of the drinking water supply systems were decentralized (WEGERICH 2000; SEHRING 2007; ABDULLAEV et al. 2010; EBERMANN et al. 2014). Whereas the urban water supply systems are still owned by the municipalities and operated by the municipal water supply and sewages operator 'Vodokanal', the responsibility for building, operating and maintaining the rural drinking water supply system was transferred to the villages themselves and their community administrations (*aiyl okmotu*) (INTERNATIONAL CONSULTANT MISSION REPORT 2012:14; NEUMANN 2013; ROST et al. 2014). Numerous villages are now more or less self-responsible for their local drinking water supply. But soon it became evident that there were no adequate institutional structures for the rural water management. The local community administrations do not have any financial means or qualified staff for an effective operation and maintenance of the water supply system (WORLD BANK 2001:5). The absence of an incentive system for collective action resulted in confusion, inequity and unreliability in the rural drinking water management.

The situation worsened in Central Kyrgyzstan too. The central Naryn *oblast* (province) is surrounded by high mountain ranges and therefore the traditional economic activities in this area are comparatively different from other lowland areas (as Chui, Fergana or Talas Valleys). The area was and partly still is characterized by a more or less vertical transhumant way of life (BÖCKEL and BECKER 2014). Due to pastoralism the population was organized mostly in tribes scattering usually at the foothills and in lowlands along rivers, springs or other sources of water (ABDULLAEV and RAKHMATULLAEV 2013:452). Thus it was not necessary to build artificial water supply systems (ROST et al. 2014).

During the Soviet process of collectivization many small hamlets in rural Kyrgyzstan were resettled to relatively large villages. Mainly, all these rural villages in the vicinity of Kochkor were built in the 1950s and early 1960s (EBERMANN et al. 2014:83; ROST et al. 2014). In the following decades up to the 1980s, most of the water infrastructure was built resulting in the fact that most of the settlements in rural areas have almost identical problems today in accessibility to safe drinking water, due to outdated water pipes (HERRFAHRDT et al. 2006:99; DEPARTMENT OF WATER MANAGEMENT AND MELIORATION 2013:12).

Prior to 1991, state farms (*sovkhozes*) and collective farms (*kolkhozes*) were mostly responsible for building, operating and maintaining the water supply systems in rural areas (ADB 2000:4; WORLD BANK 2001:5; MCKEE et al. 2006:365; ROST et al. 2014). After the dissolution of these farms and the transition of the economic system from centrally planned to market economy orientated, drinking water supply remained almost ownerless and fell into disrepair (ADB 2000:1; KARIMOV and SARYMSAKOV 2005:25). The dismantling of collective and state farms in the early 1990s and the absence or insufficiency of financing affected the drinking water supply system negatively. The share of sufficient-served rural settlements declined in the first decade of independence from an estimated 70 percent to 40 percent (ADB 2000:5). Kyrgyzstan is unable to maintain and rehabilitate the existing water supply system on its own (OECD 2011:12; NEUMANN 2013). Quite similar problems could be observed in all former Soviet republics in Caucasus and Central Asia. By 2011, compared to 1990, the proportion of population in these areas with access to improved drinking water sources decreased by 3 percent (UNITED NATIONS 2013:46).

Due to a lack of adequate drinking water supply systems and the poor water quality, the risk of water-related epidemics in Kyrgyzstan is ubiquitous (ADB 2000:4; WORLD BANK 2009:1). According to UNECE and WHO (2009:23) every year about 45,000 cases of parasitic diseases are registered due to the poor quality of water or a lack of elementary rules of hygiene and sanitation. The most common diseases are intestinal diseases like diarrhoea, dysentery, typhoid fever and cholera (BIRAN et al. 2005:214; WORLD BANK 2009:1; ARIS 2013:10; DEPARTMENT OF WATER MANAGEMENT AND MELIORATION 2013:13). In some remote villages the lack of an artificial drinking water supply system forces the people to take water for domestic use from rivers or open channels, which further increases the risk of diseases (ARIS 2013:6).

The poor situation of access to clean drinking water in rural areas has forced the Kyrgyz national community to consider this issue with great attention. Obtaining drinking water in a sufficient amount and with the required quality is complex and an actual as well as a general problem. But the sustainable development of water resources is of great importance and since 1999 the Kyrgyz Government became active to improve the existing situation: the ‘Law on Drinking Water’ was adopted; moreover a strategy for the development of the rural water supply and sanitation was elaborated. Regarding the special social importance of water, the government has taken measures to ensure financial support for the building and maintenance of the drinking water supply

infrastructure in rural areas (NEUMANN 2013:7). But due to a poor economic situation in the country, the government was unable to provide financial support on a proper and adequate level. Therefore, international donors such as the *Asian Development Bank* (ADB), *World Bank* (WB) and *Department for International Development* (DFID) have been involved by implementing several projects to provide an adequate drinking water supply infrastructure and to improve hygiene and sanitation, as well as water-related practices in rural areas (WORLD BANK 2009:44; ADB 2012b:1; ARIS 2013:6; NEUMANN 2013:7f.; DEPARTMENT OF WATER MANAGEMENT AND MELIORATION 2013:12).

After many negotiations the Kyrgyz Government signed an agreement with the ADB in 2000 to implement the *'Community-Based Infrastructure Services Sector Project'* (CBISSP) in the provinces of Batken, Osh, Jalal-Abad and Chui (ADB 2012b:1). In 2002 a similar agreement was signed between the government and the WB and DFID. It was named *'Rural Water Supply and Sanitation Project'* (RWSSP), covering the other three provinces Issyk-Kul, Naryn and Talas (WORLD BANK 2009:44; ARIS 2011:4). Additionally implemented was the project *'Hygiene and Sanitation in Rural Area'*, financed by the DFID (BIRAN et al. 2005:213; WORLD BANK 2009:2). All these projects were aimed to improve the drinking water infrastructure systems in the rural areas of Kyrgyzstan. Later-on the projects were combined in the *'Taza Suu'* (Clean Water) program (NEUMANN 2013:7f.; ROST et al. 2014). This program was conducted in two phases: the first main phase from 2000 to 2008 and the second supplementary phase from 2009 to 2013 (ARIS 2011:4; ADB 2012b:1f.; WORLD BANK 2012:1f.).

In regard of the implementation of these projects one of the main requirements of the international donor organizations was the set up of *'Community Drinking Water User Unions'* (CDWUU) in rural villages. The communities had to implement the self-governed CDWUU, which take responsibility for the operation and maintenance of the local drinking water supply as well as for the financial management, including the calculation and the collection of the drinking water tariffs from the water users (WARDLE 2010; ARIS 2013; NEUMANN 2013). Villages that applied for a participation in the project *'Taza Suu'* had to raise 5 percent cash contribution for the rehabilitation of their local drinking water supply system. The rehabilitation was done with loans of the World Bank. The management responsibility for the drinking water supply system in these villages was gratuitously transferred from the administration of the village community (*aiyl okmotu*) to the newly established CDWUU (ARIS 2013:6; NEUMANN 2013:15f.).

For the implementation of the *'Taza Suu'* program the Kyrgyz Government created the *Department of Rural Water Supply* (DRWS) under the *Ministry of Agriculture, Water Resources, and Processing Industry* (MAWRPI) in 2000. Unfortunately, this ministry did not pay sufficient attention to the problems of drinking water supply as it did for irrigation water management (WORLD BANK 2009:6). To ensure a more transparent and efficient management of drinking water, in 2008 the DRWS was transferred from the MAWRPI to the *National Agency for Local Self Government* (NALSG) (WORLD BANK 2009:7). But due to an unstable political situation in the country (e.g. the revolution in 2010), there have

been various changes in the internal structures of the Kyrgyz Government and as a result, the executing agency for the project *'Taza Suu'* changed five times, which of course negatively affected the general project implementation (ADB 2012b:3). From today's perspective, the transfer of the drinking water supply system on the self-governed and self-financing CDWUU failed in many villages (NEUMANN 2013). So the project *'Taza Suu'* often met on a socio-economic and political environment in which a participatory approach represents a foreign object.

For this reason, and also because of rising prices for construction products, poor contractor performance, inadequate responsibility and responsiveness from some communities, corruption as well as fraud, the project *'Taza Suu'* was unable to implement all the required work on a proper level (WORLD BANK 2009:6; ADB 2012b:1f.; ARIS 2013:5; ISABEKOVA et al. 2013:4f.; NEUMANN 2013). The project covered 533 villages (about 28 percent of the total number of villages in the country), but almost half of them (265 villages) require additional rehabilitation works due to poor project design and poor quality of construction work (ARIS 2013:5). Today, still around 74.3 percent of the villages do not have an adequate water supply system (ARIS 2013:5). Maybe the transfer of the drinking water management into the responsibility of the *aiyl okmotus* would have been more successful, as they are still regarded as responsible by the villagers to solve such problems at the community level (NEUMANN 2013:67).

This thesis aims to analyze the current state and development of the drinking water supply management system in rural areas during the period of transformation, as well as to identify the main problems regarding access to safe drinking water. The purpose of the present thesis is to contribute to a better understanding of the complex problems and challenges of the transformation processes in rural drinking water supply systems in Kyrgyzstan on the example of a more traditional Kyrgyz pastoral area, like it is to be found in the central Naryn *oblast* (province). The intention is to find some answers to the defined overall research question: What are the problems in the management of drinking water supply systems in rural areas of Central Kyrgyzstan?

In this context, for the investigation of the problems mentioned above, a more or less typical village in the Naryn *oblast* was selected as a model region. Important prerequisite was that this village was not involved in the project *'Taza Suu'*. Selected for the field research was finally the village of Kara-Suu, which is part of the Ak-Kyya community in the Kochkor *rayon* (district). Furthermore, the thesis will concentrate on the management of the local water supply system.

1.2. Research Guiding Questions

The research in Kara-Suu has been done within the framework of the joint project 'Integrated Watershed Management (IWM) in Central Asia', undertaken by the Kyrgyz National University (KNU), the Freie Universität Berlin (FUB) and the Albert-Ludwigs-

Universität Freiburg (ROST 2014). The project is funded by the German Volkswagen Foundation. IWM focuses on all components of ecological and human resources. According to the concept of IWM, a sustainable economic development and the improvement of people's living standards is largely dependent on human interactions with the environment and the rational use of its resources (EASTER and HUFSCHMIDT 1985; FORESTRY FOR SUSTAINABLE DEVELOPMENT PROGRAM 1988:1; DIXON and EASTER 1991; FFOLLIOTT et al. 2003:1; FÖRCH and SCHÜTT 2004:119).

One of the most important natural resources is water, which is absolutely necessary for the existence of humans, their hygiene and biological needs. Every human needs every day a certain amount of clean freshwater (ABRAMOV 1974:6; UNITED NATIONS 1993:275; SIMONOVIĆ 2009:51). Moreover, water plays the most important role for the social and economic development and the improvement of living standards (WWAP 2012:24). The rational use of water resources plays a vital role for the sustainable development of every country's economy and agriculture.

The construction of artificial water supply systems allows people to place their home on farther distance from natural water sources. But despite the high achievements in science and technology, the access to clean drinking water remains an urgent problem until today (GLEICK 2003:1524). Inefficient human economic activity and rapid population growth lead to a decrease in per capita water availability (SHIKLOMANOV 1993:23). This problem is especially acute in rural areas in developing or transition countries such as Kyrgyzstan (UNITED NATIONS 2013:47).

Although Kyrgyzstan has enough reserves of fresh water in the form of glaciers, lakes, rivers and groundwater, they are not equally distributed; additionally the high mountain relief makes it difficult to use those (UNITED NATIONS 2009:99). Out of the total available amount of water resources, Kyrgyzstan uses only around 10 to 17 percent, the rest of the water is temporarily retained in reservoirs or flows to the neighboring countries (UNECE and WHO 2009:8; DEPARTMENT OF WATER MANAGEMENT AND MELIORATION 2013:11). Regarding the total water consumption, Kyrgyzstan spends around 90 percent for irrigation, around 6 percent for industrial purposes, and less than 3 percent for the domestic use including drinking water (UNECE and WHO 2009:8; DEPARTMENT OF WATER MANAGEMENT AND MELIORATION 2013:11).

The overall objective of this research is to investigate the current state of the drinking water supply systems and the irrigation system for small garden plots in the backyards in rural areas of Central Kyrgyzstan, based on the example of households in the village of Kara-Suu. To investigate the local structure of governance as well as, to get an overview on the actual organization and existing problems in the rural freshwater supply system management, the following objectives and research questions were formulated:

At first it was necessary to identify the structures of governance that are responsible for the operation and maintenance of drinking water supply systems in rural areas as well as

their capabilities for the development of rural infrastructure, in particular for the drinking water pipes systems. As mentioned in the chapter above, the *sovkhozes* and *kolkhozes* played a significant role for the rural development and its infrastructure in Soviet times. During this period, a clearly organized top-down management structure was dominating (UL HASSAN et al. 2004:7; ROST et al. 2014). Since independence, there were cardinal changes in both the management and the economy of the country (BABAJANIAN 2009:7; KUDABAEV and KUDABAEVA 2009:111f.; ADB 2012a:7). The decentralization process has given the *aiyl okmotu* (administration of the village community), CDWUUs and water utility operators, such as 'Vodokanal', possibilities for more independent decision-making processes (ARIS 2013:21). So the question arises who really is the 'owner' of the drinking water supply system today in rural communities and what degree of responsibility he holds. What is the role of the local administration in solving the problems of water management in the villages? What is the Kyrgyz government making for the development of the drinking water supply in rural areas?

In contrast to other regions of the country, Central Kyrgyzstan traditionally has a more nomadic pastoral economy. Therefore it is necessary to determine the interaction between the traditional lifestyle and modern management of the water supply system. To fully understand the current situation in the countryside, as well as to better understand the changes in the water management system, it is necessary to trace the historical development of the village and the structure of its governance in the last decades.

Secondly, the socio-economic conditions of the local people and their willingness and ability to pay the water charges have to be investigated and discussed. Studying the dynamics of economic development will help to identify and to analyze the factors influencing the local water supply system. One of the main reasons for the deterioration of the existing water supply system in the villages since independence was the financial insolvency of the population (UNITED NATIONS 2010:5; WARDLE 2010:8). Therefore it is essential, to get an overview of the income structure and the living standard of the villagers under the present economic conditions.

The economic condition of the population determines their ability to pay for water, and it directly affects the charging for water by the water suppliers, as well as the establishment of a full payment for the provision of drinking water (GWP 2000:19; DEPARTMENT OF WATER MANAGEMENT AND MELIORATION 2013:18). A full payment for water would help to maintain the water supply system in good conditions (GWP 2000:19f.). Therefore, it is necessary to consider the water tariff system for both, drinking and irrigation purposes, as a tool for development of the water supply system. It is therefore necessary to examine the pricing system; and to identify those, who are responsible for the establishment of these tariffs. The actual prices in the village for drinking and irrigation water should be discussed too. Moreover, the solvency of the population should be considered in order to find out, if all water users pay the fees. To conduct a study of the tariff system, it is necessary to identify the proper price for water use, including maintenance of the water pipeline infrastructure. Another issue is the transparency in the water supply

management, who collects the money and how is it spend for operating and maintaining the water system.

Thirdly, perhaps one of the main issues is the accessibility to adequate water sources for domestic use and the watering of the private garden plots. According to UNITED NATIONS (2009:102), currently about 70 percent of drinking water in rural areas is taken from surface sources, whereas in Soviet times groundwater was the main source (about 90 percent). The usage of water for drinking purposes from rivers, channels and swamps without any pre-treatment can lead to diseases. Therefore, it is necessary to identify the main sources of drinking water in rural areas, and to examine the current state of disinfection systems. It is also necessary to consider the sources and accessibility of water for irrigation of homestead plots, because a lack of water in the nearest trench is forcing villagers to use more drinking water from the water pipe (MURZAEV 2010). In addition, it is necessary to study how far the water sources are located from the consumers and if it is a constant or only intermittently source. Distance to the source of water affects time and effort spent by the people to get the required amount of water. Moreover, a far distance or a temporary access to water may result in a limitation of water used in the household as well as for drinking purposes.

A fourth issue is the awareness of all local stakeholders about the necessity to reform their drinking water supply system. One of the important objectives of this research refers to the level of awareness among the local population about managing and exploitation of an artificial water supply system. Perhaps one of the challenges to improve the situation in rural drinking water supply system is a weak, or even missing willingness of the people to cooperate with each other and with the local authorities (WARDLE 2010:5). In most cases, the villagers are users of one or two different water supply systems and therefore practically all of them must be stakeholders in the improvement and development of the water infrastructure. Therefore, it is also necessary to investigate the level of awareness and activeness of stakeholders in a common decision-making process.

According to GLEICK (2003:1526f.) one of the solutions to this problem is a rethinking about water use. Although water itself is considered as an inexhaustible resource, its unequal distribution by the earth's surface, as well as the increasing pollution of the environment leads to a shortage of freshwater (SHIKLOMANOV 1993:13f.).Thus it is better to improve the management of water use and to increase its productivity, than to seek new sources of water (GLEICK 2003:1526).

The answers to these questions will help to characterize the current state of the water supply system in rural settlements of Central Kyrgyzstan on the example of the village of Kara-Suu. Also they will help to identify existing problems and shortcomings in domestic water supply system management.

1.3. Thesis Structure

The thesis is structured in seven main chapters. In the introduction the object of research and research guiding questions are outlined. The second chapter is dedicated to the presentation and discussion of the Integrated Watershed Management Approach. Important terms and definitions in the field of Watershed Management are described in this topic. The next chapter aims to clarify the current state of drinking water management in rural Kyrgyzstan and to describe the historical development of the drinking water supply system in the country. An overview on the current state of research on domestic water use in rural areas of Kyrgyzstan is given.

In the fourth part of the thesis the research area is presented. Here the natural characteristics as the geographical location as well as landscape and climate are reviewed. Moreover, a geographical and historical overview of the study area is given, and the socio-economic background, as well as the structure of the research village, are described. The next chapter gives an overview of the various methods applied within the scope of the investigation respectively the field research. It aims to clarify through which methods the data were collected and analyzed in detail.

In the sixth part of the thesis the results from the field research are represented and then discussed in chapter seven. In the sixth chapter the current state of the water supply systems in rural areas is surveyed on the example of Kara-Suu. These findings are mainly based on own field research and literature review. The next chapter aims to discuss all obtained results according to the research questions and the objectives of research. An evaluation of existing problems in the management of water supply systems is given. Finally, strategies and recommendations will be developed on the basis of results of the study in order to develop suggestions for a more efficient water supply management system, matching with the typical structures in Central Kyrgyzstan. The questionnaires used throughout the fieldwork in the study area are presented in the annex.

2. The Integrated Watershed Management Approach

The present research work has been carried out within the project 'Integrated Watershed Management (IWM) in Central Asia' driven by German and Kyrgyz universities and financed by the German VolkswagenStiftung. One objective of the project is to develop scientific capacities on IWM in Kyrgyzstan. The project aims at a sustainable implementation of these skills, including education and training of experts, inter alia by establishing a master study programme on IWM at the KNU, Bishkek (ROST 2014:63). One of the main research objectives of this project is to improve people's living conditions by developing concepts for a sustainable, economically and environmentally efficient use of available natural, agricultural and human resources, locally concentrated on a single test catchment (ROST 2014:63f.). Investigations in the project are carried out in a holistic research. The present thesis concentrates on socio-economic investigations, and focuses on the study of local households' water management in Kara-Suu village and in particular, the accessibility of villagers to safe drinking water.

In the mid-1980s EASTER and HUFSCHMIDT (1985:1) defined Integrated Watershed Management as: *'... a process of formulating and implementing a course of action involving natural, agricultural, and human resources of a watershed, taking into account the social, economic, and institutional factors operating within the watershed and the surrounding river basin and other relevant regions to achieve specific objectives'*.

Thus, watershed management assumes a comprehensive and rational usage of all natural and human resources within a river basin as an ecological system, in order to obtain benefits through providing needed goods and services without adversely affecting natural resources (FORESTRY FOR SUSTAINABLE DEVELOPMENT PROGRAM 1988:1; DIXON and EASTER 1991; FFOLLIOTT et al. 2003:1; FÖRCH and SCHÜTT 2004:119). Watershed management should be aimed at stabilizing the balance between human activities and the environment, and also to maintain the relationship between the upland and downstream within the watershed (DIXON and EASTER 1991; FFOLLIOTT et al. 2003:1).

Humans are an integral part of nature and their lives depend on environmental resources, and on their kind-of-use of these resources their living standard depends (FÖRCH and SCHÜTT 2004:119). But excessive stress on and irrational use of natural resources became one of the main tasks in global environmental issues (UNITED NATIONS 1973:3). Hence, the international community began to pay high attention to the problems of interaction between humans and the environment since mid-last century (PERELET 2003:10). The first international UN conference on environment was held in Stockholm in 1972 (UNITED NATIONS 1973:3). On this conference Watershed Management was considered as one of the items on environmental aspects for the useful transfer of information to the developing countries (UNITED NATIONS 1973:12). According to many experts the concept of IWM reached international significance just after the UN Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992, widely known as Earth Summit (FÖRCH and SCHÜTT 2004:119).

Although the IWM-approach was developed many years ago, it is still very relevant. One of the reasons is the still irrational use of natural and human resources against the background of growing demand. The world's population is growing, thus the demand for water, food and other goods too, that in turn leads to increased exposure on natural resources through the increase of agriculture and industry activities (DUKHOVNYY et al. 2003:8; UNFPA et al. 2013:10). But the problem is that the demand is growing faster than the development of technologies in the goods and services production (UNITED NATIONS 1993:34; UNEP 2014:51). In connection with that, the impact on the environment increases more and more. In order to meet the growing needs, most humans are not very interested in the preservation of nature, which in turn leads to its depletion and degradation. Therefore, the activities of international organizations and associations aimed to achieve sustainable development through a rational nature management in order to save the environment for future generations (UNITED NATIONS 1973:4). The concept of IWM is considered as a way to foster sustainable development in rural areas (EASTER and HUFSCHMIDT 1985; DIXON and EASTER 1991; FARRINGTON et al. 1999; LAL 2000a, b; FFOLLIOTT et al. 2003; FÖRCH and SCHÜTT 2004; HEATHCOTE 1998, 2009; CONSERVATION ONTARIO 2010).

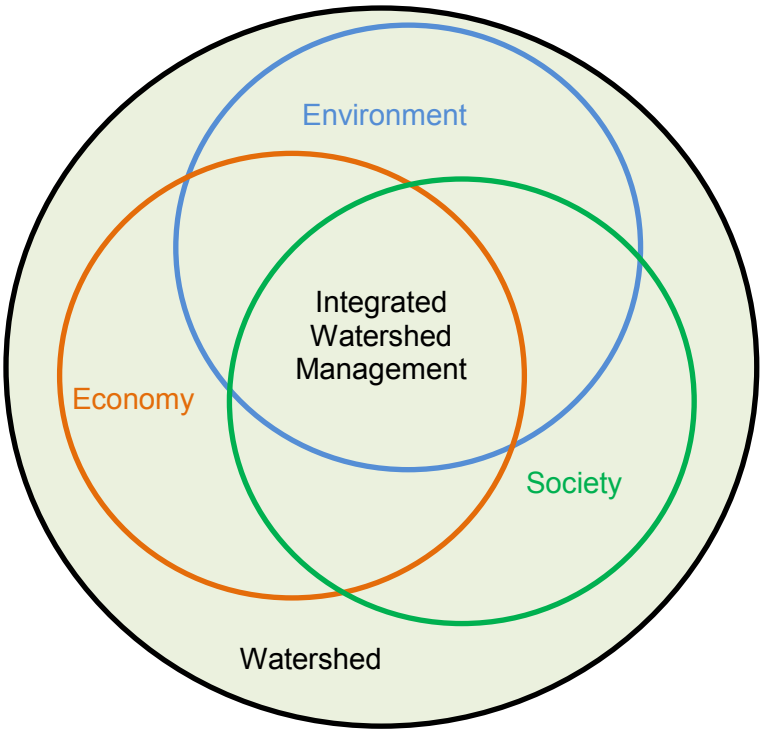

Figure 1: Interrelation of IWM with the environment, economy and society (Adopted from CONSERVATION ONTARIO 2010:6).

Along with IWM the concept of *Integrated Water Resources Management* (IWRM) is also widely adopted. In the current literature many authors apply a definition that was given in 2000 by the Global Water Partnership (GWP 2000:22): *'IWRM is a process which promotes the co-ordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems'*. The main focus of

IWRM is directed on water resources as connecting link. According to CONSERVATION ONTARIO (2010:18f.) the main object of IWRM is the integration of all water assets in rivers, lakes, oceans and other water bodies. At the same time, it has a great influence on all other natural resources and socio-economic conditions, too. The main purpose of IWRM is a sustainable development and balanced management of water resources within the socio-economic and environmental activities (GWP and INBO 2009:10).

From the above, we can state that both IWM and IWRM share the same goals but have different ways to achieve it. The present thesis research is written within the framework of Integrated Watershed Management (IWM), because the focus is on the relationship and interaction between the people and nature in one catchment (Figure 1). But what exactly means the term 'watershed' in this context and why it is used as a basic unit in IWM?

According to UNEP et al. (2004:30) a watershed *'... is the area which supplies a river system, lake or reservoir with water'*. A watershed, also often referred to as basin or catchment, is defined as the geographical area within its boundaries all water flows into a particular place (LAL 2000a:4). It may be of different size, from a few hectares to millions of square kilometres (FORESTRY FOR SUSTAINABLE DEVELOPMENT PROGRAM 1988:1; FÖRCH and SCHÜTT 2004:122). Large watersheds usually consist of many medium and small catchments that form tributaries to the main river. All natural resources in one catchment area are interconnected with each other. Modifying one of them may lead to a change in the others and therefore also in the unit of the ecological system of the watershed (FÖRCH and SCHÜTT 2004:119).

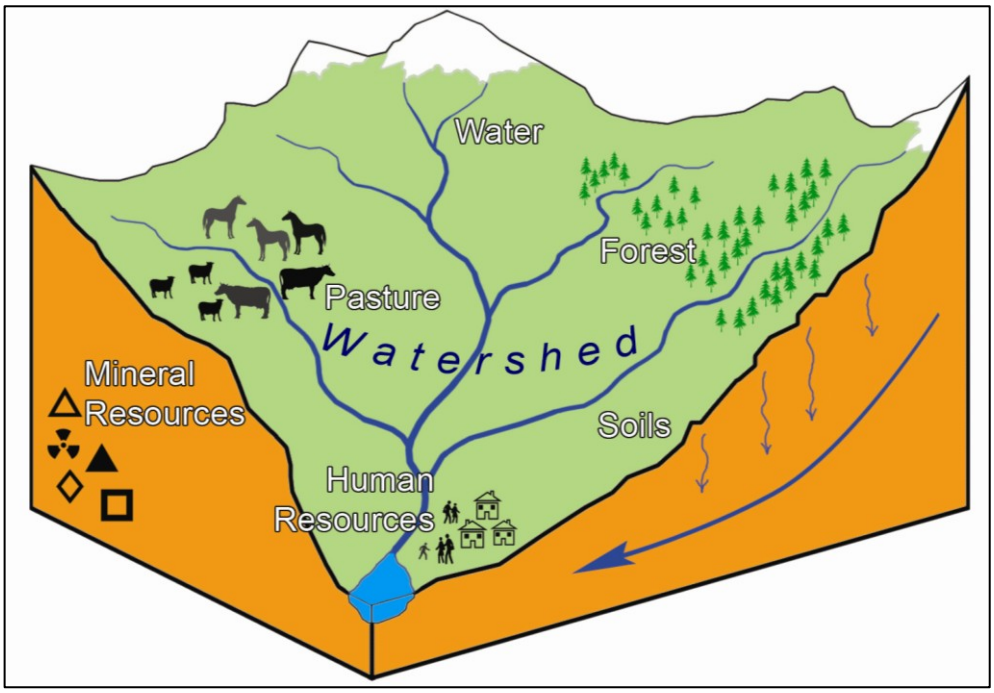

Figure 2: Scheme of a Watershed (Draft: Topbaev, 2015).

There are many negative changes occurring under the influence of human activity and especially by economic activities of the local people. Basically, natural resources and

human activities are developing and interconnecting inside a watershed. In the mountainous areas these interrelations are even more sensitive due to close location to each other (Figure 2). Misallocation of resources can not only lead to an economic downturn, but can also make an area unusable for living in general. Unsustainable activities in the upstream may adversely affect the downstream area. Therefore, the watershed is considered in IWM as a unit. And, of course, the water resources play a crucial role here. According to CONSERVATION ONTARIO (2010:28), the best model for water management is management based on a watershed, regardless of administrative boundaries. Improved water use is not only a key for meeting the growing future demand for water (RINGLER 2005:61), but one of the ways to solve many socio-economic and environmental issues, too.

3. Drinking Water Management in Rural Kyrgyzstan

On the international level the problems of accessibility to safe drinking water and sanitation are given great attention and a lot of work has already been done to improve the situation. But despite all efforts in this sector, this issue still is on the agenda in many regions, especially in rural areas in poor countries as Kyrgyzstan. To improve the situation in the water supply sector the United Nations (UN) adopted on the Millennium Summit in 2000 in New York the eight so-called *Millennium Development Goals* (MDGs) (UNITED NATIONS 2000:1f., 2013:60*).* The seventh goal of the MDGs is to *'Ensure environmental sustainability'*, which includes the target to *'halve by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation'* (UNITED NATIONS 2013:46). According to the UNITED NATIONS (2013:47) in 2011, 768 million people worldwide still had no access to safe and improved water sources, out of them 83 percent are rural residents. Moreover, 180 million people still use water for drinking purposes directly from open sources such as rivers, lakes and ponds (UNITED NATIONS 2013:48).

As it was mentioned in the introduction, the deplorable situation is observed also in the drinking water supply system in Kyrgyzstan (DEPARTMENT OF WATER MANAGEMENT AND MELIORATION 2013; NATSIONAL'NYY STATISTICHESKIY KOMITET KYRGYZSKOY RESPUBLIKI 2013b; NEUMANN 2013; ROST et al. 2014). According to ISABEKOVA et al. (2013:3) almost 70 percent of the population in Kyrgyzstan does not have adequate access to clean drinking water. And about 30 percent of rural areas have no artificial drinking water supply system at all (DEPARTMENT OF WATER MANAGEMENT AND MELIORATION 2013:12). To improve the situation, the Kyrgyz Government, with help of international donors, built or repaired water systems in many villages (WORLD BANK 2009:44; ADB 2012b:1; ARIS 2013:6; NEUMANN 2013:7f.; DEPARTMENT OF WATER MANAGEMENT AND MELIORATION 2013:12). But today, the condition of the water supply system again has fallen into an unusable state in many of these villages (ARIS 2013:5).

Traditionally for the Kyrgyz people as for many nomadic peoples, water was an object of worship and it was regarded with great respect (BAGDASAROVA et al. 2001:10). The high importance of water is still represented in many folk sayings and traditional proverbs. The attitude towards water began to change quickly with the construction of water supply systems in Soviet Union times, because access to water became now much easier, a continuously demand orientated supply was guaranteed. The water pipe system in rural areas was the property of the *kolkhozes* and *sovkhozes* and drinking water was supplied free of charge, therefore people did not care about construction, maintenance or repair works and neither about payment. But since the national independence, all water pipe systems in rural areas were transferred to the local population under the responsibility of the local administrations of village communities (*aiyl okmotus*) (Figure 3) (DEPARTMENT OF WATER MANAGEMENT AND MELIORATION 2013:12). After that, most of the rural infrastructure in Kyrgyzstan rapidly fell into disrepair without a centralized management, financial support from the government and with poor relevant knowledge and skills for the decision-making, operation and maintenance of the water supply system (BAGDASAROVA

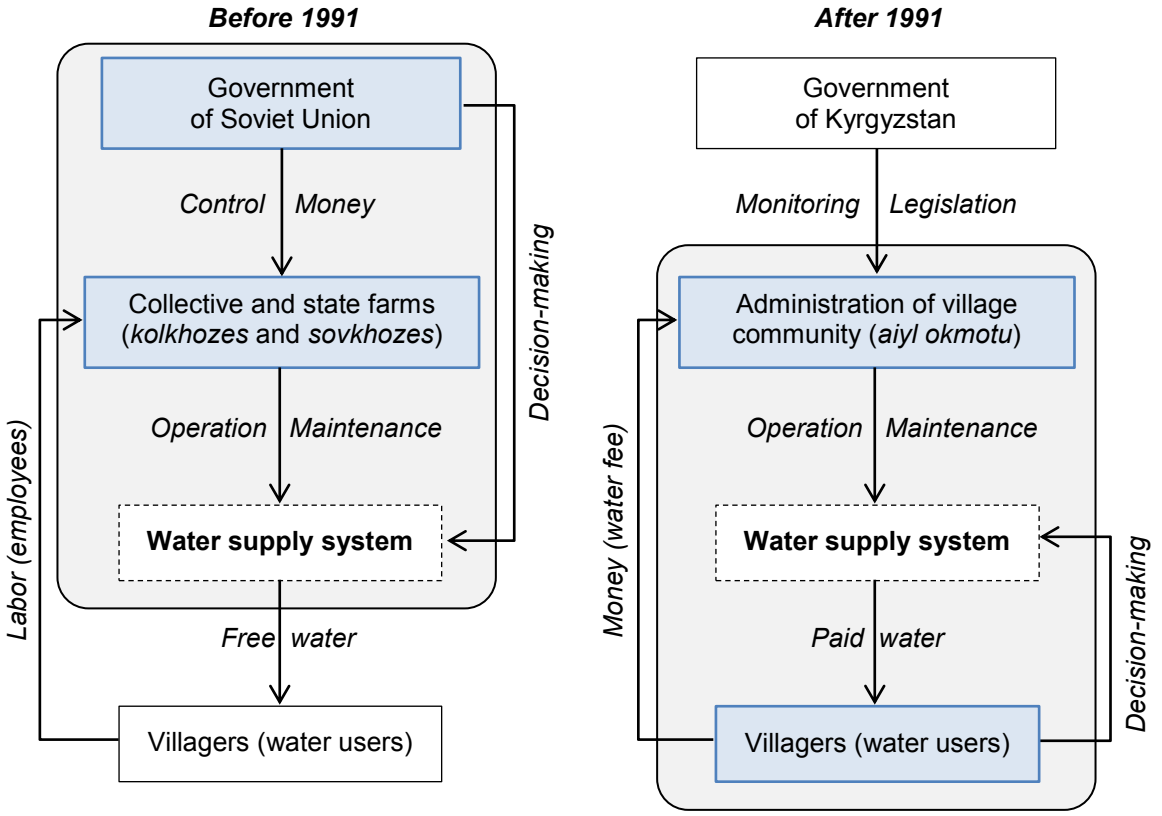

Figure 3: The structure and main actors (in the blue boxes) of the water supply system management in rural areas of Kyrgyzstan (Draft: Topbaev, 2015. Data base: DEPARTMENT OF WATER MANAGEMENT AND MELIORATION 2013; BAGDASAROVA et al. 2001; BABAJANIAN 2009).

et al. 2001; BABAJANIAN 2009:7; ARIS 2013:21; DEPARTMENT OF WATER MANAGEMENT AND MELIORATION 2013:12). According to BAGDASAROVA et al. (2001:10), the command management system of the Soviet period created a stereotype among the majority of the population, giving them the idea that water is a free and endless resource.

According to SEHRING (2005:104) water institutions must be developed as a basic tool of government in order to achieve sustainable development in the water supply management. Water institutions area water law, water policy and water administration interlinked with each other (SALETH and DINAR 1999:16). Imperfect institutions are vulnerable to corruption, pluralism and other negative influences and cannot support an equitable and sustainable water management (SEHRING 2005:106f.). The high importance given to these institutions is clearly presented in the following quotation from a report of ADB (2004): *'Do not fix the pipes, fix the institutions that fix the pipes'* (ADB 2004 cited in SEHRING 2005:111).

Most publications about water supply systems that were written during the Soviet time are basically focused on calculations of water consumption norms and/or technical aspects of water supply. Authors like KOSHELYOV and SAVINOV (1983) have developed basic technical issues for the extraction and lifting of the water from different water sources, as well as for the proper storage and the transport of fresh water to consumers. Furthermore, they gave recommendations for an appropriate protection of water sources and water

supply systems. A regulation of agricultural water was carried out by LOGINOV and SHUSSER (1980). In Kyrgyzstan, KARIMOV and ABDRASULOV (2004) developed techniques of water purification for household and technology needs, whereas KARIMOV and SARYMSAKOV (2005) examined the environmental problems of water supply. Other publications mainly consider the legal and regulatory aspects of water usage in Kyrgyzstan (BAGDASAROVA et al. 2001).

To provide safe drinking water for the rural villages, the Kyrgyz government is actively engaged with NGOs, local communities and international organizations. As mentioned in the chapter above, the main donors for the improvement of the drinking water supply and sanitation in Kyrgyzstan are the ADB, World Bank and DFID. Additionally, the problem of access to safe drinking water and sanitation was included in other projects, undertaken by organizations such as the *United Nations Development Programme* (UNDP), *United Nations Children's Fund* (UNICEF), *Global Water Partnership* (GWP), *Soros Foundation – Kyrgyzstan* (SFK) etc. On the basis of the projects implemented by these donors, some publications and reports on the current state as well as efforts to improve the water supply system in rural areas of Kyrgyzstan were released (BAGDASAROVA et al. 2001:5; UNDP 2009; JUNUSBAEVA 2010; WARDLE 2010, WORLD BANK 2012; ARIS 2013; NEUMANN 2013). But they are mostly technical documents and/or progress reports of these projects.

A significant work to assess the current state of access to clean drinking water, sanitation and hygiene was conducted with the support of UNICEF's *Water, Sanitation and Hygiene* (WASH) Programme. Within this programme three areas, respectively *oblasts*, in Kyrgyzstan were investigated: Naryn, Issyk-Kul and Talas (UNICEF 2011:5). Although the main objects of their investigation were schools and municipal organizations, we can derive the general deplorable state of the whole water supply system in Kyrgyzstan from the obtained data. According to UNICEF (2011:6), the problem of providing clean drinking water, hygiene and sanitation is one of the most urgent problems and requires a lot of attention from both the state's and the population's side.

Significant investigations on clean drinking water were conducted by the Soros Foundation–Kyrgyzstan (SFK), which is an international non-governmental private foundation. In Kyrgyzstan operations by SFK began in 1993 and *'aim to create the conditions for building an open society in the Kyrgyz Republic through supporting the development of public institutions and civil initiatives'* (SFK 2011:2). According to research done by SFK, there are many different problems in providing clean drinking water. Generally they can be classified in four dimensions: legal, financial, technical and cultural (BAGDASAROVA et al. 2001:5).

A change of the situation of water supply management is not possible without paying attention to the culture of water use. The culture of water use consists not only of consumption or economical use of drinking water. It means also the thinking and attitude of people towards water as a vital welfare and certain type of product. As consequence, it asks for the willingness to pay for water. A good control over the payment system will help

to improve and develop the water supply system. Culture of water use – it is the norms and rules of human behaviour, which set the framework for the implementation of all human activities in the sphere of water consumption, from the repair of a city water supply system to the simplest dishwashing (BAGDASAROVA et al. 2001:9).

Despite the considerable number of reports and publications devoted to water supply systems in Kyrgyzstan, there are still many unexplored issues and problems, especially in rural areas. For example poorly investigated is the water consumption within rural households, their particular livelihoods as well as their social and economic status. According to a definition of the NATIONAL STATISTICAL COMMITTEE OF THE KYRGYZ REPUBLIC (2010:176) *'a household is one person or a group of persons living together in one housing unit who make common provision for food or other essentials for living by having common housekeeping, pool and expend their incomes fully or partially. They may be related or unrelated persons and can be under marriage and family relations'.* It becomes obvious that there is a wide variety of household types and thus the consumption of fresh water in each of them is different. And the activities of every individual in each household can have a significant impact on the development of the whole water supply system management.

Basically, in publications and reports of UNDP (2009), JUNUSBAEVA (2010), WARDLE (2010), WORLD BANK (2012) and ARIS (2013), the inadequate access to clean drinking water is considered as the cause for the poor state in sanitation and hygiene. But the issues of individual water consumption and raising awareness of villagers on a rational water use were only poorly studied. Hence, their recommendations focused mainly only on rehabilitation processes, the creation of a water supply system and the raising of public awareness in the field of sanitation and hygiene. But the problem is much deeper since the problem of inadequate access to water is the result of improper and poor management. Therefore, considerable attention must be paid to study the management structures in the villages as well as to investigate the individual water consumption in the particular households. The demand for clean drinking water in the village depends on the consumption of each household; therefore it is necessary to examine in detail the water use in individual household.

4. Research Area

4.1. Geographical Location

Land-locked Kyrgyzstan is located in the north-eastern part of Central Asia between the latitudes of 39° and 43° north and longitudes of 69° and 80° east (AKADEMIYA NAUK KIRGIZSKOY SSR. OTDEL GEOGRAFII 1965:5). In the north it shares borders with Kazakhstan, in the south-east with China, in the west with Uzbekistan and in the south-west and south with Tajikistan.

The Kyrgyz Republic is divided into provinces (*oblasts*) and districts (*rayons*). The smallest administrative unit is the village community (*aiyl aimak*), consisting of one or more villages. According to the NATIONAL STATISTICAL COMMITTEE OF THE KYRGYZ REPUBLIC (2010), the administrative division of the country consists of 7 provinces with 40 districts, 25 towns (the capital of Bishkek and the city of Osh have a republican level), 28 settlements of urban type and 440 village communities, the latter including 1,834 villages.

Figure 4: Location of the Kochkor basin (Draft: Leipner, 2014).

The research area, respectively the village of Kara-Suu, is located in the Kochkor *rayon*, which is part of the Naryn *oblast* (Figure 4). This is the largest and most central *oblast* in the country with a total area of 45,160 km^2 (or 22.6 percent of the country's area) (NATIONAL STATISTICAL COMMITTEE OF THE KYRGYZ REPUBLIC 2010:12). The Naryn *oblast* lies entirely in the Inner Tian Shan. The Kochkor *rayon* belongs to the northern part of the Inner Tian Shan, the so-called Kochkor–Kokomeren sub-province (CHUPAKHIN 1959:54).

The Kochkor *rayon* was founded in 1930 and has an area of 6,407 km^2 (MAMLEKETTIK TIL ZHANA ENTSIKLOPEDIYA BORBORU 2004:508f.). Surrounding mountain ranges are marking natural inter-district boundaries: In the north it borders with the Chui *oblast*, marked by the

Kyrgyz Ala-Too mountain range. With the north-eastern Issyk-Kul *oblast* it borders partially on the Kyrgyz Ala-Too and partially on the Teskey Ala-Too mountain ranges (in some Russian publications this range has the name Terskey Ala-Too)[1]. In the south, the Kochkor *rayon* borders on the Naryn *rayon* basically by the Kara-Zhorgo and by the Baydulu mountain ranges. In the west the border with the Zhumgal *rayon* is partly marked by the Sandyk range (GLAVNOYE UPRAVLENIYE GEODEZII I KARTOGRAFII SSSR 1987).

As research area was selected the village of Kara-Suu in the Kochkor *rayon*. It was chosen as one of the more or less typical villages in Central Kyrgyzstan (ROST 2014:64). The village of Kara-Suu is located in the Ukok catchment, at an altitude of 1,870 m a.s.l. on the alluvial fan of the Ukok river and about 5 km south-east from Kochkor, the administrative centre of the *rayon* (Figure 5) (ROST et al. 2014; EBERMANN et al. 2014:83). On the left side of the Ukok river is the village of Isakeev. Further downstream the Ukok flows through the village of Jany-Jol and merges with the large Chu river.

Kara-Suu is the Kyrgyz translation for 'black water'. In this case 'black' does not refer to a colour, but rather means that the water comes from under the ground. The village got its name from the nearby swamps and springs, which do not freeze in winter (KARIMOV and ABDRASULOV 2004:15).

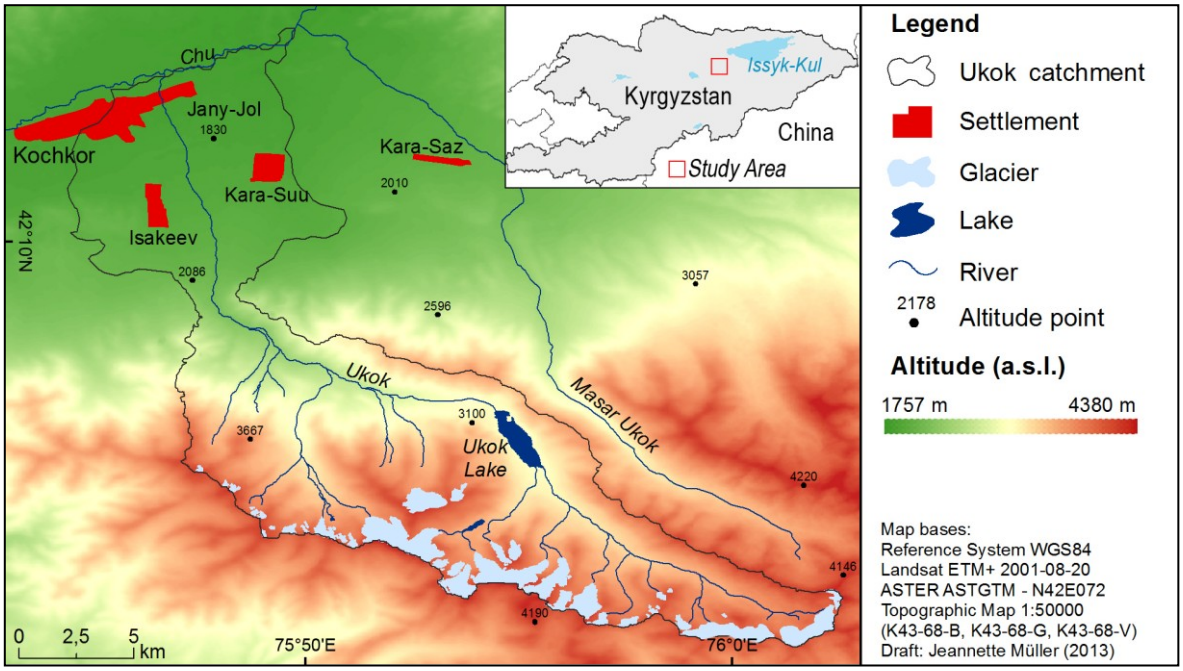

Figure 5: Topographic map of the Ukok river catchment and its surroundings (ROST et al. 2014).

[1] The meaning of 'Teskey' ('non sunny-side') seems to fit better to the name of the opposite mountain range Kungey Ala-Too ('sunny-side') in the north of Issyk-Kul, than 'Terskey' which means 'negative side'.

4.2. Landscape and Climate in the Ukok Catchment

The research area is located in the intermountain Kochkor basin, surrounded by the mountain ranges of the Kyrgyz Ala-Too and the Teskey Ala-Too. The Kochkor basin itself stretches on altitudes between 1,700 and 2,000 m a.s.l. and has a length of 80 km and a width of 20 km (MINISTERSTVO CHREZVYCHAYNYKH SITUATSIY KYRGYZSKOY RESPUBLIKI 2012:321). The basin is part of the upper Chu river catchment, which includes numerous small sub-catchments. One of them is the Ukok river catchment (see Figure 5), which is located on the spurs of the Teskey Ala-Too (Figure 6).

Figure 6: The Kochkor basin. View on the Teskey Ala-Too (Photo: Topbaev, May 2012).

The Ukok river has its source at an altitude of 3,048 m a.s.l. Its upper part drains into the Kol-Ukok Lake (GLAVNOYE UPRAVLENIYE GEODEZII I KARTOGRAFII SSSR 1987:96), which was formed by a large ancient landslide. Currently the Kol-Ukok is a natural water reservoir of 34 million m^3 and the water surface area is 1.6 km^2 (GLAVNOYE UPRAVLENIYE GEODEZII I KARTOGRAFII SSSR 1987:96).Due to its large altitude range, the Ukok catchment has different climatic characteristics. According to CHUPAKHIN (1959:62f.) five climatic belts can be distinguished in this area. In the Kochkor basin at altitudes up to 2,100–2,200 m a.s.l. the semi-desert dominates and is then replaced by a dry steppe belt in altitudes up to 2,800–2,900 m a.s.l. At altitudes between 2,700 and 2,900 m a.s.l., the dry steppe belt gradually transforms into the subalpine belt, which extends up to altitudes of 3,100–3,300 m a.s.l. Above 3,300 m an alpine belt begins, which is replaced by a nival zone above 3,600–3,800 m (CHUPAKHIN 1959:62f.). In general, the Ukok catchment is characterized by a sharply continental semi arid climate, but with higher altitude the cloudiness and the amount of precipitation increase (AKADEMIYA NAUK KIRGIZSKOY SSR. OTDEL GEOGRAFII 1965:6). Furthermore, the surrounding high mountain ranges have a major impact on the climate for they do not allow north-western and northern humid air

currents to penetrate into the territory (CHUPAKHIN 1959:22). The winter months are comparatively cold and dry, without a permanent snow cover. The average temperature in January is −10°C, with minimum temperatures reaching −36°C. The summer is moderately warm with an average temperature in July of +16°C, and a maximum of +34°C (MINISTERSTVO CHREZVYCHAYNYKH SITUATSIY KYRGYZSKOY RESPUBLIKI 2012:321). According to the meteorological station in Kochkor, the average annual precipitation is 232 mm. Precipitation is quite variable. The main share has the period April to October with more than 200 mm of precipitation. During the period November to March rainfall is quite low (GLAVNOYE UPRAVLENIYE GEODEZII I KARTOGRAFII SSSR 1987:62f.; CHUPAKHIN 1959:59*)*. In the upper mountainous catchment of the Ukok, precipitation can reach up to 700 mm (MINISTERSTVO CHREZVYCHAYNYKH SITUATSIY KYRGYZSKOY RESPUBLIKI 2012:321). The semi-arid location of the research area pre-determines a high water demand. The main sources for water in Central Kyrgyzstan are glaciers. However, they have rapidly reduced their size within the last decades (AIZEN et al. 2007; NARAMA et al. 2010:49). In the Ukok catchment the glacier's area has decreased by almost 25 percent since 1963 (MÜLLER 2013:35).

4.3. Socio-economic Situation in Kyrgyzstan and in the Naryn Oblast

The natural conditions of Kyrgyzstan, its historical development as well as socio-economic factors determined the main direction of economic activities in the country. Under the new market economy the country needs to use all of its natural and human resources and potentials for an effective overall development. Specific developments in the economic system are of far reaching relevance for the Kochkor *rayon* as well as Kara-Suu.

After gaining independence, Kyrgyzstan lost many economic relations that existed within the former Soviet Union (KUDABAEVA 2010:144). In this context the continuous decrease of the Gross Domestic Product (GDP) during the first 5 years of independence should be mentioned, reaching its minimum in 1995 (MAMLEKETTIK TIL ZHANA ENTSIKLOPEDIYA BORBORU 2004:369). Since 1996 there has been an average annual rise of 4.8 percent of the GDP (ADB 1997:223, 1998:234, 2004:277, 2010:261, 2014:270). Eventually, the GDP level of 1990 was exceeded in the year 2011 (Figure 7), although the same conditions regarding the type of income were not reached, since the service sector has grown significantly compared to the agricultural and industrial sectors (ADB 2014:270).

According to ADB (2014:271) Kyrgyzstan has the lowest GDP per capita among the countries of Central Asia. One of the main reasons for the slow development is the unstable political situation in the country (ADB 2012a:3). The rate of GDP varies greatly by territory. According to the NATSIONAL'NYY STATISTICHESKIY KOMITET KYRGYZSKOY RESPUBLIKI (2014:146), the lowest percentage of GDP is observed in the Naryn *oblast* in Central Kyrgyzstan (Figure 8). The GDP per capita in this *oblast* also has one of the lowest rates and is much lower than average across Kyrgyzstan.

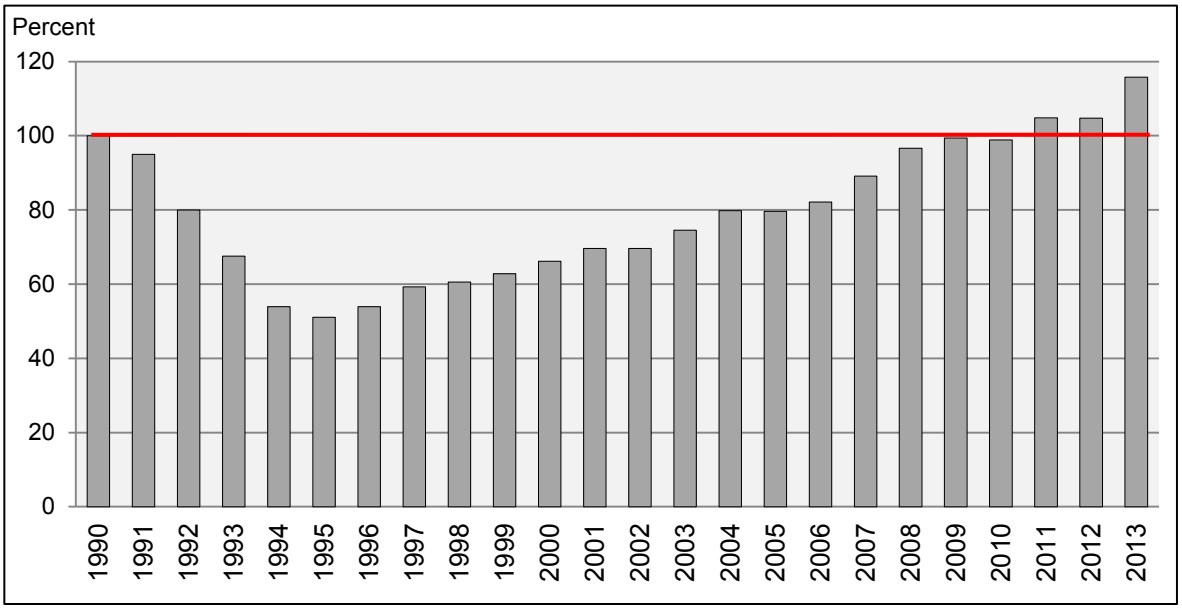

Figure 7: Growth rate of the GDP of Kyrgyzstan (percent of 1990) (Draft: Topbaev, 2014. Data base: ADB 1997:223, 1998:234, 2004:277, 2010:261, 2014:270).

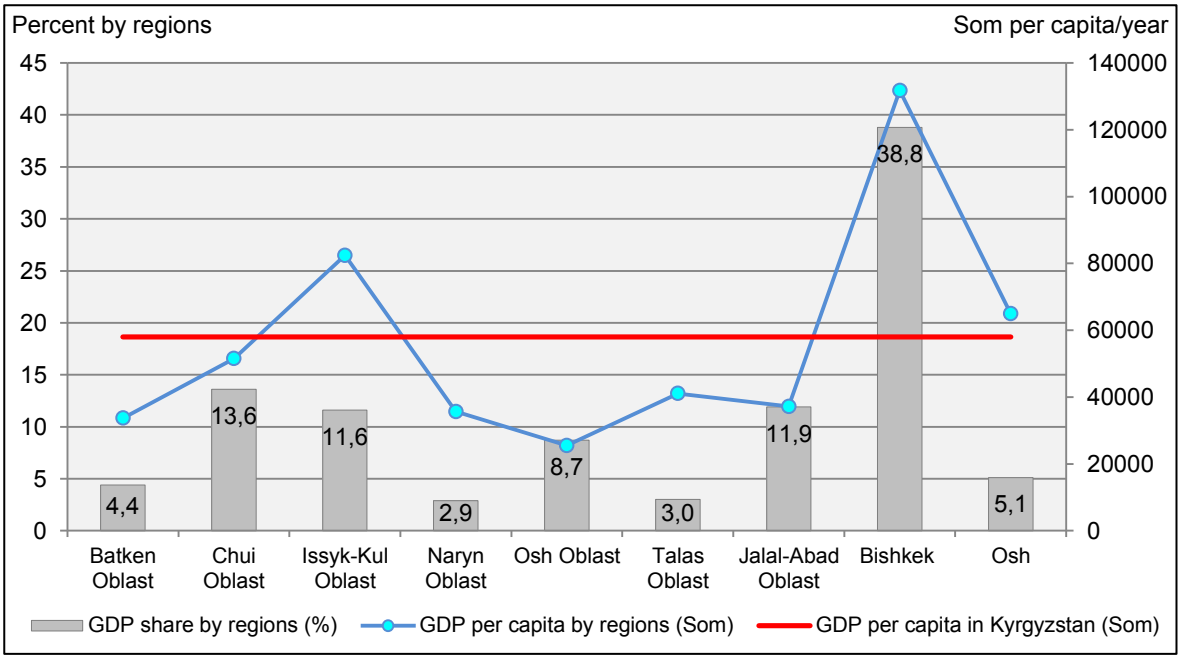

Figure 8: The GDP share by regions and per capita in Kyrgyzstan, 2012 (Draft: Topbaev, 2015. Data base: NATSIONAL'NYY STATISTICHESKIY KOMITET KYRGYZSKOY RESPUBLIKI 2014:146).

The population plays a significant role in the socio-economic development of the country. According to the NATIONAL STATISTICAL COMMITTEE OF THE KYRGYZ REPUBLIC (2010:11) during the last census of 2009 the total resident population of Kyrgyzstan consisted of 5,362,793 people. In general, due to its complex relief and quite territorial insularity, the Naryn *oblast* has a rather weakly population density, with only 5.5 people per km^2 (NATIONAL STATISTICAL COMMITTEE OF THE KYRGYZ REPUBLIC 2010:11). Nationwide the population density is 25.5 people per km^2, so in the Naryn *oblast* it is almost 5 times lower

(NATIONAL STATISTICAL COMMITTEE OF THE KYRGYZ REPUBLIC 2010:10). Among the *rayons* of Naryn *oblast*, a high population density occurs in the Kochkor *rayon* with 58,267 people (Figure 9), or 22.6 percent of the total population of the *oblast* (NATIONAL STATISTICAL COMMITTEE OF THE KYRGYZ REPUBLIC 2010:15).

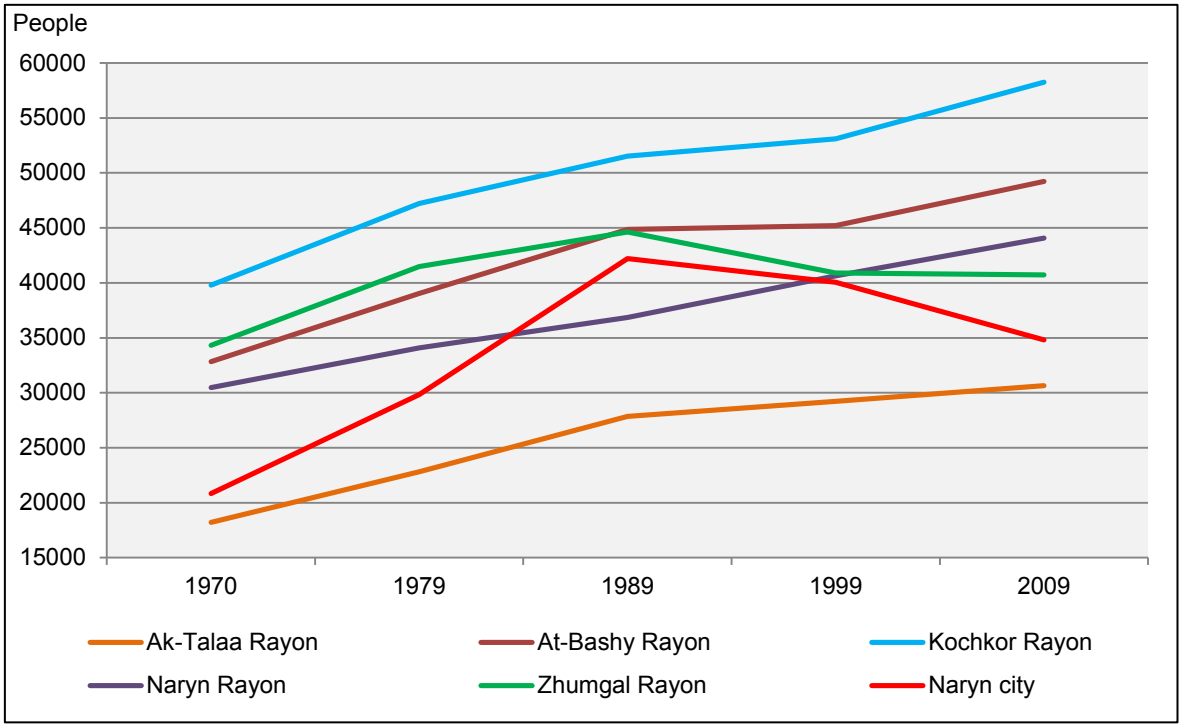

Figure 9: Dynamics of the population in Naryn *oblast* by *rayons* (Draft: Topbaev, 2014. Data base: NATIONAL STATISTICAL COMMITTEE OF THE KYRGYZ REPUBLIC 2010:15).

Due to emigration exceeding immigration a population growth can only occur on the basis of a natural growth. The lowest rate of natural increase is observed in the Issyk-Kul and Naryn *oblasts* (NATSIONAL'NYY STATISTICHESKIY KOMITET KYRGYZSKOY RESPUBLIKI 2013b:7). During 2008 and 2012, the negative balance of the migration outflow from the country amounted to 165,000; the inter-regional movement is still concentrated on the capital of Bishkek and the Chui *oblast* (NATSIONAL'NYY STATISTICHESKIY KOMITET KYRGYZSKOY RESPUBLIKI 2013b:10). One of the basic indicators of the population is the working age. According to the NATIONAL STATISTICAL COMMITTEE OF THE KYRGYZ REPUBLIC (2011:9) the population of Kyrgyzstan is quite young. In Kyrgyzstan, men between 16 and 62 years and women between 16 and 57 years are defined to be in the working age since 2011 (NATIONAL STATISTICAL COMMITTEE OF THE KYRGYZ REPUBLIC 2011:21). In the Naryn *oblast*, as well as in the Kochkor *rayon*, more than half of the population is in the working age and thus building a high potential for labor resources. According to the census of 2009, in the Kochkor *rayon* the number of residents in working age made up 53.3 percent of the total *rayon* population (NATIONAL STATISTICAL COMMITTEE OF THE KYRGYZ REPUBLIC 2010:21).

Because of the natural and climatic conditions, the economy of the Kochkor *rayon* is mainly based on livestock farming and to a lesser extent on agriculture. In the pre-Soviet

era the Kochkor region has been characterized by a nomadic pastoral economy (BÖCKEL and BECKER 2014; ROST et al. 2014). Historically the people were nomads, using a migration system of year-round grazing on pastures in different altitudes. During the Soviet period, this system was modified. The Kyrgyz nomads were settled in small villages and their herds were nationalized. Livestock herding and pastures were organized into collective and state farm structures (SCHILLHORN VAN VEEN 1995; BÖCKEL and BECKER 2014). Due to the expansion of livestock in the Soviet period, the demand for fodder increased and the arable land in the Kochkor basin was opened up for fodder production. Therefore, agriculture in this area is practically focused on fodder production. The main type of livestock farming is sheep breeding, next to cattle, yak and horse breeding.

4.4. The Village of Kara-Suu

The village of Kara-Suu (Figure 10) shall serve as an example of the self-conducted studies on drinking water management in rural areas of Central Kyrgyzstan. Kara-Suu (42°11´N/75°48´E) is located in the Kochkor *rayon* in the Naryn *oblast*. Along with the settlement of Jany-Jol and a few minor hamlets, it forms the Ak-Kyya *aiyl aimak* (village community) with Kara-Suu as seat of the village community administration (*aiyl okmotu*) (Figure 11) (KOCHKORSKIY RAYONNYY OTDEL GOSSTATISTIKI 2010).

Figure 10: Kara-Suu. View from the Kara-Dobo hill (Photo: Topbaev, May 2012).

The Ak-Kyya community has a total number of 5,672 inhabitants (2011). 2,802 people live in Kara-Suu and 2,870 in Jany-Jol. Kara-Suu has 716 courtyards and 592 households, Jany-Jol 665 courtyards and 578 households (AK-KYYA AIYL OKMOTU 2011:3). The number of courtyards is more than the number of households, because several families (usually parents and their children) live in one household.

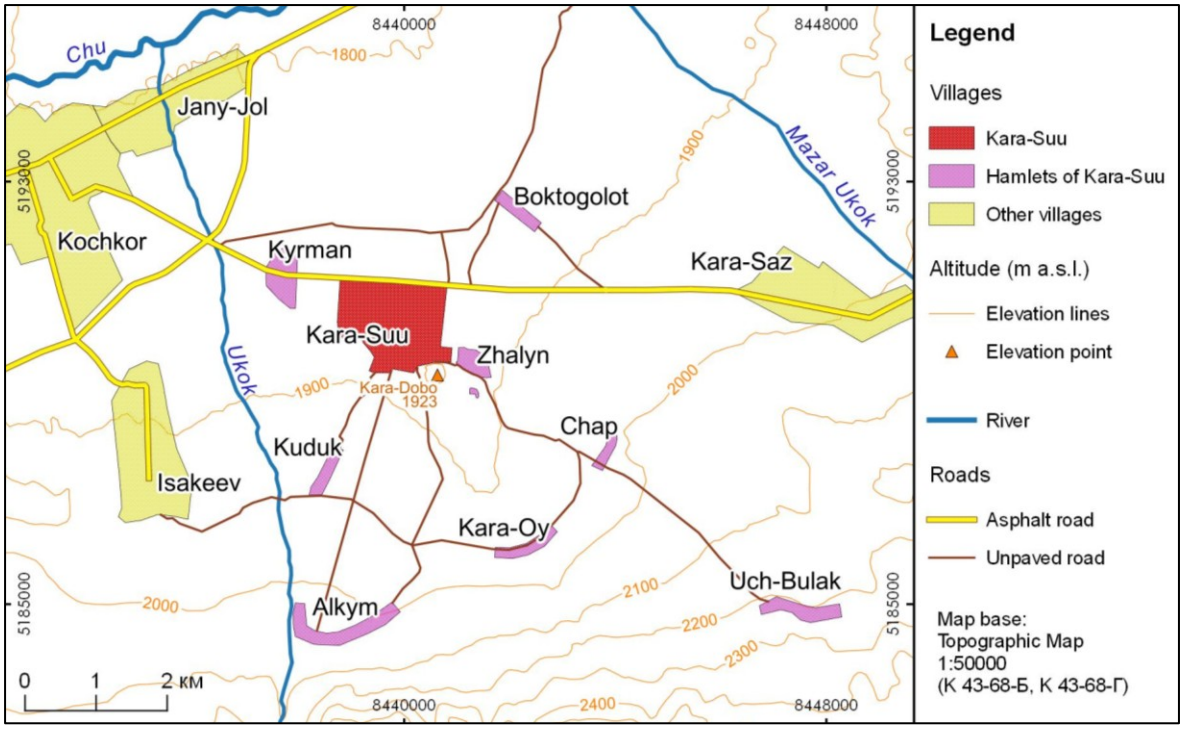

Figure 11: Location of Kara-Suu and surrounding associated hamlets (Draft: Topbaev, 2015).

Kara-Suu is a typical planned Soviet settlement (Figure 12). In an early period of the formation of the Soviet Union (before 1925), the property and animals of seven local *bays* (rich men) in this area were confiscated and concentrated in one farm. Soon the livestock was distributed between the cooperative associations (*artel*) of the two small settlements Chon-Bulak and Cholpon (AK-KYYA AIYL OKMOTU 1998). During the first collectivisation phase (late 1920's to early 1930's) the Ak-Kyya community was formed as a new county, consisting of the two cooperatives of Kara-Suu and Kurama. In 1933/34 the cooperative of Kara-Suu was divided into four *kolkhozes*: Kara-Oy, Uch-Bulak, Alkym and Kara-Suu. Kurama was divided into two *kolkhozes*: Jany-Jol and Kyzyl-Dobo. The territory of these six *kolkhozes* formed the Ak-Kyya community (AK-KYYA AIYL OKMOTU 1998).

In 1951 the collective farms of Kara-Suu, Kara-Oy, Uch-Bulak, Alkym and Jany-Jol were united into one *kolkhoz* named *'Zhdanov'*. The small settlements Kara-Suu, Kara-Oy, Uch-Bulak and Alkym were concentrated in one new planned *kolkhoz* village named Kara-Suu (AK-KYYA AIYL OKMOTU 1998). The planning of the new village followed a Soviet-style design, with a compact rectangular shape and a checkered road system (Figure 12). All public institutions like the village administration (*aiyl okmotu*), the village council (*aiyl kenesh*), post-office, library, club, stadium, sauna (*moncho*) and the shop are located in the center of the village. The old *Midwife Obstetric Unit* (MOU), built in 1958 (AK-KYYA AIYL OKMOTU 2011), was replaced in 2013 (own survey) and moved from the south to the center of Kara-Suu, near the domicile of the *aiyl okmotu*. The mosque in the north-western part of the village was newly built after the dissolution of the Soviet Union in 1998 (AK-KYYA AIYL OKMOTU 2011).

Before the dissolution of the *kolkhoz 'Zhdanov'* in the 1990s, the arable land was owned and cultivated by the collective farm. Its members were employed in animal husbandry, pasture farming and fodder production or fulfilled common tasks in administration or material and social supply. Only small garden plots in the backyards of the houses were cultivated by the private households (ROST et al. 2014).

Figure 12: Basic map of Kara-Suu (Draft: Topbaev, 2015).

After the liquidation of the *kolkhoz*, the arable land in the vicinity of Kara-Suu and the livestock were distributed between the former *kolkhoz* members, whereas the mountain pastures were excluded from land privatization. They are still managed by the community council or the district government. Most households are now living from subsistence farming, as each household in Kara-Suu possesses an average of 2.17 hectares of arable land (ROST et al. 2014). Some of the smallholders have rented additional farmland from other villagers or the community. The sale of their own agricultural products such as grain, hay, as well as the sale of livestock, is the main income sources of most households in Kara-Suu. But this type of cash income is highly dependent from the season, mostly increasing in autumn, when the crops are harvested and the cattle return from the pasture (*zhayloo*). In spring, on the contrary, expenses are increasing, because of the cultivation of the land and moving cattle up on pastures. In addition to the income from farming, the villagers in Kara-Suu receive a permanent monthly cash income from employment in the *aiyl okmotu* (village administration), school, post-office, etc. Older people and extremely poor households have permanent pension or social security benefits. Furthermore, some households are receiving additional income from own mills, shops, saunas, as well as by providing services of their own agricultural machinery (tractor, combine, truck).

According to the own investigation in August 2010, cash income is very different among households in Kara-Suu. From the 112 respondents, only 78 have a regular monthly cash income, for the remaining 34 farming is the only source of income. Most of these 78 households have an income less than subsistence level in Naryn *oblast* (Figure 13); calculated in 2010 by the National Statistical Committee of the Kyrgyz Republic it should amount to 3,300 Soms (about 50 EUR) per month per person (NATSIONAL'NYY STATISTICHESKIY KOMITET KYRGYZSKOY RESPUBLIKI 2011:73).

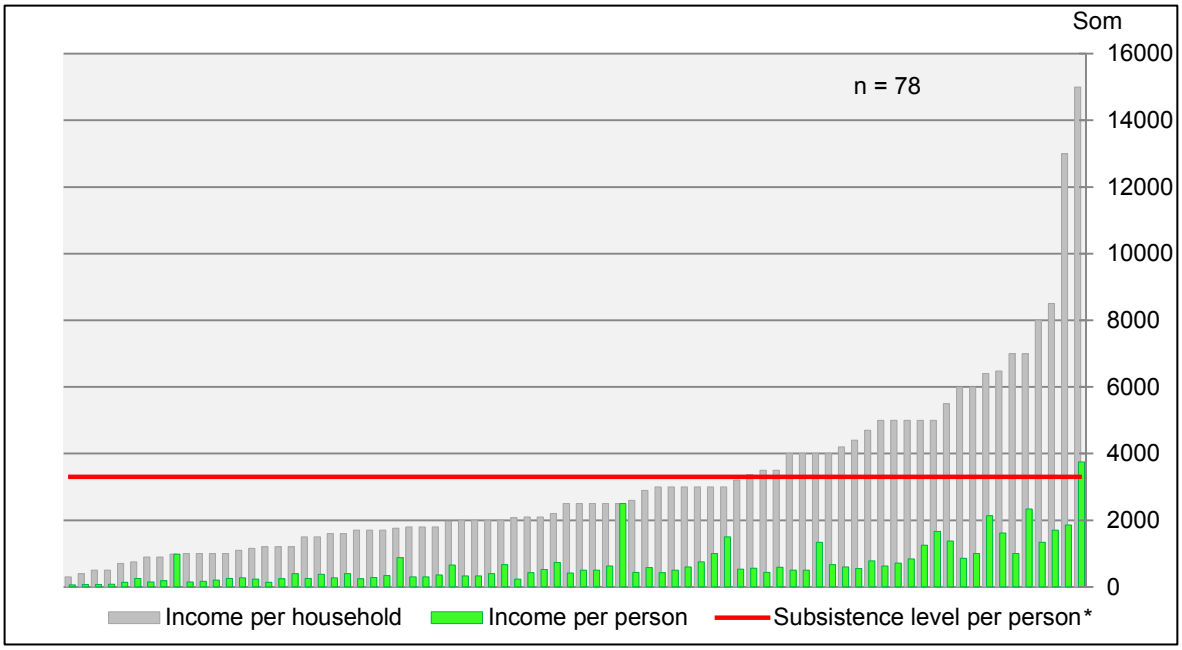

Figure 13: The monthly incomes of households in Kara-Suu and the subsistence level per person per month in Naryn *oblast*, 2010 (Draft: Topbaev, 2015. Data base: Own investigation 2010; *NATSIONAL'NYY STATISTICHESKIY KOMITET KYRGYZSKOY RESPUBLIKI 2011:73).

Like many villages in rural Kyrgyzstan (cf. SCHMIDT 2006, 2014), the Ak-Kyya community suffers from the decline of all public facilities after the nation´s independence. The financial allocations by the government for the local governments are low and many of the households have no permanent income. The deterioration of public utilities resulted in declining living standards and an aggravation of the social situation of most households (ROST et al. 2014). The on-farm irrigation infrastructure as well as the drinking water supply system, which had been operated and maintained by the *kolkhoz* before, was transferred to the local community administration (EBERMANN et al. 2014). The *aiyl okmotu* (administration of village community) is now responsible for the operation and maintenance of the local water supply and sanitation systems (ROST et al. 2014). However, the local government can not cope financially, technically nor organizationally, with this new task. The result of this development is a lack of maintenance and an increasing disintegration of the water supply infrastructure in Kara-Suu, like in many villages of rural Kyrgyzstan.

5. Methodology

The review on literature as it is given in chapter 2 clarifies that information on the situation of drinking water supply systems in rural areas of Kyrgyzstan is rather scarce. The problem of the lack of empirical work and/or official statistics on regional and especially local level in Kyrgyzstan remain, meaning that self-conducted empirical work with a mix of various methods became very important for this thesis. It is especially difficult to find authentic and also detailed information about drinking water consumption in rural areas. As a result, the research design suitable for this thesis has to be based less on literature review, the use of archives and statistic materials, but rather on collecting and analyzing own empirical data by applying some well-approved methods of empirical research.

To get a detailed overview on the current problems in the access to safe drinking water, various literature sources in English, Russian and Kyrgyz language were studied. Additionally, few reports and publications in German were partially translated and analyzed with the help of the German supervisor and colleagues. Basic literature for an extensive study of the drinking water problem on global level are publications of UN, WHO, UNICEF etc. (UNITED NATIONS 1977, 1992, 2000, 2006, 2013; WHO 2003; WHO and UNICEF 2013). Further approaches are documented in publications and reports from organizations like the UN, UNDP, FAO, UNICEF, WB, ADB, DFID etc. (ADB 2000, 2012b; WORLD BANK 2001, 2012; FAO 2004; UNDP 2009; UNICEF 2011; UNITED NATIONS 2013). According to these publications, the activities of states and international organizations aimed at studying and solving problems of access to clean drinking water and sanitation in the poor and developing countries, which were examined.

To compare the situation of the drinking water supply in Kyrgyzstan with other former Soviet countries, additional literature (OECD 2005, 2011; MCKEE et al. 2006) was studied. Furthermore, more emphasis was directed on literature about general water management problems in Central Asia, especially in Tajikistan and Uzbekistan, since these countries have a similar social and economic development (SEHRING 2005, 2007; ABDULLAEV et al. 2006, 2010; HERRFAHRDT et al. 2006; ABDULLAEV 2011, 2012; INTERNATIONAL CONSULTANT MISSION REPORT 2012; ABDULLAEV and RAKHMATULLAEV 2013).

Many international projects in Kyrgyzstan, such as ‘CBISSP’, ‘RWSSP’, ‘Taza Suu’ and others represented in literature of ARIS (2011), OECD (n.d.), WORLD BANK (2012), ADB (2012b) and ARIS (2013), aimed to solve the problem of access to safe drinking water on the field of health-sanitarian or state level. The study of their projects results (UNICEF 2011; WORLD BANK 2012; ADB 2012b; ARIS 2013) was a basis for the analysis and evaluation of current problems in water supply in the selected research area of Kara-Suu as an example for the structures of water supply systems in rural areas of Kyrgyzstan.

An overall knowledge of the general economic and social indicators is of utmost importance for answering the chosen research question. Official statistics prove to be the main source for an assessment of the demographic and socio-economic situation.

Statistical data were obtained mainly from the library of the National Statistical Committee in Bishkek that also runs a website (www.stat.kg) with some statistics in digital form. Unpublished statistical data on the main macroeconomic indicators of the Kochkor *rayon* was provided by the Kochkor Rayon Department on Statistics (KOCHKORSKIY RAYONNYY OTDEL GOSSTATISTIKI 2010). From the *aiyl okmotu* (village administration) of Kara-Suu a few data on local community indicators were obtained. Statistical data concerning the Naryn *oblast*, Kochkor *rayon* and even Kara-Suu could be obtained from the National Statistical Committee. So it became possible, to compare the structures on national, regional and local level. The analysis of population data (NATIONAL STATISTICAL COMMITTEE OF THE KYRGYZ REPUBLIC 2010) also gave information on population dynamics during the last decades, as well as about workforce and migration processes. More detailed data on the population of Kara-Suu, the social infrastructure, as well as the agricultural area and livestock, was obtained by the *aiyl okmotu* of Kara-Suu (AK-KYYA AIYL OKMOTU 1998, 2011).

The *aiyl okmotu* of Kara-Suu also provided archive material that could be used for information on the historical development of the settlement. Unfortunately, this material is non-official and unpublished; problems of exact location and chronological order could not be reconstructed in all cases. To get more historical data on Kochkor and Kara-Suu, the Central National Archives of Kyrgyzstan at Bishkek was visited. But according to an employee of this archive, they only store data concerning the republic in general and Bishkek; all other data would be found in the particular archives of the *oblast* and *rayon* centers. Thus, archive data for the Kara-Suu is located in Kochkor. Therefore the Kochkor Rayon State Archive was visited. Unfortunately, this State Archive could not provide any archival material relevant for the research question due to the fact that they do not have any data about the regional and local water supply system at all.

Due to the problem with archive data, own field research and work became of major importance. During the field work the following methods of empirical research have been applied: An overview of the research area was gained by direct and indirect, respectively participating and non-participating observations, mapping of the water supply system, semi-structured expert interviews with various stakeholders and representatives of different authorities, and standardized interviews on the basis of a questionnaire with inhabitants of Kara-Suu.

The empirical data have mainly been gathered during field research periods in July/August 2010, April and August 2011, May and August 2012 and in August 2013. Quantitative interviews, based on the standardized questionnaires on the fresh water supply system in Kara-Suu, were the most important method for data collection. Finally, a multitude of information on the condition of drinking water and the irrigation water supply system in Kara-Suu village was gained through the interviews with local residents, employees of the pump and swamp drainage stations, *murabs* (irrigation water master) and employees of the *aiyl okmotu*.

Figure 14: Interview with local people in Korumdu (Photo: Kasymov, July 2010).

The basic questionnaire and the interview questions were developed in 2010 in cooperation with Dr. T. Asykulov and Professor J. Stadelbauer in English and Russian and then translated to the Kyrgyz language. Overall aim of the questionnaire was to acquire information on local uses of fresh water, especially the typical behaviours of the villagers when dealing with fresh water. For better results the questionnaire needed to be pre-tested outside of the research area. This pre-test took place in the village of Korumdu in the Issyk-Kul *oblast* (July 27 to 29, 2010), where 30 local families were interviewed (Figure 14). After analyzing the given responses, the structure of the questionnaire was revised and irrelevant questions identified, modified or deleted. The amount of the questions also proved to be too extensive for the respondents. This, in some cases, leads to inaccurate answers. For this reason the number of questions was reduced.

As a result, a reworked questionnaire (see Annex), consisting of 61 questions and structured in four parts, was developed: 13 questions deal with demographic characteristics of the respondents, 22 questions with characteristics of the household, 13 questions with domestic freshwater use, and the last 13 with the agricultural irrigation supply system. As mentioned above, the questionnaire was standardized, meaning that all respondents had to answer the same questions in the same order. Most of the questions are formulated as so-called 'closed questions' with given answers, here the respondent has to decide for one answer category instead of formulating an answer in his own words. Advantages of these kinds of questionnaires/questions are a much bigger comparability of the collected data and an easier statistical evaluation in the end (BRADBURN et al. 2004:103).

Based on the data provided by the *aiyl okmotu* of Kara-Suu and on a total number of 592 households (Ak-KYYA AIYL OKMOTU 2011:3), it was decided in 2010 to conduct the survey

with 120 households, i.e. 20 per cent of the households in Kara-Suu, and with 80 respondents in Jany-Jol village, since this village is not the key area, but a part of the Ak-Kyya community. An additional survey was undertaken in Kara-Suu in 2011 with 50 households (partly the same households as in 2010, partly others). Fifteen of them were chosen for a three days-monitoring (see Annex), combined with a more detailed investigation of the individual freshwater use at home. The purpose of the monitoring was to determine the average daily water consumption for different types of activities in households more precisely. Each of the selected households was given a form with the main question: *How much water is used and for what purpose?* To make it easier for the respondent, five main categories of water use in the household were proposed: drinking, cooking, hygiene (hand/face washing, brushing teeth, bathing), laundry and household in general (videlicet for the cleaning, for domestic animals, etc.). The amount of water used for these purposes was classified into six classes, but unfortunately, this classification proved to be not very suitable for statistical analysis. In April 2012, preliminary results of these questionnaires were presented to the community of Kara-Suu. The local inhabitants and administrators showed a lively interest for the results of the field work. Some even discussed their ideas and suggestions for improving the local water system.

Additionally to the interviews based on a standardized questionnaire, semi-structured expert interviews have been conducted with local *murabs* (irrigation water masters), local administrators and individual experts (the employees of water utilities). In contrast to the household interviews, the expert interviews were guideline-based, meaning that the questions were pre-formulated with respect to the particular respondent, but they were not really fixed and not necessarily asked in order. Furthermore, most of the questions had an open character, giving the expert the possibility to answer according to his experiences and ideas. These expert interviews serve as an additional source for information on the local structure of the freshwater supply system. A quantitative evaluation is, in contrast to the interviews with the households, rather impossible. Nevertheless, they can point out or reflect internal structures of the freshwater supply system, existing problems or personal ideas and opinions.

General information on the structure and development of the village has been obtained from the head of *aiyl okmotu*. He also provided information on the structure of administration management, the system of municipal organizations in the village and their activities. Urgent problems of Kara-Suu, like questions of water use and the standard of living in general, were discussed with the head of village.

Information on sanitation norms, the local water management and on general rules required for drinking water were collected from the authority ‘Vodokanal’ (Department of Water Utility) in Kochkor village. The head of this department, Mr. Mambetaliev Myktybek, communicated historical and current data of the development of the drinking water supply infrastructure in Kara-Suu.

The ‘Centre of Sanitary Surveillance’ in Kochkor is responsible for monitoring the drinking

water quality throughout the *rayon* (district). But, unfortunately, detailed information about the results of laboratory tests was not available, since this information is for internal use only. So, only general information on testing results was given by this centre.

In Kochkor as well as in Kara-Suu, specialists and employees of the 'Kochkor Rayon Water Management' (KRWM) were interviewed. The head of the KRWM, Mr. Kyrgyzbaev Duyshon, gave an overview on the structure of the KRWM. This administration deals with issues concerning the agricultural irrigation system within the district. However, it is only responsible for the irrigation water supply on agricultural land, but not for the urban or rural drinking water supply. Concerning the freshwater supply system in the village itself, the *aiyl okmotu* is in charge.

During the field campaigns in Kara-Suu (Figure 15), the fresh water supply system (e.g. location of street pumps, swamps or springs) was mapped. A basic map of Kara-Suu was created by using topographic maps (1:50 000 from 1982), GPS-data and an existing sketch plan of the village. The latter one was a hand-drawn and coloured map from the local *moldo* (mullah). The new village map of Kara-Suu (see Figure 12) was drawn with the QGIS program (QGIS DEVELOPMENT TEAM 2014). It served as a basic map to visualize own results in thematic maps.

Figure 15: Visual defining of the pump's condition in Kara-Suu (Photo: Kasymov, April 2011).

Observation was another applied research method, mostly direct and participating as well as non-participating. Direct means here a direct observation of real actions, e.g. carrying water home with plastic bottles from a pump. An active form of observation is the so-called participative observation, meaning that the observer plays an active role within the group with individuals of his interest. If the observer is rather passive, thus not directly caught in the scene of action, it is a non-participating observation. Mostly, these two types

of observation are combined with each other; this combination was performed in Kara-Suu, too, by being more or less active in the particular situations of observation (BRADBURN et al. 2004; MACK et al. 2005).

By analyzing the data gathered from the questionnaires, interviews, literature research and statistics, a wide range of information on Kara-Suu and its water supply system was obtained which is represented and discussed in the following chapters.

6. Results

6.1. Fresh Water Sources and Water Consumption in Kara-Suu

Due to the landlocked location of the study area, all sources of freshwaters can be classified in three main groups: 1) surface water: rivers (in a natural or regulated state), lakes and reservoirs; 2) underground water: groundwater and artesian waters, springs, wetlands (swamps, bogs, etc.); and 3) atmospheric precipitation: rain water as well as water from melting snow and ice (KOSHELYOV and SAVINOV 1983:5).

The study area of Kara-Suu is located in the catchment of the Ukok river, but the water from this stream is practically not used for drinking water purposes, as the river is located at a significant distance from the village. Water which is diverted from the Ukok river, is only used for irrigation of the fields south of the village (EBERMANN et al. 2014:85). Kara-Suu is surrounded by several swamps and springs (Figure 16). Currently only a few number of households in the village use water from these swamps and springs for drinking water. However, most households use freshwater from these sources to irrigate their backyard garden plots. Only some of the hamlets, like Alkym, Kyrman, Uch-Bulak and Kuduk (see Figure 11), get their water from nearby rivers, rivulets and local springs.

The main source for drinking water is groundwater, which is pumped from the alluvial fan south of the village (EBERMANN et al. 2014; Rost et al. 2014). The groundwater aquifer is located at a depth of more than 50 meters and therefore is less prone to pollution and relatively clean. This groundwater is replenished by infiltration of surface water, precipitation and from irrigation water (KARIMOV and ABDRASULOV 2004:44). Therefore, in the settlement all sources of freshwater should be considered as interrelated with each other, ground water and surface water.

According to its origin, there are three sources for drinking water supply in the vicinity of Kara-Suu: 1) *Groundwater*; 2) *Swamp water,* and 3) *Spring water*. Groundwater supplies almost 90 percent of all population in Kyrgyzstan (KARIMOV and SARYMSAKOV 2005:3). It is a source for high quality drinking water (KOSHELYOV and SAVINOV 1983:6; KARIMOV and ABDRASULOV 2004:14). Moreover, groundwater is widespread within the intermountain basins, like the Kochkor basin, and provides a stable fresh water source due to a weak impact of external climate change factors (KARIMOV and ABDRASULOV 2004:14).

The installation of the freshwater supply system in Kara-Suu began during the late 1950s and early 1960s (EBERMANN et al. 2014; ROST et al. 2014). As the Kyrgyz place name Kara-Suu (*'Black Water'*) is derived from a small rivulet and three small swamps (*saz*) at the southern outskirts of the village (Figure 16), it is suggested that their existence once had been a major reason for the village foundation. In the early years of the village, these swamps were the main freshwater source. Small earth trenches (*aryk*), following the natural slope gradient, delivered water from the swamps to the properties in the village (EBERMANN et al. 2014; ROST et al. 2014).

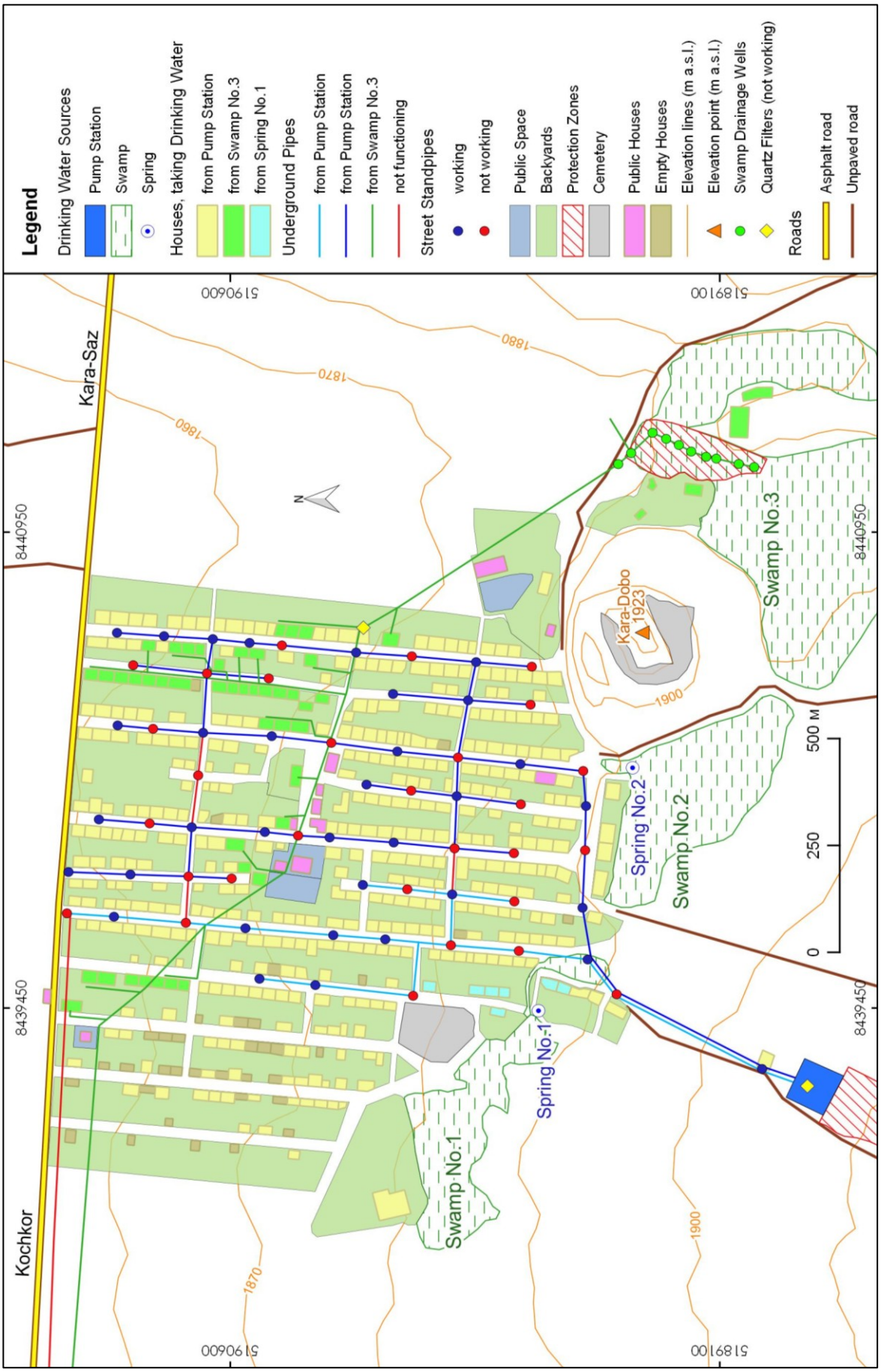

Figure 16: Fresh water sources and drinking water infrastructure in Kara-Suu (Draft: Topbaev, 2015).

Nowadays the water from these swamps is mainly used for irrigating the garden plots in the backyards of the households. Only one of them, in the south-eastern part of Kara-Suu, is used as a source for drinking water (Figure 16: Swamp No. 3).

Another freshwater source within the vicinity of Kara-Suu is spring (*bulak*) water. Compared with the swamps, the springs are widespread in the surrounding mountainous area and their water is generally of good quality and can be used for drinking purposes without any additional purification processes (KOSHELYOV and SAVINOV 1983:59; MEULI and WEHRLE 2001:12). There are two relatively essential springs in the southern and south-western part of Kara-Suu. Additionally, there are a few more springs on the mountain slopes south of the village. They serve as a source for drinking water in hamlets such as Chap, Kara-Oy and Uch-Bulak (see Figure 11). By the names of some surrounding settlements, the existence and significance of different types of water sources in this area can be identified: Uch-Bulak (*'three springs'*), Kara-Saz (*'black swamp'*), Kuduk (*'well'*) and Alkym (*'throat'*, a place where the river flows out from a mountain into the basin). According to the elderly inhabitants, the springs located around the village of Kara-Suu have been the single source for drinking water in Kara-Suu before the early 1970s.

Figure 17: Standpipe in the street of Kara-Suu (Photo: Topbaev, April 2011).

As the villagers fetched their freshwater from such unsafe sources in regard of hygiene, a new water supply system for the village was constructed during the 1970s and 1980s (EBERMANN et al. 2014; ROST et al. 2014). In a first step, a subsurface drainage pipeline was laid in the 'Swamp No. 3' in 1965 to withdraw water and deliver it to the nearby village of Kochkor (Figure 16). However, due to the poor quality of the swamp water, this pipeline was put out of service between 1972 and 1991 (see ROST et al. 2014). To improve the

local drinking water supply of Kara-Suu, a groundwater pump station was built south-west of the village in 1972 (Figure 16). The water is stored in a cistern, from which it is pumped into two separate subsurface pipelines (KOCHKORSKIY RAYISPOLKOM NARYNSKOY OBLASTI KIRGIZSKOY SSR 1976). These two pipelines deliver the freshwater to more than 60 hand-operated standpipes in the streets of the village (Figure 17). Most of these standpipes have been installed between 1972 and 1979 (ROST et al. 2014). Still most households take their drinking water from these standpipes (Figure 18).

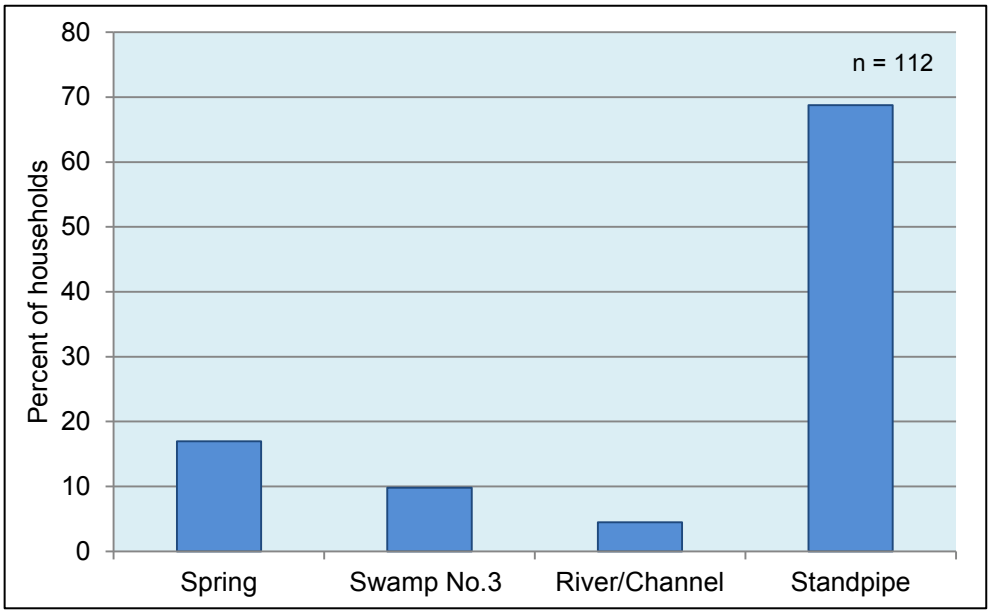

Figure 18: Fresh water sources used by households in Kara-Suu, 2010 (Draft: Topbaev, 2012).

Since the national independence and the dissolution of the former *kolkhoz 'Zhdanov'* in the early 1990s, the management, operation and maintenance of the freshwater supply system is being conducted by the community itself and the existing infrastructure has been transferred to the local administration (*aiyl okmotu*) of Kara-Suu.

Theoretically, the consumption of water in rural areas of Central Kyrgyzstan combines individual norms of water use for various needs: domestic, drinking, watering of animals, technical use of agricultural machines, watering plants in the household plots, for businesses and for the primary processing of agricultural products (KOSHELYOV and SAVINOV 1983:10). The volumes of water consumption in households are depending on many factors, such as the condition of the water supply system, the climate, welfare of the population, household size, etc. (KARIMOV and ABDRASULOV 2004:59).

The quantity of water consumption in households can be estimated only approximately, because it is very difficult to take into account all types of water use. Furthermore, no water meters exist in most households. The norms of drinking water consumption approved in the former USSR were established in 1976. According to these norms, the minimum daily norms of the consumption of water for drinking needs per person are determined as following: in a temperate zone up to 10 liters, in a hot zone 15 liters

(KOSHELYOV and SAVINOV 1983:10). In an attempt to calculate fees for drinking water consumption, the Kyrgyz state 'Department of Water Utility' (PROIZVODSTVENNO-EKSPLUATACIONNOYE UPRAVLENIYE 'BISHKEKVODOKANAL' 2009) established the following norms for the consumption of water: from street pumps 35 liters, from pumps in the backyards 60 liters and from in house water taps 100 liters per day and per person. These quantities did not change significantly since Soviet times.

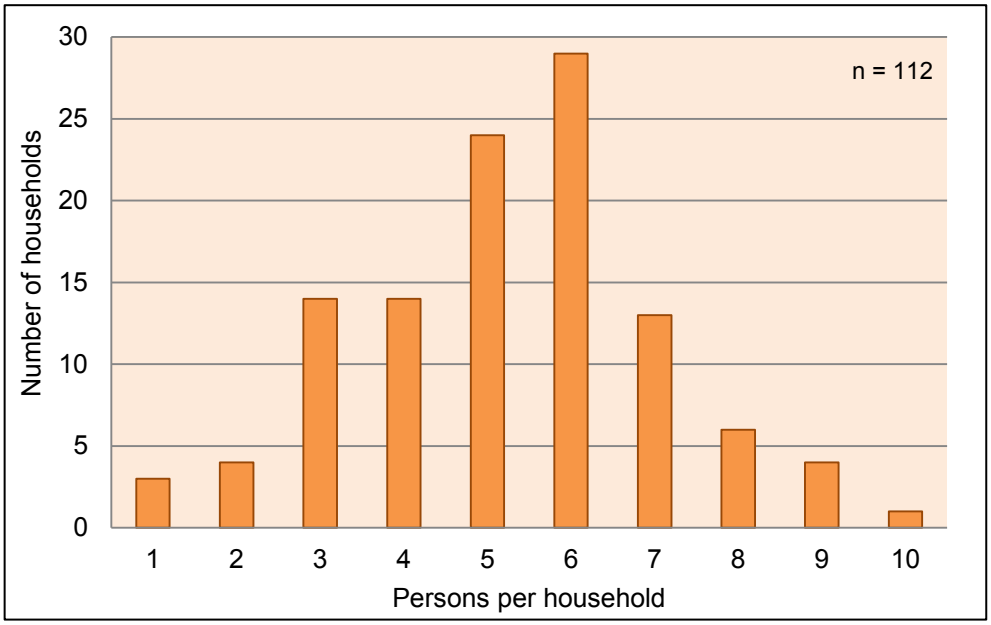

Figure 19: Number of persons per household in Kara-Suu, 2010 (Draft: Topbaev, 2013).

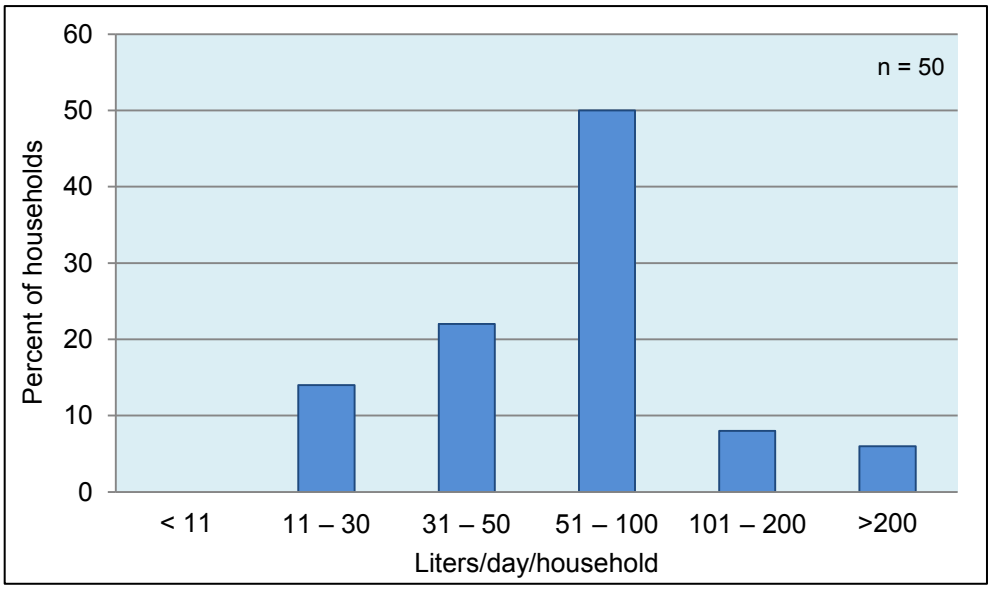

Figure 20: Daily water use per household in Kara-Suu, 2011 (Draft: Topbaev, 2013).

According to the survey of MOLDOSHEV (2006), the specific actual amount of freshwater consumption in rural villages of Kyrgyzstan is estimated about 50 liters per person/day. In view of this quantitative indication of MOLDOSHEV (2006), an average five-person

household (Figure 19) in Kara-Suu should have a daily water demand of 250 liters per day. Since there are no metric water measuring facilities in Kara-Suu, like in most rural settlements in Kyrgyzstan, the actual water consumption is difficult to determine exactly.

To determine the needed daily amount of drinking water by the households in Kara-Suu, as well as their general water consumption, own surveys were conducted in 2010 and in 2011. From the 50 households mentioned in Figure 20, 15 were asked to measure their daily water consumption over a period of three days. It became evident, that the bulk of households consume about 51 to 100 liters of water per day. Most of the respondents replied that they take their water from the standpipes in the streets (see Figure 18).

By norms of the PROIZVODSTVENNO-EKSPLUATATSIONNOYE UPRAVLENIYE 'BISHKEK-VODOKANAL' (2009), the average daily amount of water needed for a household consisting of five persons is 175 liters. This amount is higher than the result which was obtained during the survey in Kara-Suu. This means that the people in Kara-Suu consume much less water for drinking and domestic purposes than given in the established norms.

Furthermore it is important to consider the quality of the drinking water. According to an interview with the medical doctor Mr. Usonbek Borukchiev from the Kochkor Sanitary Centre in May 2012, the drinking water quality in Kara-Suu is checked periodically, once every three month. According to his information, the analyzed drinking water from the groundwater pump station near Kara-Suu *'meets the national standard for the quality of drinking water'*. However, in summer 2012 some school children in Kara-Suu fell ill with viral hepatitis (ROST et al. 2014). For water from the swamps and springs, it is recommended to boil it before drinking (pers. comm. Mr. Usonbek Borukchiev, May 2012). Unfortunately, more detailed information on the results of the laboratory tests and the chemical and biological composition of the drinking water was not available, respectively given to external persons. Therefore, the opinion of the local villagers about the quality of drinking water was examined, too.

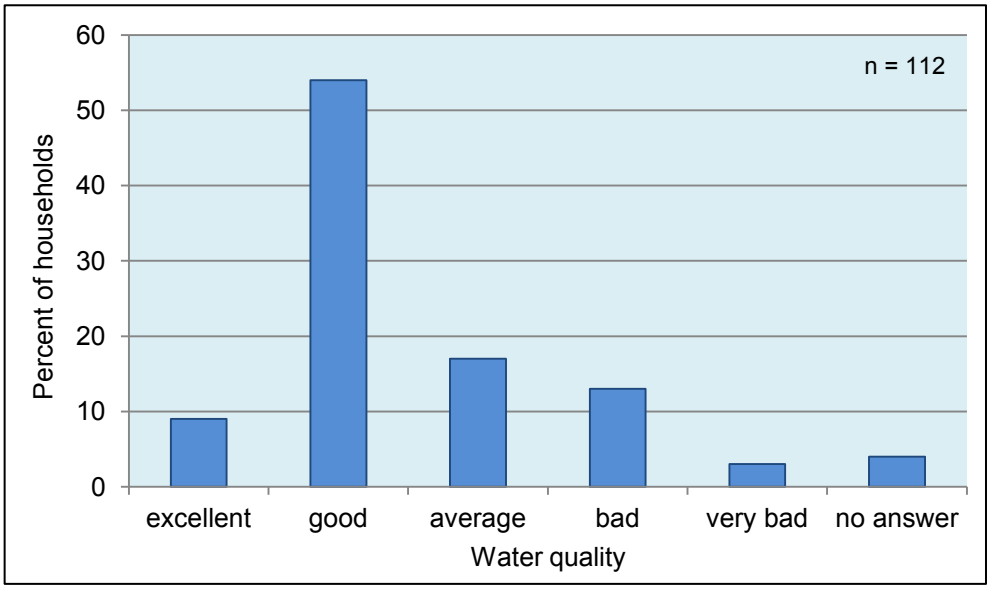

Figure 21: Inhabitants' opinion about the quality of the fresh water in Kara-Suu, 2010 (Draft: Topbaev, 2012).

More than 50 percent of the respondents replied, that the freshwater is of 'good' quality (Figure 21). An 'excellent' quality was stated in 2011 by much more people than in 2010. It is assumed that many of the respondents, who were interviewed in 2011, had their own private water pipes to their house or yard. It is important to notice that people's responses are not considering the chemical or biological quality of the water they use. For them, quality is synonimous with service and availability. Therefore, many households, who have water supply close or directly in their yard, answered here with 'good' and 'excellent'.

According to an interview with the nurse of the Kara-Suu hospital, Mrs. Saltanat, in August 2013, infectious diseases related to poor water quality (e.g. diarrhoea, viral hepatitis) are observed among two or three children every year, mostly during summer time. The main source of such diseases is the use of water from irrigation channels and, to a minor extent, from the swamps. She also confirmed that those who use groundwater for drinking are less susceptible to infectious diseases. Thus, the poor condition of the water system, as well as non-compliance with basic rules of transportation and storage of water, can lead to water-related diseases.

6.2. Infrastructure and State of Maintenance of the Groundwater Supply System

The local groundwater pump station is situated about 300 m south-west of Kara-Suu (see Figure 16). According to archive data of the KOCHKORSKIY RAYISPOLKOM NARYNSKOY OBLASTI KIRGIZSKOY SSR (1976), the borehole for the extraction of groundwater was drilled in 1972. The pumped groundwater is stored in a reservoir of two cisterns in the pump station (Figure 22), with a particular estimated volume of 576 m^3, respectively 1080 m^3. From these cisterns the water is delivered to the standpipes in the village via two subsurface pipelines (EBERMANN et al. 2014; ROST et al. 2014). The water in the pipelines follows the natural slope gradient. By archive data, the longest water pipeline in the village was then 5.8 km (KOCHKORSKIY RAYISPOLKOM NARYNSKOY OBLASTI KIRGIZSKOY SSR, 1976).

Whereas one of the pipelines supplies the standpipes in the eastern and central quarters of Kara-Suu with drinking water, the other one supplies the western part of the village. According to the pump station employee Mr. O. Saralaev (pers. comm., April 2011), these pipelines were connected into a single water supply system, but in the last decade it has been damaged in many places and therefore the two pipelines are not interacting with each other anymore (see Figure 16). So during a technical outage of one pipeline, at least half of the village could still be provided with drinking water (ROST et al. 2014).

During Soviet times, the groundwater pump station worked on the basis of two electrical pumps and a part of the water was directed to Kochkor and Jany-Jol. During the first years of independence the control of the pump station was transferred from the district government to the village administration of Kara-Suu (ROST et al. 2014). The public water supply became a local system without any relation to Kochkor and neighboring

settlements. All maintenance and repair works have to be self-financed by the village now. For several years one of the electrical pumps is out of operation and the remaining pump is periodically in need of repair. If this pump also breaks down completely, Kara-Suu would be left without its main source of drinking water, as it happened between 1996 and 2005 (ROST et al. 2014).

Figure 22: Water reservoir of the groundwater pump station south of Kara-Suu (Photo: Topbaev, May 2012).

Figure 23: The non-working quartz filter in the groundwater pump station of Kara-Suu (Photo: Topbaev, August 2012).

According to an interview with an employee of the pump station (pers. comm. Mr. O. Saralaev, August 2012), the remaining electrical groundwater pump has to work every evening till morning for 12 to 14 hours. During the nightly water hauling, the water delivery to the standpipes in the village is stopped. Therefore, the households that use water only from street pumps have to collect the amount of water required until the next morning in advance. In the morning, the electrical pump is switched off and water is delivered to the village again approximately from 8:00 a.m. to 7:00 p.m. During daytime, the water from the reservoir flows by gravity to the village. The tank becomes hence empty and is filled again during the next night.

The poor situation in the water purification sector was observed, too. In the groundwater pump station the water used to be cleaned by a so-called quartz filter during Soviet period (Figure 23). But it requires a lot of electricity to operate it. During the transition period, these filters could not be cleaned or replaced due to the lack of sufficient funding. Thus, the filter system was run down and abandoned (ROST et al. 2014). Currently, the water does not pass any purification processes.

In Kara-Suu a total number of 63 hand-operated standpipes are located along the streets in the village. According to an inventory during the field campaign in August 2011, only 34 of them were working. 'Working' in this case means that from those standpipes water comes out continuously during the day (Figure 24). From the remaining 29 non-working ones no water comes out at all. However, the number of working and non-working standpipes varies each year, because some of them are periodically repaired during the summer months. During the winter months, many standpipes freeze in and break down. However, some of the standpipes are also out of order because of theft or vandalism.

Figure 24: 'Working' standpipe in Kara-Suu (Photo: Topbaev, August 2012).

It can be concluded that one of the problems of providing the village with drinking water is the technically outdated state of the standpipes. The water supply infrastructure was established during the Soviet period and is now more than 30 years old. The installations are in need of replacement or have fallen into complete disrepair (ROST et al. 2014). Since the early 1990s, the inadequate public funding hampered the maintenance of the communal water supply infrastructure. Water service interruptions have become the norm, rather than the exception. In some years of the mid-1990s and early 2000s, the standpipe system in Kara-Suu was even completely out of service (ROST et al. 2014).

Due to this situation, many villagers are forced to install their own private water connections (Figure 25). According to an interview with an employee of the pump station, 32 households in Kara-Suu have already installed their own water pipelines (pers. comm. Mr. O. Saralaev, May 2012) and divert water from the subsurface pipeline that runs from 'Swamp No. 3' to Kochkor (see Figure 16). As the number of such pipelines is increasing, the water pressure in this pipeline will subside in this system, which actually supplies the village of Kochkor with drinking water (ROST et al. 2014).

Figure 25: Villagers digging a trench for a private connection to the subsurface pipeline in Kara-Suu (Photo: Topbaev, April 2011).

Because of the poor technical condition of the standpipes, water runs uselessly down the streets. The situation would be socially and economically more profitable with in-house water taps, not only for the households, but also for the local water supply system and for the environment. Connected to the subsurface pipeline by private pipes are in general those families which are in a good economic situation. All costs for providing the household with an own private on yard or in-house water connection have to be paid by the premises owners.

From all the foregoing we can calculate the average amount of drinking water needed per

day in Kara-Suu: As mentioned before, one household spends about 100 liters of drinking water daily (see Figure 20). Therefore, the 592 households of Kara-Suu all together use about 59,200 liters (or ≈ 60 m^3/day) of water per day. The cisterns of the groundwater pump station have a total volume of 1,656 m^3 (own measured data). A full tank of water would hence be enough to supply the village for a period of 27.6 days with fresh water. Even if they needed twice as much water than calculated, the water stored in the cisterns would be enough for almost two weeks. By own measurement in August 2012, it became evident that during one day about 80 percent (Figure 26) of the stored water (or 1,324.8 m^3) was delivered from the cisterns into the drinking water supply system. Due to the fact that only about 70 percent (see Figure 18) or 425 households in the Kara-Suu use drinking water from this source, only about 42.5 m^3 from the total of the delivered water is used and the remaining amount of 1,282.3 m^3 of water (96.8 %) is just loss.

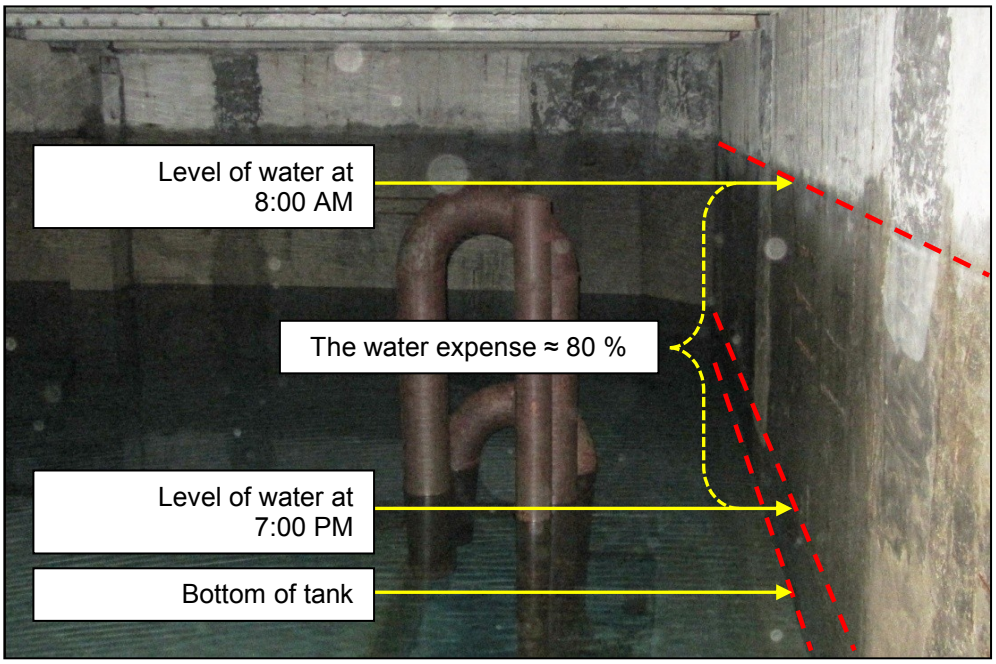

Figure 26: The water expense of the pump station per day (inside of small cistern) (Photo: Topbaev, August 2012).

6.3. The Drinking Water Supply System of Swamp No. 3

A second source of drinking water is the 'Swamp No. 3' south-east of Kara-Suu (Figure 16, Figure 27). Here, water is collected by the Swamp Drainage Station which is subordinated to the municipal water department 'Vodokanal' in Kochkor. According to the head of 'Vodokanal', Mr. Myktybek Mambetaliev, the Swamp Drainage Station was built in 1965 specifically to provide drinking water for the village of Kochkor. Therefore, all water in this system was directed to the center of the *rayon*. However, in 1972, the operation of this swamp water drainage system was shut down and an additional pump station belonging to 'Vodokanal' was built between Kara-Suu and Kochkor to supply the village of Kochkor with groundwater. But after gaining independence in 1991 and the associated decentralization processes, 'Vodokanal' stopped receiving water from the groundwater

pump station in Kara-Suu. More over, due to economic difficulties, 'Vodokanal' was not able to maintain the pump station and restarted the operation of the 'Swamp No. 3 Drainage System'.

Figure 27: The 'Swamp No. 3' south-east of Kara-Suu (Photo: Topbaev, May 2012).

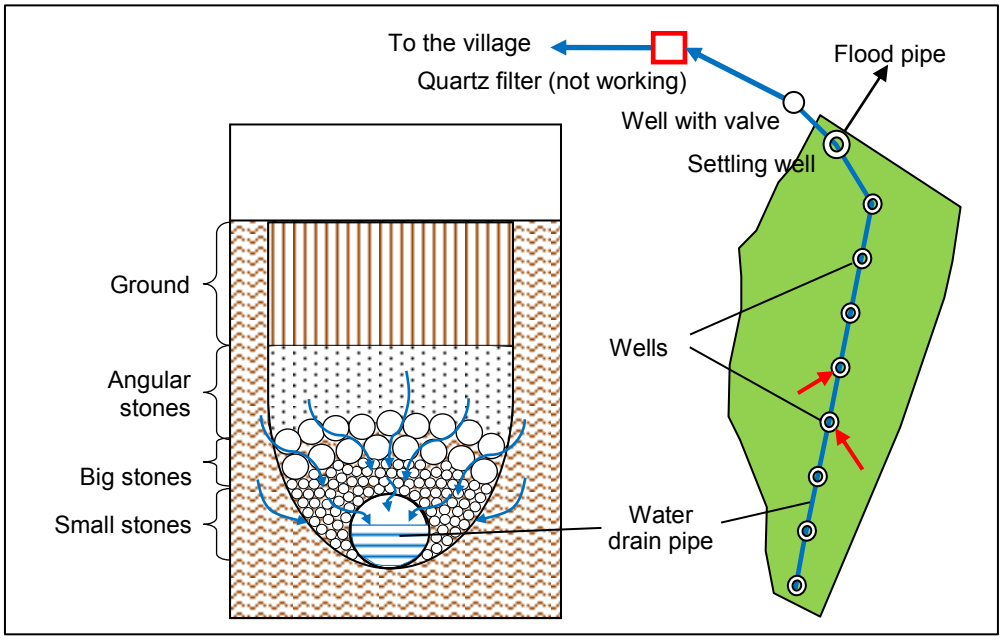

Figure 28: Structure scheme of the 'Swamp No. 3 Drainage Station' (Draft: Topbaev, 2014).

The total area of drainage around Swamp No. 3 accounts for 5 hectares. Water is collected in pipes at a depth of 2.2 m below the ground. There are nine wells within the drainage systems (pers. comm. Mr. M. Mambetaliev, April 2011). The organization of the drainage system is shown in the scheme below (Figure 28). A subsurface pipeline with the

swamp water passes through Kara-Suu village, which enables about 40 households to get connected to it (see Figure 16). Only households in the north-eastern part of the village have the opportunity to connect to this pipeline, due to their proximity to the Swamp No. 3.

Since water from the swamp was originally intended for the village of Kochkor, settling tanks are located between Kara-Suu and Kochkor, in the pump station belonging to 'Vodokanal'. Previously, the water collected in the drainage system was cleaned by a quartz filter in the east of Kara-Suu, similar to the one in the groundwater pump station (see Figure 23). Due to a lack of operation and maintenance, this water purification system is in dysfunction. Therefore, the water from the Swamp Drainage Station passes Kara-Suu without any cleaning process. However, according to the Kochkor Sanitary Centre, the swamp water meets all national quality standards and norms for drinking water.

There is only one small settling well (Figure 28) in the drainage system, in which a metal mesh serves as a filter to catch coarse particles in order to avoid that the pipes get littered. This mesh is periodically cleaned by the employee of 'Vodokanal', Mr. Zhumabek Omurzakov, who is living next to the Swamp No. 3. He is a security guard and also responsible for maintaining the cleanliness in the drainage area. If repairs or any other work on the water pipes are necessary, the valve next of the settling well is closed, which would mean that all the water coming from the drainage system flows out by flood pipes into a nearby irrigation channel.

Figure 29: Well of the Swamp Drainage System after a reconstruction process (Photo: Kasymov, August 2011).

According to Mr. M. Mambetaliev (pers. comm., April 2011), water collected from the surface of the swamp should infiltrate through some layers of earth and several layers of

stones with different size into pipes and then flow to the village (Figure 28). However, some parts of the Drainage System in the Swamp No. 3 do not fit this requirement (Figure 29). Kochkor 'Vodokanal' has established additional pipes to this Drainage System in 2011 for the increasing amount of collected water. They are marked by red arrows in Figure 28. Unfortunately, construction work was not done well and some amount of surface water flows directly into the pipeline without any draining process. Moreover, the wells in this drainage system are covered with metal lids that do not give enough protection from external contamination. Usually, asbestos cement tubes are used for the main water pipelines (Figure 30), but they are, according to modern standards, not suitable for the transport of drinking water (NERONOVA et al. 2011:31).

Furthermore, the whole territory of the drainage system is surrounded by a barbed wire fence, which should protect this drainage area against the penetration of livestock. But this rule of operation is violated by the security guard himself. Since the fenced area has a very good pasture, his cattle graze here freely. Moreover, the pit latrine and his waste water discharge of his household are also closely located to this drainage system. Upstream of the fenced area, the swamp is also used for livestock grazing. Thus, the Swamp No. 3 is not a suitable source of drinking water production.

Figure 30: The asbestoses pipes for the Drainage System in Kara-Suu (Photo: Topbaev, April 2011).

6.4. Drinking Water from Springs

In the southern and south-western part of the village, two springs provide drinking water for nearby houses (see Figure 16: Spring No. 1 and Spring No. 2). A discharge of approximately 0.3 to 0.5 l/sec. for each of them was measured during a field campaign in

August 2012. This discharge of water can vary depending on the season (MEULI and WEHRLE 2001:13). According to the villagers of Kara-Suu (questionnaires data, August 2010), the volume of output flow increases during summer and decreases in winter time. Since the south Spring No. 2 is located in a place where it is difficult to fetch water, the only Spring No. 1 used as a source of drinking water is in the south-west of Kara-Suu (Figure 31) near Swamp No. 1. The water from Spring No. 2 is mixed with the waters of the Swamp No. 2, which is mainly used for irrigating garden plots in Kara-Suu.

The springs do not freeze in winter. When the groundwater pump station stops due to prevention or because of power outages, almost half of the population of Kara-Suu is taking its drinking water from the Spring No. 1. The other villagers get the water from the Swamp Drainage Station. After the construction of water pipes, the springs ceased to play an important role in providing drinking water. Currently, they are mainly used for irrigation. Exceptions are only a few households, which are located nearby Spring No. 1 and some hamlets in the vicinity of Kara-Suu, for whom this is the main source of drinking water, since other sources or street standpipes are too far away. Additionally, there is no money charged for the use of water from the spring.

Figure 31: Spring No. 1 on the south-western part of Kara-Suu (Photo: Topbaev, May 2012).

The quality of spring water is good, it can be used without any purification system as long the source will be kept in clean conditions (KOSHELYOV and SAVINOV 1983:59; MEULI and WEHRLE 2001:12). Due to the fact that this source does not have any owner, only the villagers of Kara-Suu themselves are responsible for safety and the purity of the spring's surroundings, especially those who live nearby and use it as a main source of drinking water. To protect the freshwater from the spring from contamination, it is necessary to establish a sanitary zone like on the Swamp Drainage Station, with a radius of about 30 –

50 meters, on which no human beings, livestock or pursuing any economic activities are permitted (KOSHELYOV and SAVINOV 1983:49). This requirement is not met with Spring No. 1: located right next to a source are plots of households with latrines at a distance of less than 50 meters. Furthermore, Spring No. 1 does not have any fence that would prevent livestock from having access to both, the source and its surroundings. Moreover, the output of Spring No. 1 is open and does not have any technical installations to keep the water in clean condition (Figure 31).

6.5. The Irrigation System for Gardening and Water Use for Domestic Animals

The majority of households in Kara-Suu cultivate potatoes, cabbage, carrots, garlic and other vegetables as well as fruits (e.g. apples, apricots) in their backyard garden plots (*ogorod*) (Figure 32). Some households only plant clover or other kinds of fodder in their backyards. Most villagers irrigate their garden plots. The irrigation system for the watering of the gardens primarily is supplied with water from the three swamps south of Kara-Suu. In addition, the irrigation water destined for the fields can also be used for watering garden plots. The irrigation water flows into Kara-Suu by several channels, situated mainly in the western part of the village. It is basically the residual water of the irrigation of the above located fields; therefore, the volume of this water is rather small and it does not play such an important role for irrigating garden plots like swamp water.

Figure 32: Typical backyard garden plot in Kara-Suu (Photo: Topbaev, August 2014).

Three zones that are irrigated from different swamps can be distinguished in the village (Figure 34): The eastern part of the village is mainly irrigated with water from ‘Swamp No. 3’. The central part is getting water from ‘Swamp No. 2’, whereas ‘Swamp No. 1’ supplies

the western part with irrigation water. The water from the swamps flows downhill in open earth trenches, following the natural slope gradient (ROST et al. 2014). The trenches are running along the streets and are poorly equipped with regulation facilities (e.g. gates), or measuring facilities. People mainly practice furrow irrigation to water their small garden fields. To irrigate them, they open the simple gates between the trenches along the street and water their cultivated area (Figure 33).

Figure 33: Irrigation channel with a diverting trench into a garden (Photo: Topbaev, May 2012).

The garden plots are irrigated without regulating the volume of water, which leads to an excess of water (*maynap*). Due to a lack of an accounting or controlling system, practically every watering results in *maynap*. Thus, if one person is watering his plot, the *maynap* can be used by a neighbour located downslope.

For a consistent and well-organized irrigation of their garden plots, villagers choose a so-called *'murab'* (irrigation water master), who is responsible for determining the order and time of irrigation. Each swamp is supervised by such a *murab,* who manages the water distribution for the garden plots along two to four main streets in the village (ROST et al. 2014). The *murabs* are elected by the water users and conduct their activities more or less as a sideline job.

The allocation of irrigation water is based on demand. Basically the garden plots are watered during the night. Villagers who want to irrigate their allotment, have to inform their *murab*. He collects the water requests and notifies the requesters about the time they can divert water from the trench into their garden (ROST et al. 2014). Currently, the responsible *murab* receives 25 Som (about 0.35 EUR) from the requester for each irrigation event. People do not pay for the water itself, but for the *murab´*s service. *Murabs* are mainly responsible for the fair and rational distribution of water among the users.

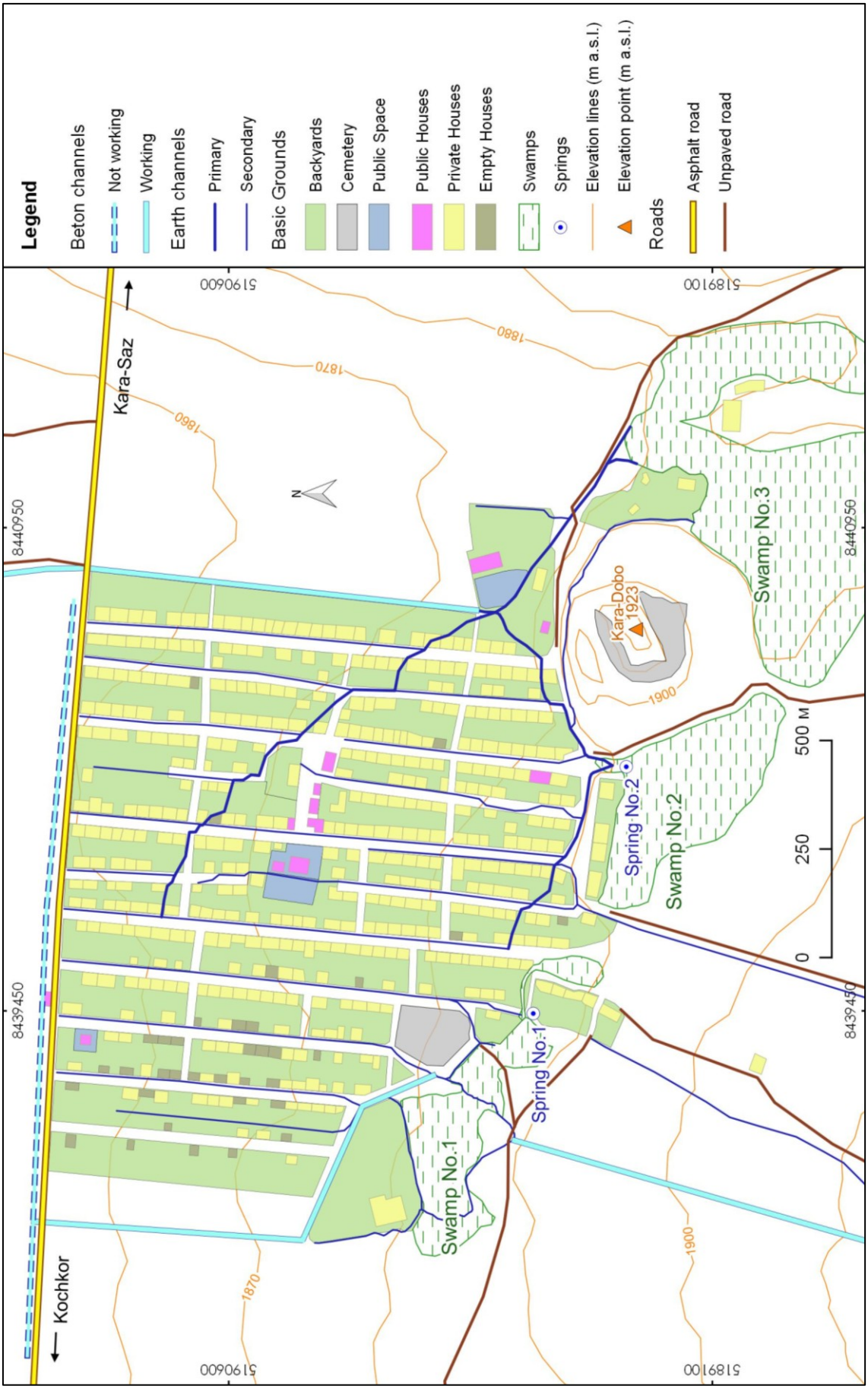

Figure 34: The irrigation system of garden plots in Kara-Suu (Draft: Topbaev, 2015).

However, due to the increased demand for water in the growing season, conflicts occur due to the large number of requests (EBERMANN et al. 2014; ROST et al. 2014). It is difficult for the *murabs* to manage the water distribution of the requesters in an orderly and timely basis. Therefore, the *murab* must solve all conflicts and disputes through discussions with water users.

The irrigation trenches are managed and maintained on a community level and every user is responsible for their operation. Usually the people clean and repair trenches only during the irrigation season. In consequence, trenches deteriorate during the winter season and in some places they are even completely dilapidated. The open earth trenches have tremendous water losses by infiltration and evaporation. Other reasons for the poor technical conditions of the irrigation and water distribution systems are the depreciation of equipment, the use of old-fashioned irrigation methods and the lack of water-saving technologies as well as drainage water systems (KARIMOV and ABDRASULOV 2004:6).

The demand on the irrigation water in Kara-Suu increased, due to the fact that water from channels is used for watering the livestock, too. However, half of the year, from May until October, most livestock (except poultry) is moving to the summer pastures. During this time the water withdrawal for animals decreases in the village. In winter, when the livestock have returned from the mountain pasture, water consumption increases. To provide them with a sufficient amount of water even during winter months, the main irrigation channels in the village are used. Dairy cows mostly remain in the village and they may consume approximately 70 to 250 liters of water per animal per day (ABRAMOV 1974:472; DENNIS 2008:2).

6.6. Domestic Water Use within the Households

Worldwide, people use approximately 30 to 300 liters of water per person and day for domestic purposes (FAO 2004:4). In the rural households the requirement of water depends on several factors. Often, an equal amount of water is not available each day in rural areas. Water consumption for different purposes is also different. For example, cooking in contrast to washing does not require a lot of water. But doing laundry, in turn, does not happen so often.

During the field campaign in August 2011, a three-days monitoring on the water consumption for drinking, cooking, laundry, sanitation and cleaning was carried out. Fifteen households with different numbers of persons and living standards, and also different distances to the particular water source, were chosen for this survey. It became evident, that the distance to the nearest place of water withdrawal plays a minor role in the amount of water consumption, as well as the type of water source. A larger influence on water demand is exerted by the type and the purpose of water use, as well as by the socio-economic status of the household. For example, the water demand increases with a larger number of people living in the household as well as with a larger number of livestock. Households with a *moncho* (bathhouse/sauna) recorded an increased demand

for water, especially in cases when they also rent their *moncho* for public usage on weekends.

Taking into account the daily biological human needs for drinking with approximately 3 liters per person (HOWARD and BARTRAM 2003:5; FAO 2004:4), it was recorded that this consumption amount is almost the same for all observed households concerning water only for drinking. For other purposes, the amount of water usage is very different among the households, depending on their living standard (DOMASHOV et al. 2011:13). Especially sanitary and hygienic purposes are significant indicators. According to the own observations, the villagers do not give enough attention to these issues, which have a direct influence on their health. In Kara-Suu, like in many Kyrgyz rural villages, the sanitation and sewage system is insufficient. Most buildings are not connected to a sewage system at all. Backyard pit latrines without nearby elementary hand-wash facilities are common. Most of the households have neither in-house water taps nor hot water taps (ROST et al. 2014).

Households with an own water pipe or a nearby standpipe have better opportunities to build a *moncho* (bathhouse/sauna) on their property. During Soviet time was the public *moncho,* belonging to the *kolkhoz 'Zhdanov'*, in the center of Kara-Suu, but it was ruined after 1991. Since gaining independence, some households in Kara-Suu have opened their private *moncho* for public usage and run them on the basis of private enterprises. Customers usually pay a usage fee of 50 Som (about 0.70 EUR) per person. This price is set by the owners. It might vary slightly, depending on the quality of the institution and the duration of usage.

Figure 35: A boy transporting water with a hand cart (Photo: Topbaev, April 2011).

Figure 36: A villager takes water from a ditch for hand-washing (Photo: Topbaev, May 2012).

A remote source of freshwater withdrawal (e.g. standpipe on the street) takes a lot of time and effort to fetch water. The responsibility for fetching water depends on the composition of the household and the age of its members. According to the own survey, mainly older children are responsible for this task, mostly boys (Figure 35). The responsibility for fetching water also depends on the distance to the source. If a water source is close to the house (less than 200 m), the younger children or older women also can fetch the water. In case of a longer distance to the water source (e.g. spring), mostly men help to fetch the freshwater by using vehicles, like a trolley or cart (see Figure 41).

Figure 37: Drying of adobe bricks for construction work (Photo: Topbaev, April 2011).

The lack of water in a proper amount and quality affect not only the personal hygiene negatively, but also the cleanliness in the house. During the warmer months, many households use water from nearby irrigation trenches for washing, laundry and cleaning (Figure 36). Although the quality of water from these ditches does not meet any sanitary standards, for many villagers it is still a major source for domestic water withdrawal.

The demand for water for cooking is comparably low. However, water of high quality is needed. In addition, water consumption for cooking depends on the diet and food preferences of the household members. Therefore, it is difficult to determine how much water is required for it (HOWARD and BARTRAM 2003:9). According to my questionnaire, up to 5 liters/day/person are required in average for this purpose.

During the summer months, water consumption also increases due to construction and repair works. In rural areas, one of the basic and most cheap building materials is clay (Figure 37). According to the own survey in Kara-Suu, about 200 liters of water are used to produce 100 adobes. The water for the adobe production is taken from the public standpipes as well as from irrigation trenches along the streets.

The seasons also influence the water consumption. Thus, the water consumption during the summer months is larger than in winter time, due to construction works, irrigation, more frequent washing and cleaning as well as for drinking. Furthermore, the temporal accessibility of water sources during the day affects the consumption of water. During the winter months, when the swamp water supply or the water in the stand pipes can freeze, the access to water might be limited. In winter, the operation of the water supply through the stand pipes is temporally restricted during the day, in order to prevent a flooding of the streets and the risk of water freezing in the pipe system (pers. comm. Mr. O. Saralaev, April 2011).

6.7. Drinking Water Supply Management in Kara-Suu

In Kara-Suu, as in most rural settlements of Kyrgyzstan, the water supply infrastructure systems date from the Soviet era. Until the beginning of the 1990s, the collective and state farms were mainly responsible for the operation and maintenance of the rural drinking water supply systems. After their liquidation, the Kyrgyz government was unable to provide the service and maintenance for the drinking water infrastructure of numerous rural villages (IVANOV 2013; NEUMANN 2013; ROST et al. 2014). Therefore, the ownership and operation of the rural drinking water supply systems were decentralized and handed over to the local village communities (BAGDASAROVA et al. 2001:24). In case of Kara-Suu, the community council (*aiyl kenesh*) and the Ak-Kyya community administration (*aiyl okmotu*) are now self-responsible for the operation and maintenance of the local public drinking water supply system (ROST et al. 2014). However, these local authorities do neither have the financial and technical capacities nor the organizational structure and the proper utilization of social norms to manage their inherited drinking water system.

Consequently, much of the public drinking water supply infrastructure has been fallen into disrepair (ROST et al. 2014).

According to a statement of the head of the village administration (*aiyl okmotu*), Mr. Adyl Salbarov (pers. comm., April 2011), the water supply system in Kara-Suu was more or less in a satisfactory condition in the early 1990s. In course of time, electric pumps, stand pipes and pipelines broke down, and in some places pipelines and stand pipes started to leak. For operating and maintaining the water supply infrastructure, the public financial funds were lacking. In the early 2000s, the Ak-Kyya commune has tried to get involved with the national project *'Taza Suu'* (cf. chapter 1), but could not collect the 5 percent investment fee, which had been required at the request by the donor organizations. Moreover, the situation worsened in the following years after a development area was opened up to the west of Kara-Suu, whose inhabitants are not connected to the existing water supply system.

The challenges the community faces in freshwater management are multifunctional. First of all, the new concept of a decentralized, community-based drinking water management is a new phenomenon for most rural villages in Central Kyrgyzstan (NEUMANN 2013). This concept, introduced by the Kyrgyz government in the early 2000s, is propagated mainly by international donor organizations (e.g. World Bank, ADB). In the Ak-Kyya community, the local administrators as well as the villagers have little knowledge about the management, operation and maintenance of a local drinking water supply system (Figure 38), which has originally been planned and managed by the prior existing collective farm. As the transformation of the drinking water supply system was implemented top-down by the national government, the local administration officers and most of the villagers continue to look to the district or national government to solve their local problems (ROST et al. 2014).

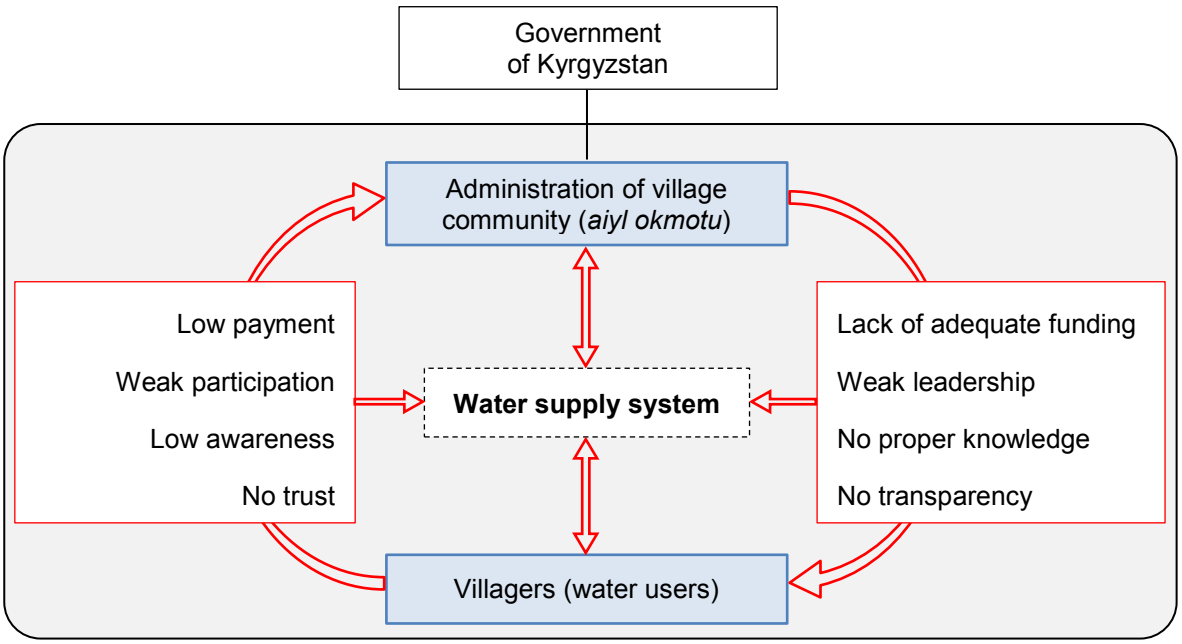

Figure 38: Circle of stakeholders' relationship in the Water Supply Management of Kara-Suu (Draft: Topbaev, 2015).

Furthermore, there is little acceptance by the water users and the local self-governing authorities for an introduction of a rather rudimentary, but more sustainable and financially less expensive supply system (ROST et al. 2014). One major obstacle for the proper management as for the operation, as well as for the maintenance and modernization of the drinking water supply system, is the permanent shortage of funds (Figure 38). To gain financial sustainability, the introduction of cost-recovering water tariffs will have to be accepted by both, the local community administration and the individual water users (ROST et al. 2014). Low tariffs for water supply services and free water usage contribute to an inefficient usage of the water resources. The attitude towards water use is directly related to the tariff of water (BAGDASAROVA et al. 2001:29).

In the village the 'Council of Deputies' (*aiyl kenesh*) decides on major issues. Usually, the village administration sets the tariffs of water supply service and the water users should pay a water service fee. Hence, this fee is based on the level of service. As the equipment for an exact volumetric measurement is lacking, some sort of flat rate tariffs are used. According to the head of the Ak-Kyya community, Mr. Adyl Salbarov (pers. comm., August 2011), one of the responsibilities of the *aiyl kenesh* was to establish a fixed price for freshwater, which is delivered by the communal groundwater pump station to the stand pipes in the streets of Kara-Suu. During the investigations in August 2010, there existed no fixed freshwater tariff system and the tariffs differed among the households in Kara-Suu. Some households paid their water fee per person on a monthly basis, while others paid a monthly fixed price for the entire household, regardless of the number of household members.

According to interviews in August 2013 with the newly elected head of local community administration (*aiyl okmotu*), Mr. Azizbek Sydykanov, a fixed fee of 50 Som per month (about 0.75 EUR) had been introduced for freshwater delivery from the pump station to the stand pipes, which every household, regardless of the number of person, had to pay in case they take their freshwater from the stand pipe system. Those few households, which have an on-yard water connection, pay 80 Som (about 1.20 EUR) per month. Households, which have a *moncho* (bathhouse/sauna) on their property had to pay 100 Som (about 1.50 EUR) per month to the village administration (*aiyl okmotu*).

Households using privately installed water pipeline and get their freshwater from the pipeline that runs between the 'Swamp No. 3' and Kochkor need to pay 75 Som (about 1.13 EUR) per month to the enterprise 'Vodokanal' in Kochkor (ROST et al. 2014). In case they run a *moncho*, these households have to pay 150 Som (about 2.25 EUR) per month. These fees only cover the costs for electricity, the salary of employees and some minor costs for the maintenance of the infrastructure. They do not at all recover the full costs for water supply and are rather symbolic.

Analysing the coherence between water supply and water payment in Kara-Suu the following result could be obtained (Figure 39): 96 of the 112 investigated households responded that they pay for water. Only 6 percent of them persist that water should be

free of charge. The remaining 16 households do not pay at all for their freshwater. 13 percent of them do not pay, because they really think it is unnecessary to pay for water. Most of those who do not pay for freshwater would be willing to pay for it, if the water supply infrastructure near their homestead would work.

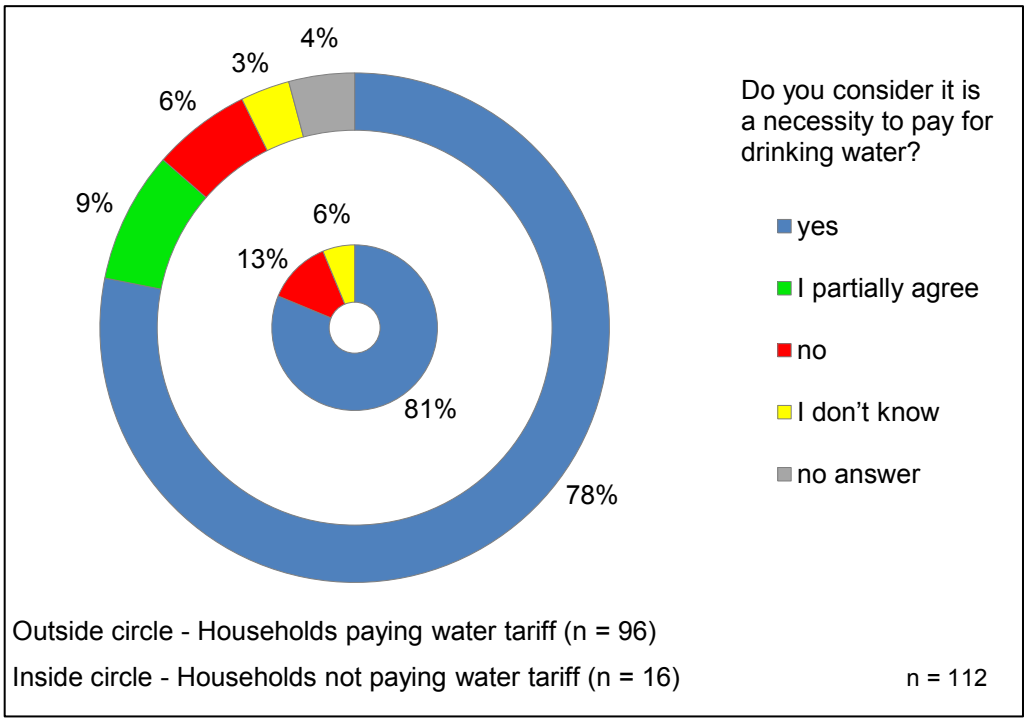

Figure 39: The attitude of the villagers in Kara-Suu toward payment of drinking water in 2010 (Draft: Topbaev, 2012).

All households, that takes water from the Drainage System on 'Swamp No. 3' pay for their water, because they all have their own private water pipes at home or in the backyard. However, it has to be considered that not all villagers are paying for water from the communal groundwater pump station. Non-payment or delays in water fee payments pose a threat to the financial liquidity of the service providers.

One reason for non-payment is that stand pipes only exist on eight streets of the village (see Figure 16). People, who are living along the new streets in the western quarters, are without any stand pipes and resist to pay. Many households refuse to pay because their nearest stand pipe is broken-down and they have to carry their water over a distance of more than 200 m from other stand pipes, sometimes even from other streets. Mainly children are transporting water in small buckets and cans (Figure 35, Figure 40). This causes them to fetch water several times a day. Some households fetch water only once a day with big cans of 100 to 200 litres (see Figure 41). On the following day, not-used water is outpoured and fresh water must be fetched from the stand pipe. As households do not pay a water fee according to the amount of freshwater they use from the standpipes, some people even take this water to irrigate their backyard gardens.

It also must be considered, that the local village administration does not employ qualified

staff for an effective water supply cost management. There is no effective control of billing and cost calculation. Thus, the financial system and the book-keeping are not transparent for the water users and the administration is often suspected of corruption (ROST et al. 2014). The water users mostly notice the increasing disintegration of the public drinking water supply infrastructure and the non-transparent water tariff policy of the local administration. Often the water fees are determined by parliament deputies in Bishkek, capital of Kyrgyzstan. In this case, the water fees are often calculated rather low, because of campaign-tactical considerations. In any case, the water users in the rural villages, like Kara-Suu, are inadequately involved in the decision-making process. However, it is supposed from the interviews in Kara-Suu, that the majority of water users are willing to pay a reasonable water service fee, if the water is available in time, with adequate quality and quantity.

According to the Kyrgyz *'Sanitary Rules, Norms and Hygienic Standards'* (*Sanitarnyye Pravila i Normy*, SanPiN) for obtaining information on the quality of drinking water, a particular number of testings are required per year, depending on the type of source. For example, taking water samples from groundwater sources for microbiological and chemical analyses has to be done once per season (four times per year) and for surface water every month (DEPARTAMENT GOSSANEPIDNADZORA MINISTERSTVA ZDRAVOOKHRANENIYA KYRGYZSKOY RESPUBLIKI 1998:21).

Figure 40: A girl is taking water from a stand pipe (Photo: Topbaev, April 2011).

To obtain data on the quality of drinking water in Kara-Suu, interviews were conducted with the sanitary doctor Mr. Borukchiev Usonbek in the Kochkor Centre of Sanitary Surveillance. This organization is state-run and responsible for conducting the quality control of the drinking water, in order to determine its compliance with sanitary and

epidemiological requirements (KYRGYZSKAYA RESPUBLIKA 1999). According to the schedule from the laboratory of the Sanitation Centre, water samples for analysis are taken from the street stand pipes in Kara-Suu four times per year in March, June, September and December, which corresponds with the requirements of SanPiN. But Mr. U. Borukchiev also mentioned, that the water samples are only taken from the pump station water supply system, since the head of the *aiyl okmotu*, which is the representative of the state authority at the local level, is responsible for it. The water is sampled only upon request or in emergency cases from other sources, when there are complaints on health problems related to water. A continuous monitoring of the quality of the water from the springs and swamps is missing. Therefore, it is difficult to argue that these sources are safe sources for drinking water.

The quality of water can be estimated by the number of diseased people in the village. According to a nurse working in a rural *Midwife Obstetric Unit* (MOU) in Kara-Suu, a few cases of water-related diseases are annually observed. A major source of these diseases might be water taken out from open irrigation trenches. This presumption corresponds with similar observations from the village of Tash-Bashat (Naryn *oblast*), where water-related diseases (e.g. diarrhea) are also common (SCHMIDT 2014:110). Although the quality of groundwater in general meets the requirements of GOST (KARIMOV and SARYMSAKOV 2005:20), the nurse also noted that diseases can occur due to non-compliance with basic sanitation rules of water use. According to the sanitary doctor, the water from the street stand pipes in Kara-Suu meets all standards and regulations, but sometimes, usually in the summer time, a slight contamination is detected. This information is reported to the head of the *aiyl okmotu* and he has to take official action on this issue. But mostly, the village administration cannot solve the problem because of a lack of funds. He can only recommend the people to be more cautious and to boil water before drinking.

7. Discussion and Recommendations

In the past two decades, the people of Kyrgyzstan have been facing many problems, which are connected with the management of water resources (HERRFAHRDT et al. 2006; KHAMZAYEVA 2009:11; ABDULLAEV 2012; DEPARTMENT OF WATER MANAGEMENT AND MELIORATION 2013:12; ABDOLVAND et al. 2014). As one main supplier of water for the territories of the neighboring lowland countries, Kyrgyzstan plays a significant role in Central Asia (OECD n.d.:23; ROST 2004). But at the same time, Kyrgyzstan itself has many areas that suffer from a lack of water, mainly due to the poor condition of the water supply system (BAGDASAROVA et al. 2001:5; DEPARTMENT OF WATER MANAGEMENT AND MELIORATION 2013:12).

As it is described above on the example of the village of Kara-Suu, rural areas in Central Kyrgyzstan are facing many challenges. One is the inadequate freshwater water supply system of private households. Deterioration of the rural drinking water supply system is not only observed in this area, but at the same time throughout whole Kyrgyzstan, due to a sharp decline in public funding of rural communities after the independence and the accompanying decentralization of water management (EUWI–EECCA 2005:3; KARIMOV and SARYMSAKOV 2005:25; WARDLE 2010:3; NEUMANN 2013; ROST et al. 2014). The deterioration of the freshwater water supply system in Kara-Suu expresses itself in the fact that much of the water supply infrastructure (e.g. pumps, pipelines, public stand pipes) is technically outdated, poorly maintained and out of function due to different causes. As a result, the access to drinking water has become limited. This trend is observed not only in the village of Kara-Suu, but in many former Soviet countries in the Caucasian Region and Central Asia, too (WEGERICH 2000; OECD 2011:12; INTERNATIONAL CONSULTANT MISSION REPORT 2012).

Two main reasons for such a sharp deterioration of the situation in rural areas are the discontinuation of funding from the government as well as the unwillingness or inability of the local community to self-management (KARIMOV and ABDRASULOV 2004; KUDABAEVA 2010; NEUMANN 2013; ROST et al. 2014). Furthermore, in the transition period since 1991, the newly independent states experience an economic crisis (EUWI–EECCA 2005; KUDABAEVA 2010; BABAJANIAN 2011). The situation is also exacerbated due to continuous changes in the management of government administrations and departments, which are responsible for providing an adequate drinking water supply for the countryside (ADB 2012b:3; DEPARTMENT OF WATER MANAGEMENT AND MELIORATION 2013).

Whereas during the Soviet period the collective and state farms were responsible for the rural water supply system, this responsibility now lies with the local authorities themselves. Furthermore, on state level the responsibilities for the rural water supply system management were assigned to the ‘Department of Water Supply and Sanitation’ at the ‘State Agency for Construction and Regional Development’ under the Government of the Kyrgyz Republic. But despite of the existence of this responsible department the problematic situation did not change significantly, often because of a lack of adequate

funding and ineffective management structures on all administrative levels (DEPARTMENT OF WATER MANAGEMENT AND MELIORATION 2013:18). Moreover, since the mid-1990s, during the process of decentralization, in every single rural village the community administration (*aiyl okmotu*) itself became the owner of the local drinking water supply system, when the Kyrgyz government simply transferred the legal responsibility for the local water supply management to the community, respectively the primary water users. However, they practically had no experience in this sector (INTERNATIONAL CONSULTANT MISSION REPORT 2012:14; NEUMANN 2013; ROST et al. 2014).

In most of the rural villages, the members of the local administration did not have the administrative and technical knowledge for the management, operation and maintenance of the drinking water supply system, which had been handed-over to them. In addition, most communal administrations are not in the financial position to pursue drinking water supply infrastructure and to maintain it in a functioning technical condition (ROST et al. 2014). Normally, the local self-managed drinking water supply should be financed by water supply service fees, paid by the water consumers. However, the service fees currently charged are rather symbolic and do not cover the operating costs. Own financial resources for necessary investments are non-existent. The lack of funding and the ineffective management of the rural drinking water supply system as well as the insufficient awareness and activity of the various stakeholders on the need for far-reaching reforms in management, operation and financing of the communal water supply in rural areas, is observed throughout most parts of Kyrgyzstan (WARDLE 2010; UNICEF 2011; NEUMANN 2013; ROST et al. 2014).

According to Paragraph No. 26 of the Kyrgyz Republic's 'Law on Drinking Water', everyone has the unconditional right to drinking water supply in the required quantity and quality, and it is the obligation of the state to ensure this right (KYRGYZSKAYA RESPUBLIKA 1999). To ensure this right, as well as to improve the socio-economic situation in rural areas and to meet the correspondingly millennium goal (adequate access to clean drinking water), the Kyrgyz government has concluded agreements with international donors such as the Asian Development Bank (ADB), the World Bank and the British Department for International Development (WORLD BANK 2009:44; ADB 2012b:1; ARIS 2013:6; DEPARTMENT OF WATER MANAGEMENT AND MELIORATION 2013:12; NEUMANN 2013:7f.).

On the basis of these various agreements, several mainly donor-driven projects under the title of *'Taza Suu'* have been implemented, resulting inter alia in the creation of *Community Drinking Water User Unions* (CDWUU) (e.g. NEUMANN 2013; ROST et al. 2014). Unfortunately these CDWUUs were established in only one fourth of all settlements in Kyrgyzstan (WORLD BANK 2009:6; ADB 2012b:1f.; ARIS 2013:5; ISABEKOVA et al. 2013:4f.). Kara-Suu, like the majority of rural villages, was not selected for this donor-driven development program. These villages have to operate and maintain their local drinking water supply system according to their particular social, technical and financial capacity.

In the Paragraph No. 8 of the 'Law on Drinking Water' of the Kyrgyz Republic it is stated that when selecting water sources for a centralized drinking water supply the preference should be given to the underground sources in order to improve security guarantees for drinking water (KYRGYZSKAYA RESPUBLIKA 1999). Pursuant to KARIMOV and SARYMSAKOV (2005:3) and the NATSIONAL'NYY STATISTICHESKIY KOMITET KYRGYZSKOY RESPUBLIKI (2013a:127), groundwater is the principal source of drinking water in the country. However, according to the UNITED NATIONS (2009:102), most people in rural areas of Kyrgyzstan use surface water for drinking. So the data given by the UN are very different from the official data of the National Statistical Committee of the Kyrgyz Republic.

In Kara-Suu, most people use groundwater. The only exceptions are a few households, which take their drinking water from swamps, springs, small rivulets or channels. This ratio fits more with the National Statistics Committee data, than with the UN data.

During the construction of the drinking water supply system in Kara-Suu during the 1970's and 1980's, the access to drinking water was organized through public standpipes in the streets. At that time, nobody had a private water pipe in the garden or inside the house. Today, there is a tendency to an increased plumbing in private homes or yards. This is due to a higher welfare of some villagers and an accompanying increasing demand for water in domestic use (e.g. using a washing machine, improving hygiene facilities, building own bathhouses). According to the head of the local *aiyl okmotu* as well as to 'Vodokanal', about 70 households (or about 12 percent of all households in Kara-Suu) already have an in-house water tap. About 40 of them are connected to the swamp drainage system ('Swamp No. 3') and the remaining 30 to the communal groundwater pump station water supply system.

However, according to the NATSIONAL'NYY STATISTICHESKIY KOMITET KYRGYZSKOY RESPUBLIKI (2013b:32), on average only 9 percent of the population in the countryside of Kyrgyzstan have water pipes at home. According to a survey of UNICEF (2011:6), almost 15 percent of the respondents from the Naryn *oblast* (province) have water pipes directly in the house, which is almost the same ratio as reflected in the data from Kara-Suu.

Currently, more than two thirds of the population in Kara-Suu get their water from public street stand pipes. That practically corresponds to the average data for rural areas across Kyrgyzstan, which is equal 70.9 percent (NATSIONAL'NYY STATISTICHESKIY KOMITET KYRGYZSKOY RESPUBLIKI 2013b:32). This data is very different from the urban settlements, where more than half of the population has in-house water taps, whereas less than 40 percent of city dwellers uses street stand pipes (NATSIONAL'NYY STATISTICHESKIY KOMITET KYRGYZSKOY RESPUBLIKI 2013b:32).

Many private households in Kara-Suu seek to have their own water tap at home, since stand pipes in the streets are the property of the community and so the residents usually do not take care about their technical condition. The pipes periodically break or freeze in winter time, what makes the access to water additionally difficult. None of the inhabitants

want to be responsible for their condition or even the monitoring of their condition. Among the people the opinion has developed that 'the common is not mine and therefore I am not responsible for it'. People are accustomed that for all public facilities only the government is responsible, or in this case the community administration (*aiyl okmotu*). There is little participation on decision-making processes by the water users in the village.

In Kara-Suu, only a minor part of the population uses drinking water from swamps and springs in large quantities. But whilst still about one third of the population takes their drinking water from swamps and springs in Kara-Suu, across Kyrgyzstan only 1.5 percent of the population uses spring water, and swamp water even less (UNITED NATIONS 2009:103). Based on the investigations in Kara-Suu, it can be concluded that some households use spring water because this source is closer to their homes than stand pipes in the streets. For laundry or the cleaning of the house, people often use water from a nearby ditch. In choosing a source of drinking water, the distance to it instead of its quality becomes the dominant factor. People prefer to use a closer source and than just care in a second step for the quality of the water. Furthermore, the water from the springs and trenches is in free of charge.

Despite the increasing number of households in Kara-Suu with plumbing inside of the house or in the yard, the volume of used water did not change much. According to the WHO (2003:12) *'the amount of water collected every day by households is largely determined by how far the source of water is from the home'.* But, according to the own survey, this statement does not quite fit for Kara-Suu. There, the distance and type of source have little effects on the volume of domestic and drinking water use. The water consumption is almost identical in all the interviewed households, with about 20 to 25 liters per person per day, regardless of the distance to the water source. This corresponds to the basic provision of water per person per day according to HOWARD and BARTRAM (2003:22) and the STATE AGENCY OF ENVIRONMENTAL PROTECTION AND FORESTRY UNDER THE GOVERNMENT OF KYRGYZ REPUBLIC (2009:22), but is almost two times less than the data (for urban areas) given in PROIZVODSTVENNO-EKSPLUATACIONNOYE UPRAVLENIYE 'BISHKEKVODOKANAL' (2009) and MOLDOSHEV (2006) and almost four times lesser than calculated by the UNITED NATIONS (2009:168).

It is likely that despite of nearby water sources, the low water consumption of the inhabitants of Kara-Suu in domestic use can be explained by the rather poor development conditions in the village. Furthermore, personal hygiene facilities, like a bathhouse/sauna (*moncho*), a shower and even washstands, are lacking in some households. Moreover, the widespread pit latrines in the backyard area are without any sanitation services, so they do not require flush water. The installation of basic sanitation facilities, like washstands near the toilets, would be an elementary contribution to personal and puplic health. Hygiene facilities are better developed in urban areas, thus the water consumption in the city households is more than two times higher compared to rural areas (PROIZVODSTVENNO-EKSPLUATACIONNOYE UPRAVLENIYE 'BISHKEKVODOKANAL' 2009; STATE

AGENCY OF ENVIRONMENTAL PROTECTION AND FORESTRY UNDER THE GOVERNMENT OF KYRGYZ REPUBLIC 2009:22).

The hygiene and sanitation problem is closely linked with the problem of the access to water (HOWARD and BARTRAM 2003:10). The lack of a permanent water source at home is therefore also a reason for the lack of hygiene facilities**.** The poor condition of personal hygiene equipment is observed in all rural areas of Kyrgyzstan (MINISTERSTVO ZDRAVOOKHRANENIYA KYRGYZSKOY RESPUBLIKI 2005:3). According to WHO (2003:12) and HOWARD and BARTRAM (2003:22), a basic access to a fresh water source is given, when the distance to it is between 100 m and 1,000 m (or 5 to 30 minutes) for water fetching. If the distance from the household to the water source is more than 1,000 m and/or fetching of water takes more than 30 minutes of time, the household is considered as not having access to water (HOWARD and BARTRAM 2003:22; WHO 2003:12).

According to the survey in Kara-Suu, the majority (about 70 percent) of households has a drinking water source at a distance of less than 100 m to their homes. About 30 percent of the population of Kara-Suu, mostly residents in the recently built west quarters of the village, do not have access to standpipes and need to fetch water from sources in a distance of more than 100 m, but less than 500 m. According to HOWARD and BARTRAM (2003:22), Kara-Suu is therefore a village with *'basic access'* to drinking water with many residents having an *'intermediate access'*. According to NATSIONAL'NYY STATISTICHESKIY KOMITET KYRGYZSKOY RESPUBLIKI (2013b:96), only slightly more than half of the people (51.13 percent) in the Kyrgyz Republic has access to a water source at a distance of less than 100 m and this is mainly in urban areas, while the other half (48.48 percent) takes the water at a distance of 100 to 200 m and more. Thus the overall situation in Kara-Suu is better than the country's average.

In Kara Suu, the distance to the nearest sources of drinking water, mainly to the standpipes, does not exceed 500 m. This considers the fact that a half of these standpipes does not work. If all existing public standpipes in the village were operating, the distance to their nearest source of drinking water would be much less for many households. People from households in the neighboring hamlet of Kara-Oy reported during an interview that they use groundwater, transferred from Kara-Suu, mainly for drinking and cooking. According to calculations of HOWARD and BARTRAM (2003:22), Kara-Oy has no access to drinking water (because the distance exceeds 500 m). However, despite of their location, the amount of consumed fresh water in Kara-Oy is quite as much as in the households in Kara-Suu. According to the investigations in Kara-Suu, households with a source at home or close to the home spend almost the same amount of water, and sometimes even less, than households located far from the source. The explanation is that those who need to bring water from far away (100 m or more), prefer to bring a lot of water all at once in order to store it and save time. It is necessary to agree with the statement of WHO (2003:14): *'Households who do not have to travel to collect water have more time for economic activity, food preparation, child care and education'*.

For fetching water over long distance, usually tanks with volumes of 100 liters and more are used. To transport such tanks, people use carriages or vehicles, donkeys or horses (Figure 41). The amount of water fetched with such big tanks usually exceeds the daily requirement of the household. So when people need to get fresh water on the next day, they must first simply pour out the water from the day before. Thus, water gets wasted in an ineffective manner.

Figure 41: Fetching drinking water in a barrel with a horse-drawn vehicle (Photo: Kasymov, August 2010).

However, almost the same situation is observed in households that have access to a nearby standpipe or an in-house water tap at home. The reason or it is that the public water supply gets interrupted periodically. Since the groundwater pump station is operating only during the day, water from standpipes as well as from in-house water pipes connected to this system, is only available during a limited period of time. Most people take additional water for storage. Although the households using water from the 'Swamp No. 3 Drainage System' have almost a constant access to water, some of them also collect water in buckets or barrels. Thus, regardless of the distance from the source most villagers of Kara-Suu store their water at home in expectation of possible disruptions of the water supply.

Based on the investigations, the problem in Kara-Suu is rather the inadequate access as well as the quality of the water, than the provision to the villagers of the required volume of fresh water for domestic use and consumption. Practically, all public water supply infrastructure in Kara-Suu was built almost 40 years ago and is now heavily deteriorated. In many places the facilities are broken and in need of repair or even reconstruction. None of the water purification systems are operating. As a result, the quality of the provided water is doubtful, too. This observation corresponds to the situation nation-wide: over 70

percent of the water supply system in Kyrgyzstan is in poor conditions and the remaining 30 percent require repair or replacement (KARIMOV and SARYMSAKOV 2005:9).

According to the Paragraph No. 13 of 'Law on Drinking Water' of the Kyrgyz Republic the drinking water quality must meet the requirements of state standards (GOST) and sanitary rules, norms and hygienic standards (SanPiN), approved in the established order (KYRGYZSKAYA RESPUBLIKA 1999). The applied state standards (GOST) in Kyrgyzstan were established during the Soviet period, and only some of them are new or have changed slightly during the independence (DEPARTAMENT GOSSANEPIDNADZORA MINISTERSTVA ZDRAVOOKHRANENIYA KYRGYZSKOY RESPUBLIKI 1998; JAILOOBAEV et al. 2009:26). To provide the population with a well-operating water supply system and clean, safe drinking water, it is necessary to constantly carry out a number of activities such as monitoring, proper storage, purification, equal distribution, etc. (JAILOOBAEV et al. 2009:20f.). These tasks are the basis for an efficient water supply management. Such an efficient water management also requires the creation of favorable conditions for self-financing the supply system which finally should also result in the independence from external donors.

One of the main reasons for the lack of funds for the operation and maintenance of the water supply system in rural areas is the non-cost covering water tariff system. The situation is aggravated due to the unwillingness or inability of some users to pay for water (INTERNATIONAL CONSULTANT MISSION REPORT 2012:12f.; NEUMANN 2013; ROST et al. 2014). According to the ADB (2007:46, 2012b:27), the widespread poverty of the rural population in Kyrgyzstan does not allow the introduction of appropriate tariffs for drinking water that cover the expenses for a sustainable development of the water supply system and keep it in good conditions. The same situation is observed for Kara-Suu, where the price for drinking water corresponds not with the full costs for the water supply. It is more based on the economical solvency of the population, which is very low.

A definition of the affordability of water for the households and a correspondingly tariff is quite difficult (INTERNATIONAL CONSULTANT MISSION REPORT 2012:13). The introduction of different tariff categories is almost impossible. Even if the fee for water is comparatively low as in Kara-Suu, not all residents (can) pay. Such situation is observed everywhere in Kyrgyzstan. In both, rural and urban areas, the collection rates are about 60 percent of the population (OECD n.d.:71). According to the OECD (2009:4), the situation was even worse in the mid-2000s, when the collection of a drinking water fee in rural areas was only about 25 percent and in urban areas 50 percent. The majority of households who could afford the fee simply does not want to pay. Some households cannot pay because of their poverty. For example, for extremely poor households in Kara-Suu the payment of 150 Soms for drinking water may reach almost 50 percent of their total income (Figure 42). According to the OECD (2009:3), the tariff of drinking water should not exceed the maximum level of affordability or 2.5 percent of the total income of the household. In Kara-Suu nearly a quarter of households has a regular income of less than 2,000 Soms, so the

payment of even 50 Soms every month (more than 2.5 percent of income) is already difficult for them.

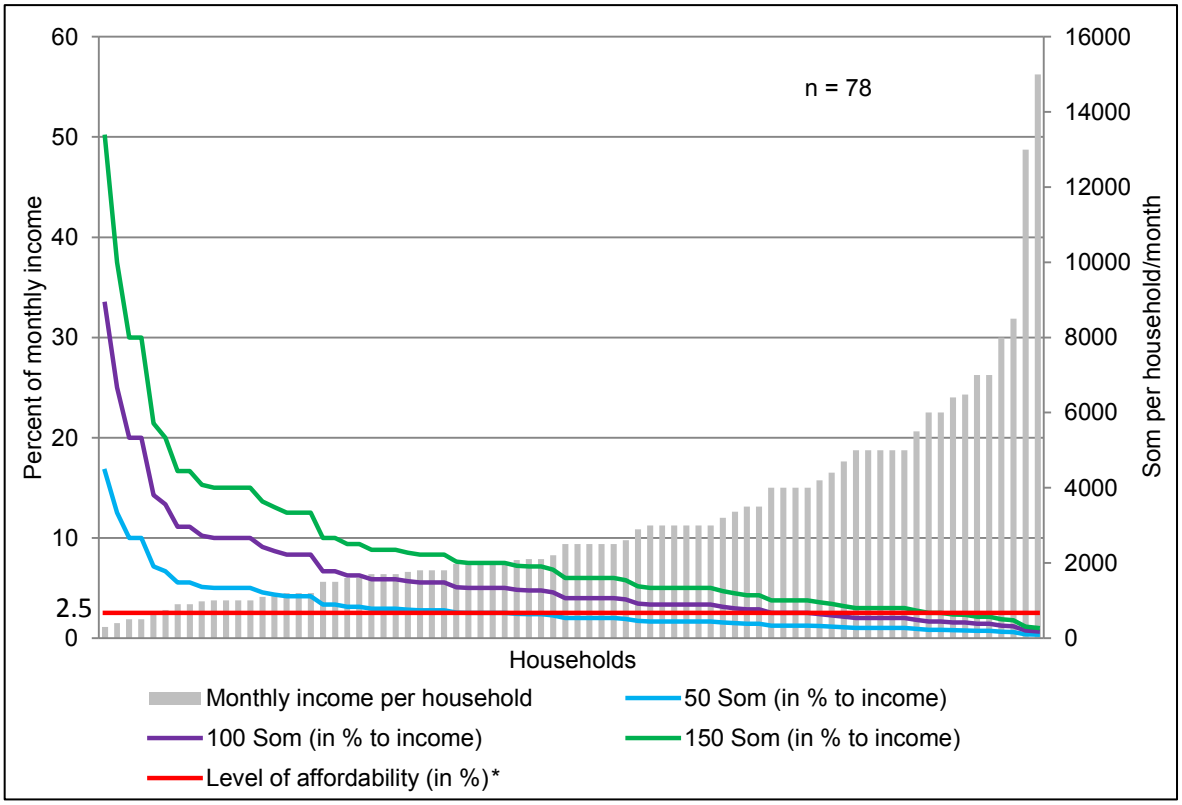

Figure 42: The proportion of drinking water tariff on the cash income per household per month (in percent to income) (Draft: Topbaev, 2015. Data base: Own investigation 2010; *OECD 2009).

Traditionally, water was regarded as a good free of charge. According to ancient Islamic customs, all available water should be equally distributed among the population of a settlement or in a river catchment. But, because of the water scarcity in recent times, it is worldwide discussed if water really is a free good. On the 'International Conference on Water and the Environment' (ICWE) in Dublin, Ireland, from 26–31 January 1992, the Dublin Principles were adopted. According to Principle No. 4 *'… it is vital to recognize first the basic right of all human beings to have access to clean water and sanitation at an affordable price'* (UNITED NATIONS 1992). The basic idea of this principle is that water is an economic good and should have a price (UNITED NATIONS 1992; BAGDASAROVA et al. 2001:28; SEHRING 2005:103). Moreover, according to the 'Law on Drinking Water' of the Kyrgyz Republic, drinking water has a strategic, practical and economic importance, so it is seen as a good (KYRGYZSKAYA RESPUBLIKA 1999). This means, that private households should pay for the water they use. According to SEHRING (2005:103), *'the lack of or inadequate pricing mechanisms are seen as main causes for inefficient and wasteful water use'* in Kyrgyzstan.

However, as it is evident from the own investigations in Kara-Suu, many people still do not perceive water as an economic good. Such an attitude of the people results from the command management of the Soviet Union, when the water seemed to be free of any

charges for all residents of rural areas in Kyrgyzstan, whilst in reality it was paid by state or collective farms (*sovkhozes, kolkhozes*) (BAGDASAROVA et al. 2001:10). Although in Kara-Suu many people refuse to pay because of the poor condition of the water infrastructure, they would be willing to pay for water, if the water supply system operated properly.

According to KYRGYZSKAYA RESPUBLIKA (1999), tariffs for the drinking water supply services in rural areas are set by the local authorities of the village community. Additionally, the local authority should maintain records of drinking water consumption and provide the population with necessary information on the quality of drinking water, the payment procedure, its norms as well as ways to a more effective consumption (KYRGYZSKAYA RESPUBLIKA 1999).

For agricultural activities water is normally used as a natural resource without any artificial treatment. But for the drinking water supply, purification processes are needed, which cause additional expenses (INTERNATIONAL CONSULTANT MISSION REPORT 2012:13). Though water is still mostly seen as a free good, these additional expenses have to be paid by the population. Therefore, a tariff system for clean water seems to be appropriate. However, as it was mentioned before, the existing tariffs for drinking water in Kara-Suu cannot at all cover the costs for the operation of the water system. Theoretically, with the tariff or water fee not the water itself is paid, but the services of extraction, purification, storage and delivery (INTERNATIONAL CONSULTANT MISSION REPORT 2012:13). With the raised fees, maintenance or the construction of a modified water supply systems with purification processes and new electric pumps is illusory. The salaries of the workers of the water supply systems are normally paid with the raised fee, too. Furthermore, the costs for electricity and maintenance of the groundwater pumping station should also be taken into account. According to the INTERNATIONAL CONSULTANT MISSION REPORT (2012:12), water tariffs, which are lower than the existing costs, cannot ensure a sustainable water management.

As mentioned above, there are two water pipe systems in Kara-Suu that are operating independently from each other. Therefore, the tariff rates for drinking water differ in the village. Since the ‘Swamp No. 3 Drainage System’ is operated by ‘Kochkor Vodokanal’, all their customers are paying fees to ‘Vodokanal’, which are quite higher than the fees for water from the local groundwater supply system. This is explained by the fact that all villagers that are connected to the Swamp No. 3 system have private water pipes to their homes. In turn ‘Vodokanal’ is responsible for operating and maintaining this supply system.

Responsible for the local groundwater supply system is the *aiyl okmotu* (administration of village community), respectively the head of the local village administration. Therefore, these tariffs are established by the *aiyl kenesh* (village council). According to the *aiyl okmotu,* the collected money is only enough for the payment of the electricity needed for the groundwater pumping station, as well as for a small salary for the employees at this

station and minor repair works. Defining a suitable and reasonable price for drinking water in Kara-Suu is difficult, due to the lack of any water measuring facilities in the village and the poverty of many villagers. Reliable calculations, depending on the number of persons in a household, have also proved to be difficult, since people are constantly migrating in search of work to Kochkor (center of the *rayon*) or Bishkek (capital of Kyrgyzstan). Therefore, the *aiyl okmotu* and *aiyl kenesh* decided to introduce the same water tariff for all households, regardless of their socio-economic status and their number of members. The only adjustment applies to households with an own bathhouse (*moncho*). They have to pay fees that are twice as much as the normal one, because of the additional water consumption.

Perhaps one of the solutions to increase the number of payers would be to provide water pipes with metering devices to each yard. Although it is more expensive, it may eventually make a profit in the form of time savings and a more sustainable access to water during the whole year. Furthermore, it would be possible to influence those who do not pay by the disconnection of their water pipe.

According to an own investigation in Kara-Suu, a significant part of the water is lost due to the poor technical condition of standpipes and water leakage. This situation is intolerable, as for the pumping of the groundwater a lot of electricity is needed and instead of an appropriate use of it, the water just runs out to the streets unused.

In 2013 a new head of the *aiyl okmotu* was elected in Kara-Suu. Mr. Azizbek Sydykanov now tries to improve the water supply system in the village by some reforms. His suggestion is to create so-called standpipe committees (*kuduk zhamaat*), which consist of the households which taking drinking water from the same standpipe in the street. Each *kuduk zhamaat* should be responsible for the maintenance of their standpipe and ensure its unobjectionable operation (ROST et al. 2014).

During the Soviet period, most of the freshwater from Kara-Suu was delivered to Kochkor and Jany-Jol. Therefore, one possible solution to improve the water management in the village might be the reactivation of the cooperation with ‘Vodokanal’ in Kochkor for providing drinking water to Kochkor and Jany-Jol. It would generate an additional income for the *aiyl okmotu* that could be used for the improvement of the local infrastructure. Such a system already exists with the ‘Swamp No. 3 Drainage Systems’, where the money of the water users in Kara-Suu is transferred to ‘Vodokanal’ in Kochkor. A transfer of the drinking water supply system from Kara-Suu to the hands of ‘Vodokanal’ seems to be no option for the *aiyl okmotu* and the villagers.

One of the main constraining factors for a sustainable development of the water supply system in the village is the weak capacity and awareness of both, local authorities and the population itself (ROST et al. 2014). Practically all the infrastructure in the village was inherited from the former *kolkhoz*. At that time the water supply system has been built, operated and maintained by the state (BAGDASAROVA et al. 2001:10; WARDLE 2010:8).

People are accustomed to the fact that the government is responsible for everything and are still waiting for help from the government's side.

To increase the activity of the population, their participation in decision-making is important, as well as the creation of a sense of responsibility for the maintenance and proper use of the water supply system and the rational use of drinking water. So *Community Drinking Water User Unions* (CDWUU) were established in some rural villages (ARIS 2013:6; NEUMANN 2013:15f.; ROST et al. 2014). These communities should be formed and organized by the local people. Thus, the management of the water system will be transferred to the villagers themselves (ARIS 2013:11). But practically their establishment was rather a requirement of the international donors, than the will of the local people themselves. Therefore, as noted by ARIS (2013:11) and WARDLE (2010:8), less than half of the created CDWUUs in Kyrgyzstan are sustainable. The others require further support or are not existing anymore. Most of them were created only according to the existing conditions of the contract with an international donor organization. After the completion of construction and rehabilitation works, they stopped operating (ARIS 2013:11). Perhaps, one of the reasons for the failure of many CDWUUs was that they were created in a short period of time without any good preliminary training or explanations of their functions to the water users.

The efforts of the Kyrgyz government and international donors to improve the water supply system in rural areas were directed in many cases on the repair and building of infrastructure, whereas little attention was paid to the issue of public awareness and the development of skills on local level (ADB 2012b:1). A passive attitude of the people towards the common problem of inadequate access to clean drinking water has also been observed during the surveys conducted among the local population of Kara-Suu. Many people responded that they want to improve the situation, but do not know how to do it. To solve the problem of access to clean drinking water, some households build at their own expense water pipes in their homes that are connected to the main water supply system. This solution is basically only suitable for those people, who do not have financial difficulties. These individual actions can neither solve the general problem, nor improve the local water supply system itself. So still the access to clean drinking water is easier and more comfortable for some private households than for others.

Of course, the creation of structures such as CDWUUs seems to be a proper solution for the problems in water supply management in rural areas (WARDLE 2010:10). A sufficient management of CDWUUs can be achieved through a good level of knowledge and high awareness among the members of this community. But it is not enough to educate only a few people within the CDWUU. Everyone in the village should act like a stakeholder (actually every water user is a stakeholder) and participate in decision-making.

On the other hand, the CDWUU repeats with their functions some activities of the *aiyl okmotu* (Figure 43). Perhaps it would be better to improve the performance of the local administration, rather than to create some sort of duplicate organization. It is not enough

just to create a new CDWUU, to build up a water supply system or to give money for it. It is also necessary, to create effective conditions for a sustainable development of infrastructure and a more transparent and mutually supportive relationship between the local government and the people.

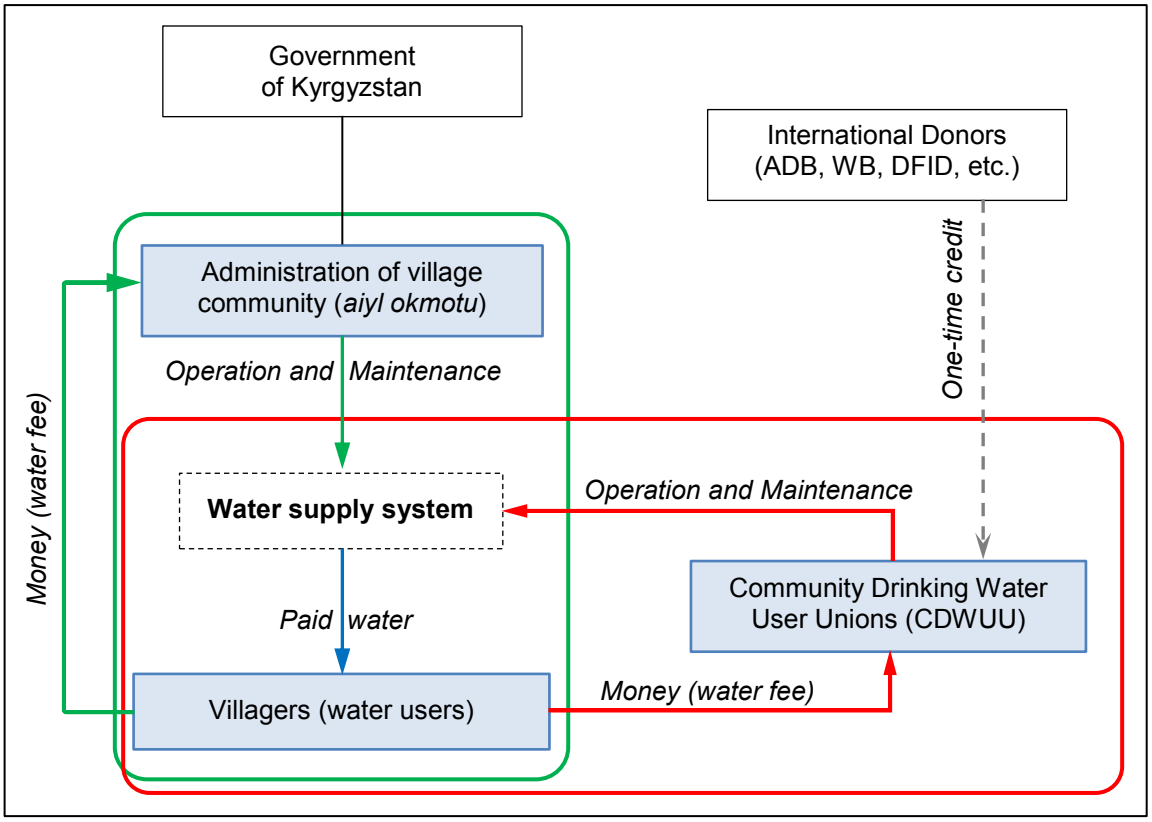

Figure 43: Activities of *aiyl okmotu* (green) and CDWUU (red) in the Water Supply Management in rural areas of Kyrgyzstan (Draft: Topbaev, 2015).

As it can be seen practically, the lack of public funds is not the only problem for the poor condition or even the lack of a water supply system (WARDLE 2010:3; ADB 2012b:8; ARIS 2013:11). The problem lies also in the attitude of the people and in their missing participation and activity. According to the survey in Kara-Suu in 2010 and 2011, many people are dissatisfied with the performance of the *aiyl okmotu*, but at the same time, they are doing nothing to change this situation. The water supply management exceeds the capacity of the *aiyl okmotu* and therefore all villagers together have to solve the common problems. Advocacy work should be carried out among the population so that finally all inhabitants of the village will have a new view: 'the common means that it is mine, too, and therefore I am responsible for it, too'.

Summary

After gaining its independence in 1991, Kyrgyzstan began to experience huge social and economic difficulties (ADB 1997:71; NATIONAL COUNCIL FOR SUSTAINABLE DEVELOPMENT OF THE KYRGYZ REPUBLIC 2013:58). In the first five years of independence the GDP decreased by almost a half compared to the level of 1990 and only now it begins to reach this level again (MAMLEKETTIK TIL ZHANA ENTSIKLOPEDIYA BORBORU 2004:369; KUDABAEVA 2010:145). Practically in all sectors of economy a decline in production was observed, mainly due to the rupture of economic relations between the former Soviet republics (KUDABAEVA 2010:144). It turned out that one of the most pressing problems in this transition period is the poor management of water supply systems, especially in rural areas (WORLD BANK 2009:1; MURZAEV 2010). Until today, management and maintenance of water supply systems in rural areas are characterized by a lack of financial and technical means.

During Soviet times the collective and state farms (*kolkhozes* and *sovkhozes*) provided funds for the operation and maintenance of the rural water supply systems (ADB 2000:4; WORLD BANK 2001:5; MCKEE et al. 2006:365). Due to a lack of appropriate knowledge as well as a big budget deficit, the newly formed Kyrgyz government, including all authorities on local level, was not able to provide the population with a functioning drinking water supply system including all its connected proper services (BAGDASAROVA et al. 2001:11; NATIONAL COUNCIL FOR SUSTAINABLE DEVELOPMENT OF THE KYRGYZ REPUBLIC 2013:59). On the other hand, the people of Kyrgyzstan who live in mostly in rural areas, were not ready to make own decisions and operate the inherited water supply systems independently. The situation even got worse, when the government could not fully assume its responsibility towards the society, mostly due to the severe budget deficit (BAGDASAROVA et al. 2001:24; NATIONAL COUNCIL FOR SUSTAINABLE DEVELOPMENT OF THE KYRGYZ REPUBLIC 2013:60). As a consequence, large-scale privatization and decentralization processes took place in the mid-1990s on all levels of economy. The rural drinking water supply systems were also affected by these processes, when the Kyrgyz government transferred ownership, responsibility and management to the particular local authorities (*aiyl okmotu*) (WEGERICH 2000; SEHRING 2007; ABDULLAEV et al. 2010; NEUMANN 2013; ROST et al. 2014).

More than half of the total population of Kyrgyzstan lives in rural areas (NATIONAL STATISTICAL COMMITTEE OF THE KYRGYZ REPUBLIC 2010:10). Especially for villagers, the accessibility to and quality of natural resources, in particular of land and water, are extremely important (NATIONAL COUNCIL FOR SUSTAINABLE DEVELOPMENT OF THE KYRGYZ REPUBLIC 2013:55). Although Kyrgyzstan is theoretically very rich in fresh water resources, many areas suffer from water shortage, because of poor conditions of the local water supply. In some regions, water structures are even absent (BAGDASAROVA et al. 2001:13). Especially the access to clean drinking water is a major problem in rural areas. In urban areas the condition and the management of the water supply systems is much better. This is mainly due to the fact that the whole urban water network was transferred to

the municipal water utility and sewage operator named 'Vodokanal', which has the experience and knowledge of operating and maintaining water supply systems (INTERNATIONAL CONSULTANT MISSION REPORT 2012:14).

In the present thesis the current state and problems of the drinking water supply system in Central Kyrgyzstan are discussed on the example of the village of Kara-Suu in the Naryn *oblast*. Today in most villages in Kyrgyzstan, the responsibility for the drinking water supply lies within the *aiyl okmotu* or so-called Community Drinking Water User Union (CDWUU). Within the framework of international development projects, the creation of these CDWUUs was one of the requirements of the donors, to increase the participation as well as the responsibility of local people for the management of the village's water supply system. The CDWUUs were formed within the national project *'Taza Suu'*, sponsored by foreign donors, like the Asian Development Bank (ADB), the World Bank and the British Department for International Development (DFID) and executed by the Kyrgyz government (NEUMANN 2013).

However, only a small number of the Kyrgyz villages could be involved in the project *'Taza Suu'*. These villages are characterized by a good progress regarding the water supply system and many villages obtained an adequate access to clean drinking water. But, according to ADB (2012b), some villages could not achieve their goals due to problems with corruption, a low level of participation and poor awareness of the local population. Many CDWUUs ceased to operate, due to a poor understanding of their responsibilities. The system of CDWUUs is a western structure, based theoretically on a bottom-up management, which means that the decisions are made by the water users themselves. But for Kyrgyzstan this is a quite new approach. During the Soviet period, management structures were basically established in a top–down manner, without sufficient explanation and enough acceptances of local peculiarities. Therefore the formation of CDWUUs often was not really understood or accepted by the stakeholders and the concept of a community-driven, self-governed water user union was not realized and exists only on paper in many rural villages (NEUMANN 2013).

Despite all the efforts of the Kyrgyz government to transfer the drinking water management to the CDWUUs, currently most of the local water supply systems in rural areas are still under the control of the *aiyl okmotu*. However, most of the *aiyl okmotus* do not have sufficient funds and skilled staff for an effective operation and maintenance of the water supply system. Moreover, the costs for the operation and maintenance of a water supply system are not at all covered by the water tariffs. The poverty of many water users hampers the establishment of properly operated and managed communal drinking water supply system (INTERNATIONAL CONSULTANT MISSION REPORT 2012:12f.). In addition, the low level of payment among the rural population increases the problem (OECD n.d.:71; 2009:4). The unwillingness or the inability to pay for water services is widespread in rural areas, as water for most of the people is still a resource that should be free of charge (BAGDASAROVA et al. 2001:13).

Practically, Kyrgyzstan has enough drinking water resources, but there are no adequate management structures and foundations for an efficient and sustainable use of it. For water supply and wastewater the Kyrgyz government allocates less than 0.3 percent (about 3.5 million Soms / 53,000 EUR per year) of the state budget expenditures (OECD 2009:4; DEPARTMENT OF WATER MANAGEMENT AND MELIORATION 2013:18), whereas about 20 billion Soms (more than 300 million EUR) would be needed to improve the drinking water supply system in Kyrgyzstan. Because of the state budget deficit, the investments of international donors have been involved in projects like *'Taza Suu'* and have reached almost 180 million US$ in the last decade (DEPARTMENT OF WATER MANAGEMENT AND MELIORATION 2013:18). Unfortunately, as mentioned above, only the investment of money can not improve the situation in the water supply system in rural areas. It is difficult to create favorable water governance structures in the country and to improve the water supply infrastructure without the active participation of the population. It is necessary to change the attitude of the water user towards water as an economic good, but also to raise their awareness, responsibility and capacity to manage the water supply system properly (BAGDASAROVA et al. 2001:23; INTERNATIONAL CONSULTANT MISSION REPORT 2012).

A well managed water supply system improves the local living standard in rural areas and helps to develop industry and agriculture. Water supply is the complex of action, directed to provide water to the people, animals, as well as for industrial and agricultural needs (KOSHELYOV and SAVINOV 1983:3). To foster and secure an adequate access for the rural population to safe drinking water, it is not only necessary to build a water supply system, but also to establish the legal and social institutions that would help to create the needed conditions for a sustainable development and management of the rural water infrastructure.

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Appendix

Questionnaire, 2010/2011

Кочкор районунун суу бассейнинин жаратылыш ресурстарын интеграциялык башкаруу боюнча

СУРАМЖЫЛОО

(Анкета по интегрированному управлению речным бассейном в Кочкорском районе)
(The Questionnaire on Integrated Watershed Management in Kochkor Rayon)

Урматтуу респондент

Кочкор районунун суу бассейнинин жаратылыш ресурстарын интеграциялык башкаруу боюнча илимий изилдөө проектиси 2010 жылдан башталды. Сиздин аймагыңызда жана үй чарбаңызда суунун пайдаланууcу жана суунун абалы боюнча Сиздин ойюңузду билүү биз үчүн кызыктуу. Эгер Сиз төмөнкү суроолорго так жана толук жооп берсеңиз, Сиз келечекте Кочкор аймагынын суу чарбасынын оңолушуна жана бул проектинин ишке ашышына өзүңүздүн салымыңызды кошосуз.
Сурамжылоо суроолордон турат жана Сиздин жообуңуз керектелинет. Сурамжылоо илимий максатта гана колдонулат.
Сурамжылоо аноним түрдө жүргүзүлөт. Сиз өзүңүздүн атыңызды белгилебей деле койсоңуз болот.

Сурамжылоону түзгөндөр:
Топбаев О. А.
Касымов М. К.
проф. Штадельбауер Й.
доц. Асыкулов Т. А.

Бишкек–Кочкор 2010

1-бөлүм. Респонденттин демографиялык мүнөздөмөсү

1) А.А.А._____

2) Анкетаны толтурган жер _____

3) жашыңыз_____

4) улутуңуз_____

5) жынысы: *01* аял *02* эркек

6) билимиңиз

01 орто *02* орто кесиптик

03 бүтпөгөн жогорку *04* жогорку

05 башка_____

7) Кесибиңиз_____

8) Азыркы иштеген жериңиз_____

9) Үйбүлөңүз барбы?

01 бар *02* жок

10) Канча балаңыз бар?_____

11) Ата-энеңиз силер менен турабы?

01 ооба *02* жок

12) Пенсия жана жардам аласыңарбы?

01 ооба *02* жок

13) Бир айлык кирешеңиз, айлыгыңыз канча (сом менен)?

01 _____

02 аялыңыздын (күйөөңүздүн)_____

03 балдарыңардын_____

04 үй бүлөнүн башка мүчөлөрү_____

2-бөлүм. Үй чарбанын жалпы мүнөздөмөсү

1) Силердин үйүңөрдө канча киши турат _____

2) Үй чарбаңарда канча жериңиз бар?

01 айдоо жерлер_____ га;

02 короо жай (огород) _____га;

03 жайлоо_____га;

04 башка _____

3) Суу жоктугунан иштетилбеген жер үлүшүңүз барбы?

01 ооба *02* бар болсо, канча_____га *03* жок

4) Кайсы жерлерди арендага аласыңар? Канчага?

01 айдоо жерлер _____га;_____сом

02 чабык аянттары_____га;_____сом

03 жайлоо _____га;_____сом

04 башкалар _____га;_____сом

5) Жерлерди кимден арендага аласыңар?

01 айыл өкмөтүнөн *02* менчик жер ээлөөчүлөрдөн

03 мамлекеттен *04* башкалар_____

6) Жер үлүшүңүздү арендага бересизби? Канчага?

01 ооба (_____сом) *02* жок

7) Короо жайыңарда (огороддо) кандай айыл чарба өсүмдүктөрүн өстүрөсүңөр?

_____

_____

8) Айдоо жериңизде эмне өстүрөсүз?

01 буудай *02* арпа *03* картөшкө

04 көп жылдык чөп (беде, эспарцет) *05* башкалары болсо_____

9) Айдоо жериңизден канча түшүм аласыз?

01 буудай_____ *02* арпа_____ *03* картөшкө_____

04 көп жылдык чөп (беде, эспарцет)_____ *05* башкалары болсо_____

10) Түшүмдүн канча бөлүгүн сатасыңар?_____

11) Кандай жер семирткичтерди колдоносунар?

01 кык *02* минералдык *03* колдонбойм

12) Талаа иштеринде ким жардам берет?

01 үй бүлөө *02* туугандар

03 жалдайм *04* айыл өкмөт

13) Менчик унаанын саны

01 жеңил машина_____ *02* жүк ташуучу машина _____

03 трактор _____ *04* прицеп _____

05 араба_____ *06* башкалар_____

14) Малыңыздын саны

01 жылкы_____ *02* уй_____ *03* кой_____

04 эчки_____ *05* эшек_____ *06* тоок _____

07 индюк_____ *08* башкалар_____

15) Кыштан чыкканга өз тоютуңар жетиштүүбү?

01 ооба *02* жок *03* ар кандай

16) Эгерде жетпесе канча сатып аласыңар?

01 жем_____ тонна *02* чөп_____ тонна

03 башка_____ тонна

17) Былтыркыга салыштырмалуу малдын саны кандай өзгөрдү?

01 көбөйдү *02* азайды *03* өзгөргөн жок

18) Өзгөрсө, себеби эмнеде?_____

19) Малды кайсы жерде багасыңар?

Жазында:

01 короодо *02* аңыздарда

03 жаздоодо *04* башка_____

Жайында:

01 короодо *02* аңыздарда

03 жайлоодо *04* башка_____

Күзүндө:

01 короодо *02* аңыздарда

03 күздөөдө *04* башка_____

Кышында:

01 короодо *02* аңыздарда

03 кыштоодо *04* башка_____

20) Жайлоодо малды ким багат?

01 өзүбүз *02* малчыга кошобуз

03 туугандар багат *04* кошпойбуз_____

21) Малды баккан үчүн канча төлөйсүңөр? (бир айда сом менен?)

01 бир уйга_____ *02* бир койго_____

03 бир жылкыга_____ *04* башкаларга_____

22) Туристтерден пайда аласызбы?

01 ооба *02* жок

3-бөлүм. Райондун суу чарбасынын өнүгүү деңгээли боюнча.

3.1 Турмуш-тиричилик жактан суу менен камсыздоо.

1) Турмуш тиричилик жактан суу кайсы жактан аласыз?

01 булактан *02* үйдөгү суу түтүгүнөн

03 арыктын суусунан *04* колонкадан *05* башка _____

2) Үйүңөрдө суутүтүкчөө жок болсо, канча аралыктан суу аласыңар?

01 10 м-ге чейин *02* 10 м-ден 50 м-ге чейин

03 50 м-ден 100 м-ге чейин *04* 100 м-ден ашык

3) Үйүңүздө суу түтүгү жок болсо, үйүңүзгө суу түтүгүн киргизгенге акы төлөгөнгө даярсызбы?

01 ооба *02* жок

4) Айылдагы суу түтүгүндөгү суунун сапатына сиздин ойуңуз.

01 эң жакшы *02* жакшы *03* орточо

04 начар *05* эң начар *06* сиздин ойуңуз_____

5) Суу түтүктөрүн ким тейлейт?

01 жеке ишкана

02 суу чарбасы

03 айыл өкмөту

04 суу пайдаланучуулардын ассоциациясы (АВП)

05 башка уюмдар:_____

6) Кимдин башкаруусунда суу түтүктөрү мыкты иштейт?

01 мамлекеттин көзөмөлүндө

02 жеке ишканалардын башкаруусунда

03 суу пайдаланучуулардын ассоциациясынын (АВП) көзөмөлүндө;

04 башка ойуңуз_____

7) Суу түтүктөрүнөн (колонкадан) пайдаланган сууга айына канча төлөйсүз?

_____сом

8) Суу үчүн төлөм акыны өз убагында төлөйсүзбү?

01 ооба *02* жок *03* төлөбөйм

9) Ичүүчү суу сапаты көрсөтүлгөн тарифтерге дал келеби?

01 толук дал келет *02* жарым- жартылай

03 жок *04* билбейм

10) Турмуш-тиричилик керектөөсүнө сиздин үй-бүлөө күнүнө канча суу коротот?

суутүтүгүнүн суусун:

01 1л – 10л *02* 11л – 30л *03* 31л – 50л

04 51л – 100л *05* 101л – 200л *06* 200л-ден көп

арык суусун:

01 1л – 10л *02* 11л – 30л *03* 31л – 50л

04 51л – 100л *05* 101л – 200л *06* 200л-ден көп

11) Совет убагында суу түтүктөр кандай абалда болгон?

01 эң жакшы *02* жакшы *03* орточо;

04 жаман *05* эң жаман *06* сиздин оюңуз_____

12) Суу түтүктөрүнүн азыркы абалы:

01 эң жакшы *02* жакшы *03* орточо;

04 жаман *05* эң жаман *06* сиздин оюңуз_____

13) Аймактагы суунун сапаты аркылуу козголгон оорулар_____

3.2 Сугат суулары

1) Айдоо жумуштарынын алдында жериңизди сөзсүз түрдө сугарасызбы?

01 ооба *02* жок

2) Негизги айыл чарба түшүмүн алыш үчүн айдоо жериңизди сезондо канча жолу сугарасыз?

01 буудай_____ *02* арпа _____ *03* картөшкө_____

04 көп жылдык чөп (беде, эспарцет)_____ *05* башкалар_____

3) Айдоо жериңизди сугарган үчүн кандай төлөйсүз?

01 сезондо бир жолу _____сом

02 ар бир сугарган үчүн _____сом

03 башка _____

4) Короо жай (огород) сугарган үчүн кандай төлөйсүз?

01 сезондо бир жолу _____сом

02 ар бир сугарган үчүн _____сом

03 башка _____

5) Айдоо жерлерди кандай ыкмалар менен сугарасыңар?

01 арык менен *02* башка_____

6) Короо жай участокту кандай ыкмалар менен сугарасыңар?

01 арык менен *02* суутүтүкчөө менен *03* башка_____

7) Айдоо жериңизди ким сугарат?

01 өзүм *02* сугатчы жалдайм *03* башка_____

8) Сууну ким бөлүштүрөт?

01 мураб

02 СЧРБ (суу чарбанын райондук башкаруу)

03 суу пайдалануучулар ассоциациясы (АВП)

04 айыл өкмөтү

9) Мамлекет эгемендүүлүк алганынан бери сугат каналдары узардыбы?

01 ооба *02* жок *03* кыскарды *04* билбейм

10) Сугат каналдарын курууга суроо-талаптар барбы?

<u>реконструкция</u> (кайрадан оңдоп куру боюнча)

01 ооба *02* жок

<u>жаңы куруу (узартуу боюнча)</u>

03 ооба *04* жок

11) Силердин аймакта саз жерлерди кургатууга муктаж жерлер барбы?

01 ооба *02* жок *03* билбейм

12) Сиз сууну экономикалык жактан баалуулук деп эсептейсизби?

01 ооба *02* жарым-жартылай макулмун

03 жок *04* билбейм

13) Сууну пайдаланган үчүн акы төлөш керек деп эсептейсизби?

01 ооба *02* жарым-жартылай макулмун

03 жок *04* билбейм

Чоң рахмат!

Датасы_____

Fresh water consumption in single rural household during three days, 2011

Турмуш-тиричилик түрлүү керектөөсүнө сиздин үй-бүлөө күнүнө канча суу коротот?
How much water is used and for what purpose?

Суроого жооп берген үчүн чоң рахмат!
Thanks for answering the question!

Ф.И.О. (FIRST NAME, MIDDLE INITIAL, LAST NAME): _____

1 күн / day 1						
	< 11 l	11 - 30 l	31 - 50 l	51 - 100 l	101-200 l	>200 l
Ичүү үчүн Drinking						
Тамак аш даярдоого Cooking						
Гигиена (жууну/киринүү) Hygiene (washing/bathing)						
Кир жууш үчүн Laundry						
Үй тиричиликке (тазалоо, мал үчүн жана башка). Household (cleaning, for domestic animals, etc.)						

2 күн / day 2						
	< 11 l	11 - 30 l	31 - 50 l	51 - 100 l	101-200 l	>200 l
Ичүү үчүн Drinking						
Тамак аш даярдоого Cooking						
Гигиена (жууну/киринүү) Hygiene (washing/bathing)						
Кир жууш үчүн Laundry						
Үй тиричиликке (тазалоо, мал үчүн жана башка). Household (cleaning, for domestic animals, etc.)						

3 күн / day 3						
	< 11 l	11 - 30 l	31 - 50 l	51 - 100 l	101-200 l	>200 l
Ичүү үчүн Drinking						
Тамак аш даярдоого Cooking						
Гигиена (жууну/киринүү) Hygiene (washing/bathing)						
Кир жууш үчүн Laundry						
Үй тиричиликке (тазалоо, мал үчүн жана башка). Household (cleaning, for domestic animals, etc.)						

Erklärung

Hiermit erkläre ich, dass ich die Dissertation selbstständig angefertigt und keine anderen als die von mir angegebenen Quellen und Hilfsmittel verwendet habe.

Ich erkläre weiterhin, dass die Dissertation bisher nicht in dieser oder anderer Form in einem anderen Prüfungsverfahren vorgelegen hat.

Berlin, 16.03.2015

_____

Oktiabr Topbaev