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Socio-economic assessment, state of irrigated agriculture and operation of pumping stations in Sughd province and Zafarobod district of Tajikistan

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Disclaimer:

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Authors:
Bakhrom Gaforzoda, National Expert on Land Reclamation and Irrigation
Abdunabi Boboev, National Expert on Hydraulic Engineering Structures
Kholnazar Yunusov, National Expert on Power Engineering
Khalim Khajiev, National Expert on Hydraulic Engineering Structures
Dzhamoliddin Jalolzoda, National Expert on Water Sector Economics

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Abbreviations and Acronyms

AWC	Association of Water Users
RIA	Reclamation and Irrigation Agency of the Government of the Republic of Tajikistan
ASMPC-PS	Automated System of Monitoring of Power Consumption by Pumping Stations
BFC	The Grand Fergana Canal
WB	World Bank
GDP	Gross Domestic Product
GRP	Gross Regional Product
GPS	Golodnostep Pumping Station
HES	Hydraulic Engineering Structures
SRIA	State Reclamation and Irrigation Agency for Districts and Cities
EU	European Union
LULUCF	Land-Use, Land-Use Change and Forestry
IWRM	Integrated Water Resources Management
DNW	Drainage Network
PR	Productivity Ratio
VAT	Value Added Tax
NWRMP	National Water Resources Management Project in Tajikistan
GHG	Greenhouse Gas
IPPU	Industrial Processes and Product Use
CAREC	Regional Environmental Center for Central Asia
VDW	Vertical Drain Well
M&O	Maintenance and Operation
NFC	Northern Fergana Canal
SDRI	Reclamation and Irrigation Department for Sughd region
SSF	Social Security Fund for Population

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Introduction

The Republic of Tajikistan has limited land resources. The total area of the country is 143,100 km2, of which 93% is occupied by mountains. The total area of land, potentially amenable to irrigation, is estimated at 1570 thousand hectares. As of 1 January 2020, the area of 762,198 hectares, or 5.3% of the total territory of the country, was cultivated. The population, as of January 1, 2020, was equal to 9.3 million people. Hence, the irrigated land area per capita is just 0.08 hectares.

The development of irrigation-based farming is one of the main drivers for achieving key strategic objectives, including food security and employment of the population engaged in agricultural activities, as they are defined by the National Development Strategy of the Republic of Tajikistan for the period up to 2030.

Irrigation farming contributes to the development of agriculture because about 80% of the agricultural output is produced on the basis of irrigated land, and 70% of the country's active residents are employed as agricultural workers[1]. In general, the contribution of the agricultural sector to the national GDP accounts for 21%. Given its important socio-economic role, agriculture is also significant water and power consumer in the country.

In order to provide irrigation services for the national cropland, 26.7 thousand kilometers of water supply networks have been constructed, as well as mainline canals and 11.4 thousand kilometers of drainage pipelines, 7099 hydraulic engineering structures, 390 pumping stations (the total length of the pressure pipelines is 624.67 km) with 1500 pump units, 505 vertical drill wells, 169 culverts, 110 aqueducts, 5455 water distribution posts, 3858 water gauge stations.

In order to engage the foothills in commercial usage, large-capacity cascade pumping stations were built, reaching 2-7 stages. Overall, there are 228 cascade pumping stations equipped with 922 pump units, which supply water that irrigates 213.2 thousand hectares of farmland.

However, the irrigation and drainage systems operating on the farmlands were built for the most part in the 1950s-1970s, and this infrastructure is extremely complex in terms of engineering facilities and maintenance technologies. Furthermore, it is heavily worn down, given its long service life, and is characterized by very high-power consumption.

According to RIA's calculations, on average, 1.41 billion kWh of electricity (about 10% of total electricity consumption across the country) is drawn by the irrigation and land reclamation system in one year during the vegetation and winter periods. Of this amount, about 1 billion kWh of electricity, or 80% of the total power consumed by the pumping stations, is taken up by the Sughd region, since about 75% of the Sughd farmland is irrigated by pumping stations.

In this context, the RIA offered to implement the national demonstration project "Improvement of the system of monitoring and control of power consumption by pumping stations and proposed upgrading of the large-capacity pumping station in the Sughd region of the Republic of Tajikistan" under the European Union funded project "Central Asia Nexus Dialogue Project: Fostering Water, Energy and Food Security Nexus and Multi-Sector Investment (Phase II)" implemented by the Regional Environmental Center for Central Asia (CAREC) and support of the project "Laboratory of Innovative Solutions for the Water Sector of Central Asia" under the Central Asia Water and

[1] Source: https://stat.ww.tj/a5adbabc421a020f46bc7f5d29b1cc98_1518005187.pdf

Energy Program (CAWEP). The objective of the demo project is to ensure water-energy-food security by upgrading the system of monitoring and control of power consumption by the pumping stations in the Sughd region of the Republic of Tajikistan and developing technical and investment proposals to upgrade the cascade of the large-capacity pumping stations GPS-1 and GPS-2 in the Zafarabad district of the Sughd region on the basis of the latest energy-saving technologies and innovative solutions.

Thus, this analytical review covers the socio-economic status of the region and district, the contribution of the irrigated farming to the formation of the GRP and gross output of the district, provides a description of the condition of the land reclamation and irrigation infrastructure, as well as an analysis of the general performance of the pumping stations in the Sughd region, in particular, in the Zafarabad district.

1. Sughd region

1. The Sughd region is an administrative province of the Republic of Tajikistan. It was formed on the 23 of December 1970 (from 27 October 1939 to 28 March 1962 it existed as the Leninabad region within Tajikistan) and is situated in the northern part of the country. Its land area is equal to 25.2 thousand sq. km. Its population is over 2.7 million people. The residents are mostly Tajiks, as well as Uzbeks, Russians, and Kyrgyz. The average population density per 1 sq. km is 102 persons. The Sughd region is divided into 18 districts and cities and towns, the districts including Aini, Asht, Devashtich, Zafarabad, Matcha, Gorno Matcha, Spitamen, J. Rasulov, Bobojon Ghafurov, Shakhristan, and the following cities and towns: Khujand, Isfara, Kanibadam, Penjikent, Istarafshan, Buston, Gulistan, and Istiklol.
2. The administrative capital is the city of Khujand. On the territory of the region, there are massive mountain ranges. In the North, these are the Kuramin ranges (altitude up to 3 768 m) and the Mugul mountain (altitude up to 1 624 m), in the South such as the Turkistan ranges (altitude up to 5 509 m), the Zarafshan ranges (altitude up to 5 489 m) and the Gissar northern ranges and mountain slopes.
3. The space in between the Kuramin and Turkestan Mountain ranges is occupied by western Fergana Valley. The Sughd region is rich in mineral resources, such as coal, lignite, oil, ozocerite, copper and complex ores, bismuth, iron, fluorite, phosphates, salt, molybdenum, antimony, mercury, mineral pigments.
4. Generally, some parts of the territory of Tajikistan differ significantly from each other in their geographic location, terrain characteristics, climate, and the mix of high-altitude natural belts. In this regard, the Sughd region is somewhat particular in certain respects. Most of its territory is occupied by the Fergana Valley plains. Only to the north and south of them loom mountain ranges and highlands. Geographically, the Sughd region covers the Syr Darya and Zarafshan river basins.
5. The Syr Darya River is 195 km in length within the region. Its main tributaries are the Isfara, Khojabakirgan, Isfana, and Aksu rivers, which flow down from the Turkestan range. The territory includes the Kayrakkum, Farkhad, Kattasai, and Daganai reservoirs, as well as the Great Fergana and Northern Fergana Canals.
6. The Zarafshan River is 303 km in length within the region, and its main tributaries are Fan Darya, Kshtut and Mogiyandarya rivers. The catchment area of the Zarafshan River stretches along the latitudinal axis between the Turkestan range and south-eastern ridges of the Gissar and Zarafshan ranges.
7. The climate in the area is continental, the average temperature in January (in the valley) is -1^0C, in July $+28^0$C; at an altitude of 1000 m, in January -4^0C, and in July $+26^0$C. The precipitations average between 150 to 400 mm per year.

1.1. Zafarabad district

8. Pursuant to the Executive Order of the Supreme Soviet of the Republic of Uzbekistan of 23 April 1959, an area of 50.5 thousand hectares of steppe (Mirzochul) in the Republic of Uzbekistan was ceded to the Republic of Tajikistan. That same year, in accordance with the Decree of the Presidium of the Supreme Soviet of the Republic of Tajikistan, dated 1 June 1959, the above 50.5 thousand hectares of land were integrated into the Republic of Tajikistan. The Presidium of

the Supreme Soviet of the Republic of Tajikistan by its Decree of 25 December 1965 established the Zafarabad district with Zafarabad as its administrative center.

9. Zafarabad district, an administrative unit in the Sughd region of the Republic of Tajikistan, is located 100 km west of the city of Khujand, the administrative center of the Sughd region. Zafarabad is its district center. The area of the Zafarabad district is equal to 441.0 sq. km. The district comprises 5 jamoats, including A. Jami, Zafarabad, Mehnatabad, H. Aliev and Ravshan. The population, as of 1 January 2019, was 75,483 people. The residents are mostly Tajiks, as well as Uzbeks, Russians, Kyrgyz, etc. Zafarobod is divided into 5 jamoats: Jomi, village council Zafarobod, Mehnatobod, H. Aliev and Ravshan.

10. The Zafarobod district borders from the north on the Yangiobod district, from the south - on the Zomin district, and from the east - on the Bekobod district of the Republic of Uzbekistan, as well as on the Spitamen and Devashtich districts of the Republic of Tajikistan.

11. The Zafarabad district is situated upstream of the Syr Darya River and actually has no surface water resources. The irrigated lands of the district are mainly supplied by large-capacity cascade pumping stations (KNS and GNS), which draw water diversion channel for Farkhad HPP located after the Farkhad reservoir based in the Sy Dariya River.

12. In general, during the years of the formation of the district (1959-1991), more than 478 thousand sq. m of residential houses and other industrial, cultural, and entertainment facilities were built, as well as 8 contemporary villages with all modern conveniences and 18 rural settlements, which are united by 5 jamoats. More than 36 thousand hectares of irrigated land were cultivated, 666 km of drainage pipelines were laid, along with 213 km of inter-farm irrigation canals, about 1 thousand km of highways, over 300 km of power transmission lines, and 205 km of natural gas pipelines

13. The local climate, like across the entire Fergana Valley, is continental; it is cold in winter and hot in summer; the weather is dry in summer, with average temperatures ranging from $+30^0$C to $+40^0$C, and from -10^0C to -15^0C in winter. The winds are prevalent in the NW direction. The average annual precipitations are 600 mm. In summer there is typically no rain, and the humidity level is very low.

2. Water resources of the Syr Darya River basin

14. Most of the territory of Tajikistan is occupied by mountain ranges with altitudes above 2 000 m. Extended cold spells at such altitudes, abundant precipitations, and rugged topography have turned these areas into water deposits. More than a thousand rivers and streams, as well as sais (seasonal rivers), cover the entire mountainous terrain of the country by a uniform hydrographic network, and also there are 947 small and large rivers and 276 sais.

15. The total length of the rivers of 10 km and more, exceeds 28 500 km. The rivers of Tajikistan are part of the basins of the Amu Darya (including the Zarafshan River) and the Syr Darya. The large differences in altitude between the sources and estuaries of the rivers account for significant flow rates and enormous energy resources. The total installed capacity of the electric power generation system of the Republic of Tajikistan is equal to 6 142 MW, and that of the co-generation power plants (CPP) - 718 MW.

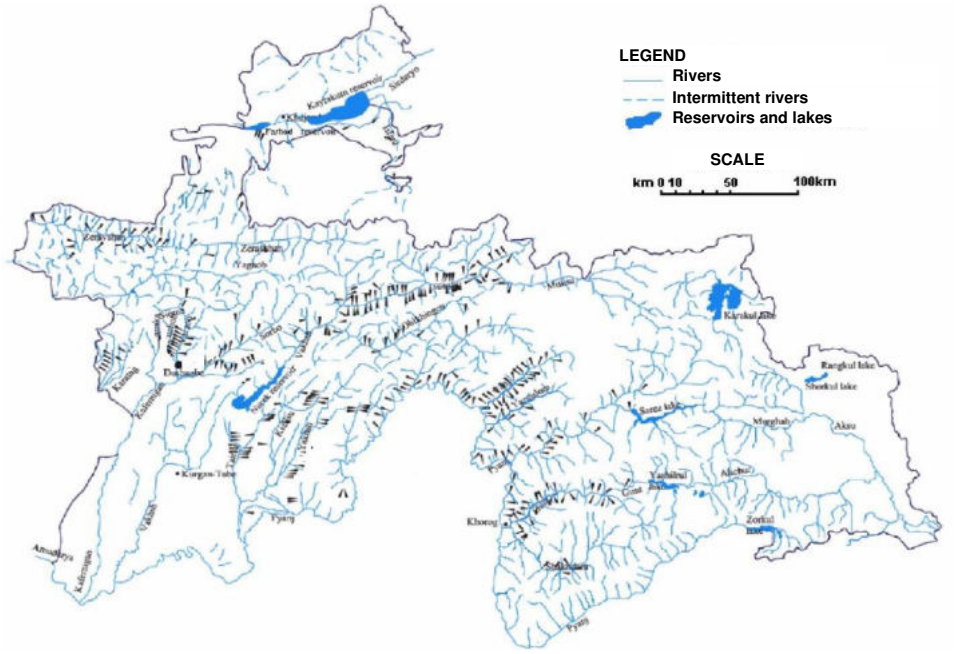
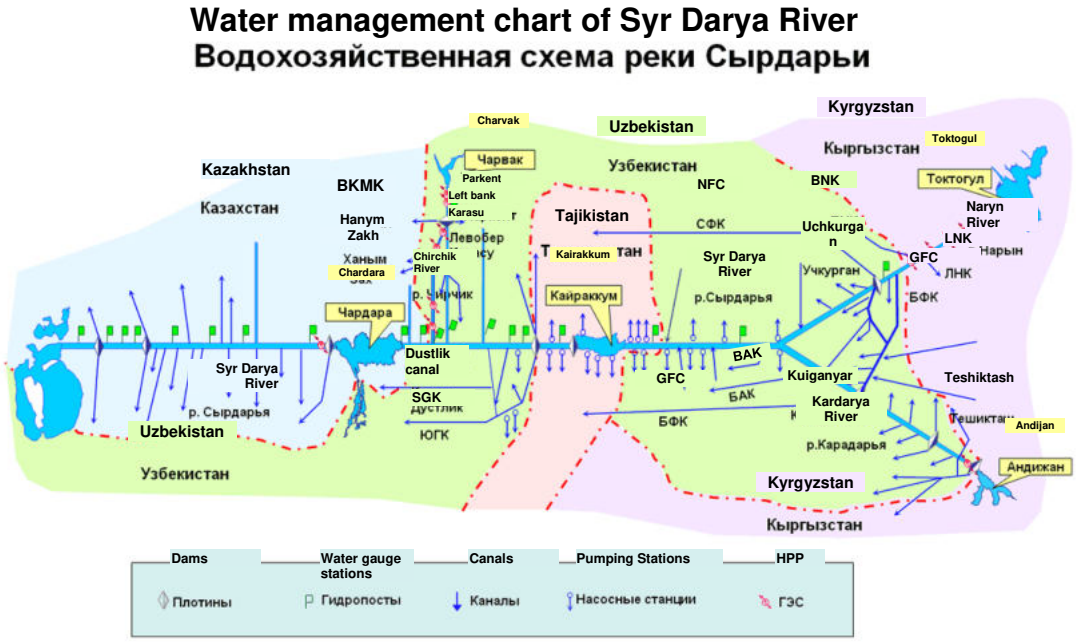


Figure 23. Hydrographic network of Tajikistan[2]

16. The Syr Darya River flows across the northern part of Tajikistan which stretches for 192 km. The total runoff originating in the Tajik part of the Syr Darya basin is minor and amounts to about 1.1 km3/year. The bulk of the runoff of the Syr Darya basin is formed in Kyrgyzstan - about 73.77%. Next, the Syr Darya River flows across the territory of Uzbekistan and Tajikistan and, ultimately, enters Kazakhstan, flowing into the Northern Aral Sea. About 11.15% of the Syrdarya River runoff is generated on the territory of Uzbekistan, 12.12% - in Kazakhstan, and about 2.96% - in Tajikistan.



[2] Source: Brochure of the Ministry of Melioration and Water Resources, Dushanbe – 2010

Figure 24. Water management chart of the Syr Darya River[3]

Table 2. Formation of surface runoff of the Syr Darya River

Country	Syr Darya River	
	km^3	%
Kazakhstan	4.50	12.12
Kyrgyzstan	27.40	73.77
Tajikistan	1.10	2.96
Uzbekistan	4.14	11.15
Total	**37.14**	**100.00**

Source: The main provisions of the water strategy of the Aral Sea Basin, 1996

17. The main natural water bodies in the Tajik part of the Syr Darya basin are small rivers and sais (seasonal rivers). Lakes, marshes, and other types of wetlands are non-existent owing to the extremely dry climate.

18. Rivers flowing on the left bank of the Syr Darya River: Isfara, Khojabakirgan, Tomchisai, Isfana, Aksu, Shirinsai, Kattasai, and Shahristansai. Small sais on the right bank of the Syr Darya River: Sarvaksai, Punuksai, Ashtsai, Ashabasai, Pangasai, Mullomirsai, Karamazorsai, Saihunsai, Utkansai, Rawatsai, Cholatsai, and Takelisai.

19. The total amount of water resources available in the Tajik part of the Syr Darya basin, both surface and ground, constitutes 3 663 million m^3/year. The annual volume of surface water resources in the Syrdarya River basin amounts in total to 2 940 million m^3.

20. As mentioned above, the Zafarabad district is located within the catchment area of the Syr Darya River basin, and has no access to surface water sources. Groundwater resources in that area were evaluated in 1983 and estimated at around 47 million m^3/year[4].

3. Social and economic analysis of Sughd region and Zafarabad district

3.1. General social and economic development prospects for the Sughd region

21. **Population.** The population of the Sughd region, as of 1 January 2020, was 2,705.4 thousand people, including men 1,358.1 thousand, and women 1,347.3 persons. Out of the total population numbers, 75.3% live in rural areas (Table 1 in Annex 1).

22. In general, the population growth over the past 10 years vs. 2010, was recorded at 457.8 thousand people, which is an average of 2.12% per year. Given such average rate of growth, in 2030 the population numbers in the Sughd region will increase to 3,407.6 thousand people. The average annual payroll number of those employed in the commercial sectors of the region is currently 821.5 thousand people. Employment is basically observed in the industrial and farming sectors of the economy. The number of jobless people, officially registered at the employment centers, is 8.9 thousand.

POPULATION IN SUGHD REGION
FOR 2010-2019 (IN THOUSANDS OF PEOPLE)

[3] Source: http://www.cawater-info.net/syrdarya-knowledge-base/

[4] Basin Plan for the Use and Protection of Water Resources in the Tajik Part of the Syrdarya River Basin, Dushanbe, May 2020.

Figure 25. Population of Sughd region, as of 1 January for 2010 - 2019 (,000 of people)[5]

23. The comprehensive per capita income in the Sughd region at the end of 2019, stood at TJS 543.11 per month, which is 9.4% more than in 2018, including from household farming income of TJS 51.12 per month.

24. Migration of the population mainly occurs when people move out of the country in search of better jobs. According to the statistical data on the Sughd region, the total migration numbers for 2014-2019, including those related to urban and rural population, the outflow of the population exceeded its inflow.

25. **Industry.** One of the principal branches of the national economy in the Sughd region is its industrial sector, which has a direct impact on the status of social and economic developments of the region. The Sughd region is regarded as an area, characterized by a high level of industrial development, where a free economic zone has been established. At the beginning of 2020, there were 657 manufacturing facilities, and these numbers tend to grow with every coming year, with construction and commissioning of new production plants of all forms of ownership. For example, in 2014 the number of industrial companies was 566, which by 2020 had increased by 91 units. The ongoing expansion of the industrial sector enables the creation of new jobs. The average annual number of industrial production personnel for 2020 equals 35,091 people, including 24,771 workers; an increase of jobs compared to 2014 (25,000 people, including 17,836 workers) totaled more than 10,000 people.

26. The industrial sector of the region is mainly concentrated in the cities of Khujand, B. Ghafurov, Isfara, Istaravshan, Penjikent, Kanibadam, and Guliston, which account for over 60% of the regional industrial output. The industrial sector is represented by mining and manufacturing industries, including such as ore mining and minerals extraction industries, power generation,

[5] Source: Statistical Yearbook of the Sughd region for 2020

textiles, metallurgy, mechanical engineering, and construction. In the structure of the industrial sector of the Sughd region, the predominant portion of the production volume, more than 67%, is provided by the manufacturing industry. Companies engaged in mining and processing of gold, silver, uranium, zinc, mercury, antimony, and many other non-ferrous metals, operate in the region.

27. More than 214 mineral deposits are currently being exploited or prepared for mining operations in the region's discovered and explored subsoil reserves. The most important companies active in these industries are: JV "Zarafshon", Adrasman Mining and Processing Complex, "Vostokredmet" Industrial Association, JV "Aprelevka", "Zarya Vostoka", etc.

28. The industrial production output, net of the agricultural products (in prices of 2018), in 2019, amounted to TJS 13,053.5 million, compared to the volume produced in 2014 (TJS 5,169.7 million). The manufacturing sector accounts for 63.6% of the total industrial output, while the minerals mining segment - for 28.5%, and the generation and distribution of electricity, natural gas, and water supply - for 7.9%.

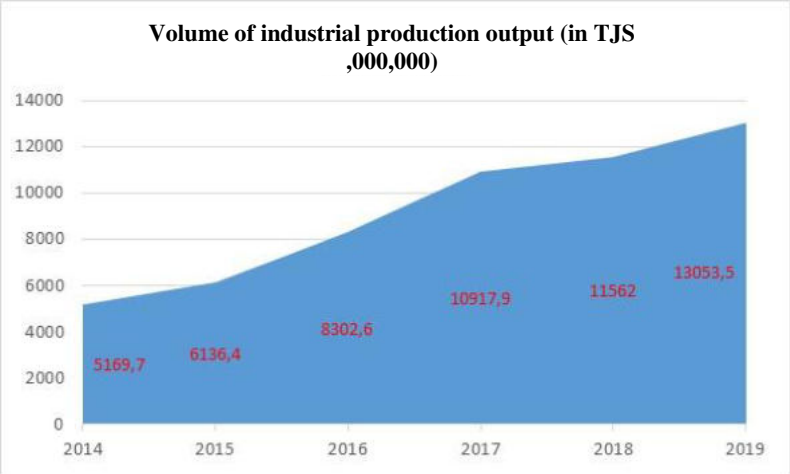


Figure 26. Volume of industrial production output (in TJS ,000,000)[6]

29. **Agricultural sector.** The agricultural sector is one of the key industries, which has a profound impact on the status of economic development in the Sughd region and the country as a whole. The advancement of the agricultural business plays an important role in ensuring food security and preventing migration through providing employment opportunities for the population in the Sughd region. Following the acquisition of independence, beginning in 1996 pursuant to the Law of the Republic of Tajikistan "On Land Reform" of 5 March 1992, # 594 (as amended by the Laws of the Republic of Tajikistan of 21 July 1994 № 1005, of 4 November 1995 # 134, of 15 May 1997# 421, of 3/03/2006# 175), and the Executive Order of the President of the Republic of Tajikistan of 25 June 1996 # 522 “On restructuring agricultural production facilities and organizations”, the country has engaged in reforming the land use and farming sectors. In the Sughd region, in the context of the said reform, all former collective and state farms were completely reorganized, and dehqan (peasant) farms have been created in most places.

30. Dehqan farming is a form of free entrepreneurship based on the use of owned or rented land and property, to engage in the production, processing, and sale of agricultural produce. Overall, across Tajikistan 171 915 dehqan farms had been established by the end of 2019,

[6] Source: Statistical Yearbook of the Sughd region for 2020

including 65 174 farms or 37% of the total number nationwide, in the Sughd region. Compared to 2014, the number of such dehqan farms had increased by 2.1 times. That was due to the reorganization of large dehqan farms and downsizing them into smaller ones The land area of the dehqan farms varies from 0.25 to over 5 hectares. As the number of dehqan farms expanded, the network of water consumers also increased. Accordingly, since 2006, WUAs have been established in the region to ensure equitable water distribution among the dehqan farms.

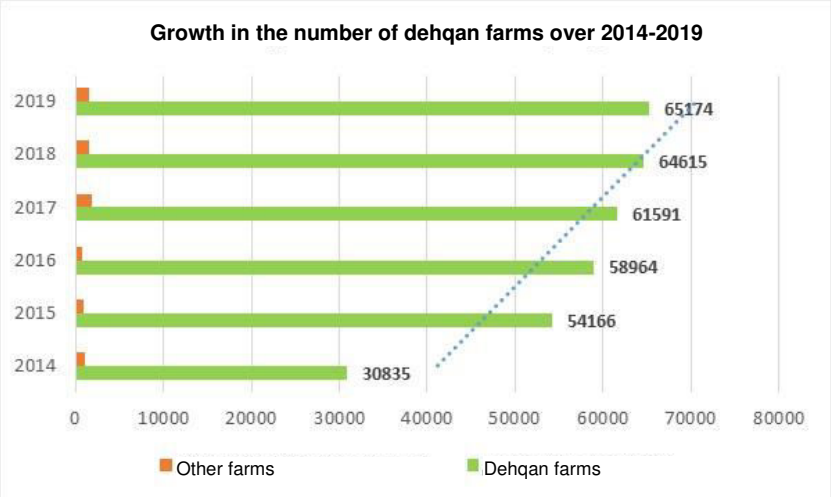
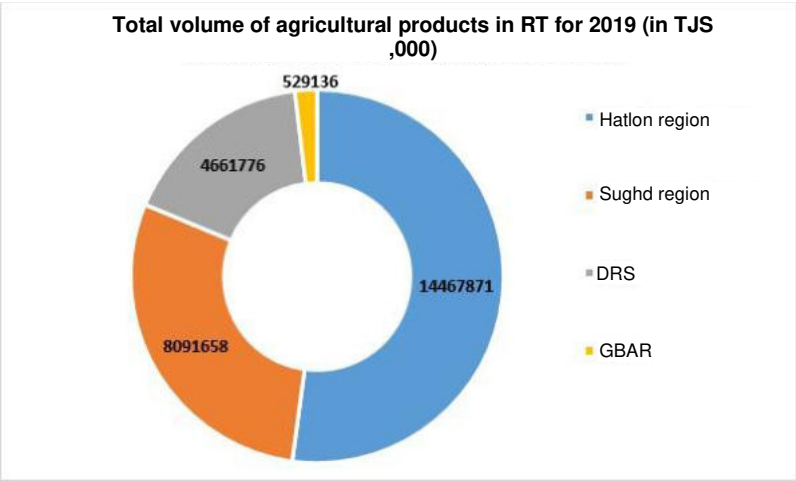


Figure 27. Growth in the number of dehqan farms over 2014-2019[7]

31. The gross output of agricultural products in the region at the end of 2019, based on the input of farms of all forms of ownership, was TJS 8,091,657.8 thousand, which is 23% more than for the same period in 2014. The share of contribution provided by the dehqan farms to the above gross output was 43%, by other agricultural producers - 14%, and by the households - 43%. The input of the households into the gross production output is high owing to their livestock breeding practices. The table below shows the performance indicators of gross agricultural output for 2014-2019.

32. In terms of the total volume of gross agricultural output provided by farmers of all forms of ownership at the end of 2019, the Sughd region ranks second after the Khatlon region.



[7] Source: Statistical Yearbook of the Sughd region for 2020

Figure 28. Total volume of agricultural products in Tajikistan for 2019 (in TJS ,000,000)[8]

33. **Farming land area.** According to the Land Registry, in the Sughd region as of 2020, the total area of land used by all kinds of businesses is equal to 2,616,436 hectares, with 51.3% thereof belonging to agricultural producers' land.

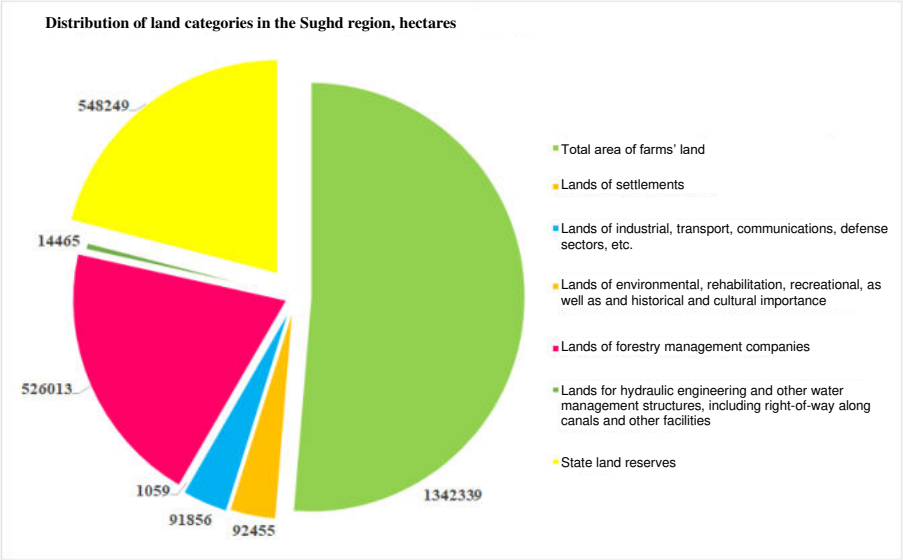


Figure 29. Distribution of land categories in the Sughd region in 2020[9]

34. The area of land used by agricultural producers (including pastures) is equal to 1,342,339 hectares, of which a large portion of 1036,982 hectares, or 77.2%, is allocated for the establishment of small and large dehqan farms of various forms of economic management, such as crop and livestock farming.

35. The area of arable land for agricultural crops in the Sughd region is 288 hectares and includes lands maintained by water management organizations belonging to the RIA system under contracts, which total 208.0 thousand hectares, of which over 159.5 thousand hectares, or about 75%, are located within the pumping irrigation zone[10].

[8] Source: Statistical Yearbook of the Sughd region for 2020
[9] Source: Statistical Yearbook of the Sughd region for 2020
[10] Statistical Yearbook of the Sughd region for 2020

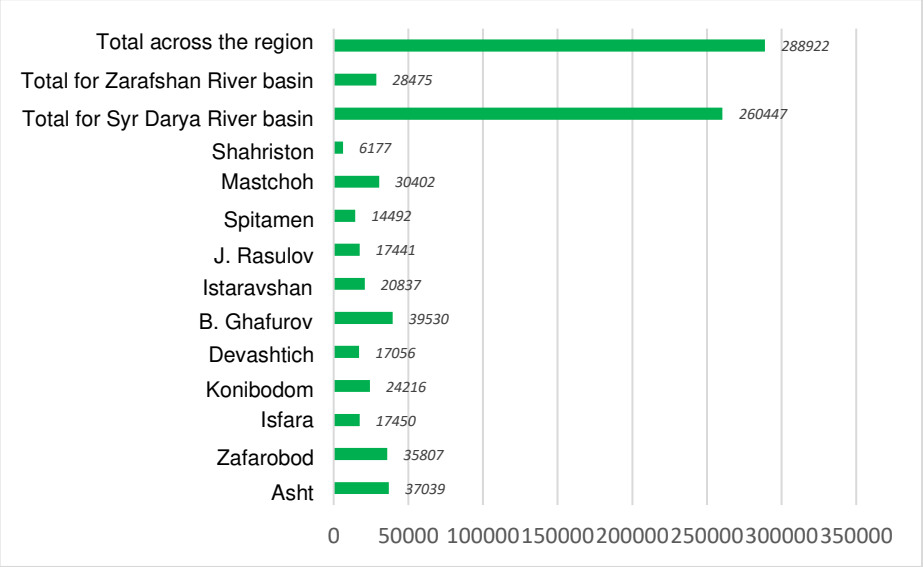


Figure 30. Data on agricultural lands broken down per districts and urban areas in the Sughd region[11]

36. **Crop growing.** The development of crop production in the Sughd region plays an important role in ensuring social and economic progress, including in terms of food security and promotion of the textiles industry The whole cropland area used by all kinds of agribusinesses in the Sughd region as of the year-end in 2019, was 274.8 thousand hectares, which is more than in 2014 by 10.2 thousand hectares, or by about 4% (Table 4 in Annex 1).

37. A large area in the Sughd region in 2019 was occupied by grain and legume crops, as well as cotton. It was 120.2 thousand hectares. If in 2014, the area planted with cotton crops, was 51.9 thousand hectares, in 2019 it was equal to 58.4 thousand hectares, or 28% of the total land under the control of the water management organizations according to contracts signed with the system of SDRI. Unfortunately, the authors were unable to determine, how many hectares of cotton plantations are in the catchment zone of pumping irrigation.

38. According to the statistics available for 2019, in the Sughd region, farms of all categories produced more than 330 thousand tons of grain, 130.3 thousand tons of raw cotton, 450.3 thousand tons of potatoes, 494.9 thousand tons of melons and gourds, and 127.5 thousand tons of gourds. For all crops, except for potatoes and vegetables, growth trends are observed in the gross yield in 2019, compared to previous periods (Table 6 in Annex 1).

39. However, more than 150 thousand tons of fruits and berries and 61.7 thousand tons of grapes were produced, which is also indicative of an upward trend in the gross harvesting performance compared to previous years (Table 7 in Annex 1).

40. Basically, the yield of agricultural crops in 2019, tends to improve relative to recent years, except for potatoes. Areas planted with potatoes according to the statistics increase annually; for example, in 2014 this crop occupied 11.9 thousand hectares, and in 2019 - 22.4 thousand hectares. However, the yield is declining, apparently due to the poor quality of seeds and other planting materials.

41. **Livestock breeding.** On the whole, the performance of livestock and poultry farming across all business categories in the Sughd region shows an upward trend for 2014-2019, especially as it relates to the poultry sector, where large agricultural producers increased the numbers of

[11] According to the data of Division of Melioration and Irrigation for the Sughd region RIA

chicken from 799.1 thousand in 2014 to 3,534.1 thousand in 2019, an equivalent of 442% surge. The most advanced district in this area is B. Ghafurov, where large poultry farms have been established and the rate of poultry population growth was 416% compared to 2014-2019 (Table 9 in Annex 1).

42. The trend of growth in the number of cattle in the Sughd region is also observed for 2020-2021. For example, the stock of cattle for 2020 was equal to 666.4 thousand animals, and in August 2021, it reached 671.8 thousand. In dehqan farms, the stock of cattle, as of August 2021, numbered 42.5 thousand. In private farms, the stock on 1 August 2021 stood at 623.2 thousand, whereas in public farms it was equal to 6.1 thousand. Local breeds of cattle like "Joydori" are mainly raised in the region. But in recent years, such breeds as "Holstein", "Carpathian" or "Schwyz" are already produced, because they are known for their high milk yield.

43. With the development of the livestock farming business across all categories of farms, the output of livestock products is also growing. For example, in 2014-2019, production of live-weight meat increased by 134%, milk yield - by 117%, egg production - by 343%, and wool production in physical mass - by 116% (Table 10 in Annex 1)

44. **Agricultural contribution to GDP, by sectors.** In 2019, the Sughd regional GRP was equal to TJS 20.5 billion (US$882.3 million), which accounts for 26.5% of the country's entire GDP In 2020, as a result of the measures envisaged to develop the regional economy, the GRP amounted to TJS 21.6 billion, and its growth rate reached 104.5%. The input of the regional gross domestic product to the national GDP was 26.2%.

45. The volume of the agriculture contribution to the GRP at the end of 2019, as mentioned above, was equal to TJS 8.09 billion, including from plant growing TJS 5.72 billion and livestock farming TJS 2.36 billion. Thus, the input of agriculture in the formation of gross regional product in 2019 constituted 39.4%.

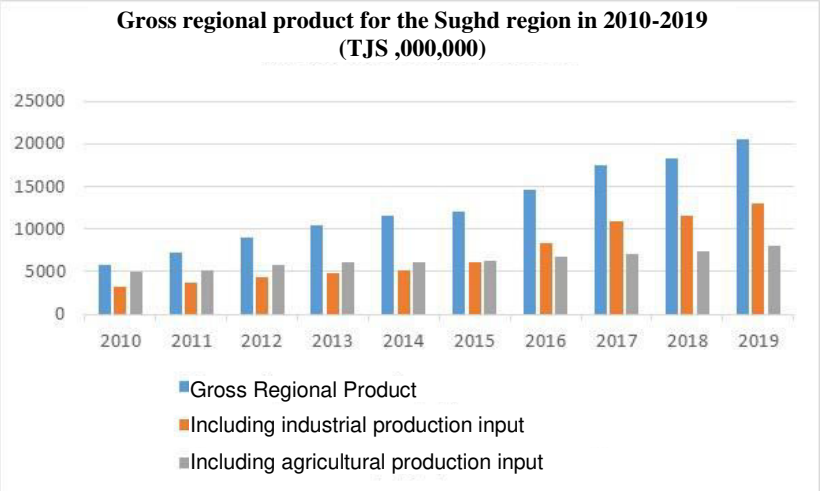


Figure 31. Gross Regional Product for the Sughd region in 2010-2019 (TJS ,000,000)[12]

46. **Reclamation status of irrigated lands.** One of the principal factors contributing to low crop yields is the reclamation condition of the irrigated lands and the inefficient use of water in irrigation-based farming. According to the Land-Reclamation Registry, the total area of lands in poor condition amounts to 2,518 hectares.

47. The most critical land reclamation status persists in the area of the villages of Kostakoz, Ispisor of B. Ghafurov district, Matcha, Paldorak and Obburdon of Matcha distrcit, Chilgazi,

[12] Statistical Yearbook of the Sughd region for 2020

Kulkent and Lyakan of Isfarin district, Bulok, Kamishkurgan and Yangisarai of Asht district. All in all, 24 settlements in the region are in flood water zones.

48. One more problem consists in power consumption by the irrigation pumping stations and drainage wells, operated to reduce the groundwater levels. For example, to maintain 12,787 hectares of the land in good reclamation condition, 8 pumping stations in Kanibadam city and 2 pumping stations in B. Ghafurov district are operating all year round in the area surrounding the reservoir Bahri Tojik. Over 200 million m³ of groundwater are annually pumped out and released back into the reservoir, i.e., it is a continuous process of water circulation that requires year-round power consumption by these pumping stations. The groundwater area around this reservoir at the depth of 0-1 m is 664 hectares, at 1-2 m - 7,378 hectares, at 2-3 - 4,317 hectares, and at 3-4 m - 433 hectares.

49. Also owing to the improper operation of the drainage infrastructure on the sites of filtration of water from canals, inefficient operation of the control valves and penstock conduits, non-compliance with water-use plans, inadequate water metering systems, and many other issues, salinization and waterlogging of the irrigated lands persist, thus about 30 thousand hectares of the irrigated lands are exposed to the risk of degradation.

Table 2. Groundwater tables on irrigated lands in the Sughd region

Regions and districts	Groundwater levels/area, ha					
	1.0 м or less	1.0 -1.5 м	1.5 -2.0 м	2.0 -3.0 м	3.0 -5.0 м	deeper than 5.0 м
Sughd region	2701.1	15957	13767.5	57725	13155	184196

50. **Irrigation forecasts.** The population of the Sughd region, as of 1 January 2020, was 2,705.4 thousand people, its irrigated land area was equal to 288 922 hectares, i.e., 0.1 hectare per capita. The Food Security Program of the Republic of Tajikistan for 2019-2023 points out that the Republic of Tajikistan is among the countries, which rank low on the availability of irrigated land per capita, with its rating for 2020 at just 0.08 hectares.

51. According to the Resolution of the Government of the Republic of Tajikistan, dated 31 August 2018, # 451 "On approval of the recommended physiological dietary standards for the consumption of basic foodstuffs per capita in the Republic of Tajikistan", each person annually consumes bread and bread products, cereals and legumes - 147.7 kg; meat and meat products - 40.8 kg; fish and fish products - 9.0 kg; milk and dairy products - 115.3 kg; eggs - 180; butter/oils (vegetable oil, fats) - 16.6 kg; sugar - 20.0 kg; vegetables and gourds - 166.1 kg; fruits and berries - 124.1 kg; potatoes - 92 kg; tea - 1.8 kg.

52. It is clear that products grown on 0.1 hectares, will not cover the annual consumption requirement per person. Therefore, some foodstuffs are imported and paid for with proceeds from economic activities in other sectors of the economy.

53. The Design Institute "Tajikgiprovodkhoz" during the Soviet years, evaluated the lands, potentially amenable to irrigation, and concluded that in the Sughd region, an area of 524,600[13] hectares were potentially suitable for irrigation. Yet, only 55% of it had been cultivated by 2020.

[13] Schemes for the development of melioration and water management in the territory of Tajikistan until 2005, Giprovodkhoz MMWH, Dushanbe -1988

It is expected that the population in the region by 2030 will grow to 3,407.6 people. If no action is taken, the irrigated area per capita will shrink to 0.08 hectares. Alternatively, to maintain the 0.1 hectares per capita, it would be imperative to expand the irrigated lands by at least 6,000 hectares per year.

54. Currently, about 75% of the irrigated lands in the Sughd region are occupied by upland terraces and only a few of them are located in the lower parts of the valley. It is therefore clear that in the future, the reclamation of new lands will be mainly focused on the virgin and pasture areas located above the water sources, which will require the allocation of larger areas for pumping irrigation in the future.

55. In the region it is possible to reclaim the Kyzyli range, the Shahristan cavity in the area of Shahristan and Devashtich, as well as other large ranges may be considered, such as the Asht steppe, Samgar-Mirzavat, and Matpara. For this purpose, large annual investments will be required for the construction of upgraded, energy-efficient pumping stations, as well as irrigation and drainage infrastructure facilities.

56. **Food imports and exports.** In 2019, the Sughd region was connected with 59 countries via its operations in export-import shipments of goods. Ten of them were CIS countries and the other 49 - from outside the CIS. Total exports in 2019 accounted for US$ 471.1 million, which was US$ 88.6 million less than in 2018. Total exports in 2019 amounted to US$ 1571.6 million, which was US$ 115.7 million more than in 2018.

57. Food imports in January - December 2019, increased by 7.9%, compared to January - December 2018, including imports of eggs up by 17.2%, flour - by 81.8%, vegetable oil - by 24.2%, wheat - by 7.0%, pasta, noodles, cones, etc. - by 29.8%, tea - by 13.7%, sugar and confectionery by 39.3%, fruit and vegetable juices by 40.8%, milk and dairy products - by 1.2%. However, during the same period, imports of fruits decreased by 4.2%, potatoes - by 88.5%, vegetables - by 72.0%, and canned vegetables, tomatoes - by 33.3%[14].

3.2. General and socio-economic development prospects for the Zafarabad district

58. **Population.** The population of the Zafarabad district, as of 1 January 2020, was 75.5 thousand people, including men 37 thousand, and women 38.5 thousand persons. Out of the total population numbers, 41.5% live in rural areas. In general, the population growth over the past 10 years vs. 2010, was recorded at 14.7 thousand people, which is an average of 2.3% per year. Given this rate of growth, in 2030 the population numbers in the Sughd region should increase to around 100.0 thousand people. The average annual payroll number of those employed in the commercial sectors of the region is currently 16.2 thousand people. People are basically employed in the industrial and farming sectors. The number of jobless people, officially registered at the employment centers, is 237 persons.

[14] Source: Statistical Yearbook of the Sughd region for 2020

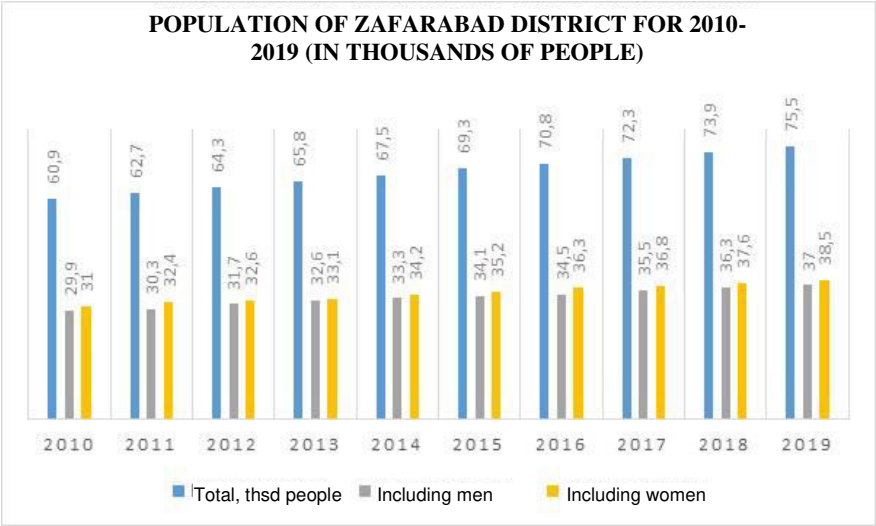


Figure 32. Population of Zafarabad district for 2010-2019 (in thousands of people)[15]

59. **Industry.** The industrial sector of the district constitutes the key resource for processing cotton and producing finished products from local raw materials. There are 21 operational industrial entities in the district, including 19 manufacturing facilities, 2 power, gas, water supply and distribution utilities. Overall, the number of industrial companies has increased by 6 units, as compared to 2011. The average annual number of industrial production personnel equals 440 people, including 228 workers.

60. The industrial production output, net of the agricultural products for the year-end of 2019, amounted to TJS 216.5 million, up by 47.5%, compared to 2014. The manufacturing sector accounts for 69.0% of the total industrial output (primarily, cotton fiber processing), whereas the input of 5.8% is provided by power, gas and water supply and distribution utilities, and 25.2% - by other industries.

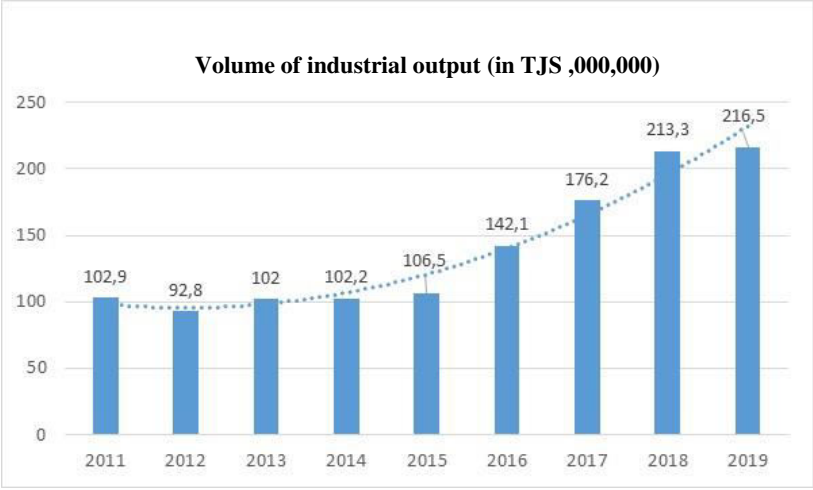


Figure 33. Volume of industrial production output (in TJS ,000,000)[16]

61. In Table 11 in Annex 1 are given data on the industrial production output in Zafarabad district for 2012-2019.

[15] Source: Statistical Yearbook of Zafarabad region for 2020
[16] Source: Statistical Yearbook of Zafarabad region for 2020

62. **Agricultural development.** The Zafarabad district is considered as one of the farming leaders in the Sughd region. Agriculture is the key source for the district budget revenue. 4 068 dehqan farms have been established in the district, as well as 117 other agricultural businesses. Compared to 2011, the number of such dehqan farms has increased by 1.8 times, whereas the other farming units are down from the previous 220 to 117. To ensure equitable water distribution among the dehqan farms, 37 WUAs are operating in the Zafarabad area, 33 of them for the district.

63. The gross output of agricultural products in the region at the end of 2019, based on the input of farms of all forms of ownership, was TJS 450639 thousand, which is 294% more than for the same period in 2011. The contribution of the dehqan farms to the above gross output was 71%, primarily provided by the crop growing businesses, 5.2% - by other agricultural producers, and 23% - by local households. The input of the households into the gross production output is such as it is, owing to their livestock breeding practices. The table below shows the gross agricultural output for 2011-2019.

64. The below diagram shows the contribution of the Zafarabad district agricultural enterprises, dehqan farms and local household subsistence businesses. As can be observed in the diagram, the input of the dehqan farms in 2019 amounted to over 70%, that of the households - 23.4%, and the contribution provided by other agricultural enterprises was 5.3%.

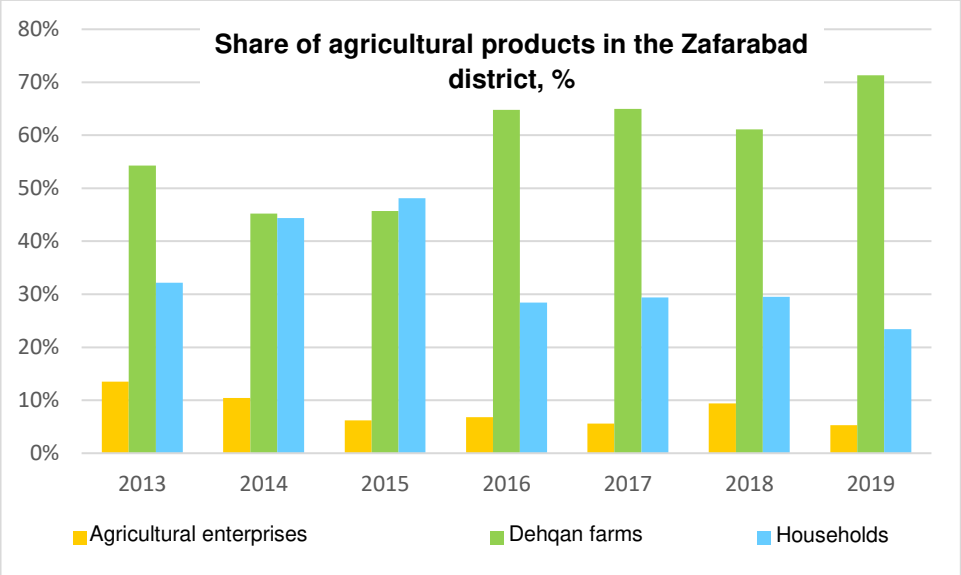


Figure 34. Share of agricultural products in the Zafarabad district[17]

65. **Farming land area.** The total land area in the Zafarabad district is 44,097 hectares, including 3,602 hectares of farmland, including 30,926 hectares of ploughland, 1,064 hectares of perennial plantations, 732 hectares of pastures, and 880 hectares of fallow land.

66. **Crop growing.** Crop production is considered one of the key agricultural activities in the Zafarabad district since the area occupied by crop plantations in 2019 is 30,640 hectares. More than 50% of them are used for growing industrial crops, including cotton and oilseeds (Table 14 in Annex 1).

67. The gross harvest output of agricultural crops provided by all categories of farming businesses in 2019, was equal to 14.3 thousand tons of grain, 28.7 thousand tons of raw cotton,

[17] Source: Statistical Yearbook of Zafarabad region for 2020

2.7 thousand tons of potatoes, 8.1 thousand tons of vegetables, and 21.0 thousand tons of melons and gourds (Table 15 in Annex 1).

68. Yield of agricultural crops provided by all categories of farming businesses in 2012-2019 is given in the following table. It is noteworthy, that the average yield of agricultural crops relative to the average yield across the region in 2019, is somewhat lower. For example, grain crops below by 2 c/ha, raw cotton - by 1.6 c/ha, potatoes - by 84.6 c/ha, vegetables - by 133.9 c/ha, and melons - by 43.3 c/ha.

69. **Livestock breeding.** Livestock farming in the Zafarabad district is showing growth and expansion, especially in terms of increasing the number of cattle compared to previous years. E.g., the stock of cattle in the period 2012-2019 increased by 2,743 thousand animals, including 2,508 thousand cows, 2,853 thousand goats, and 10,317 chickens. Yet, the numbers of sheep and horses went down by 292 thousand and 33 thousand, respectively. The development of cattle breeding is mainly carried out by dehqan (peasant) farms and private household businesses (Table 17 in Annex 1). Production of livestock foodstuffs is also mainly carried out by the dehqan (peasant) farms and household subsistence businesses (Table 18 and 19 in Annex 1).

70. **GDP in agriculture and other sectors.** The gross district product is basically created by industrial output, agricultural production, and trade turnover, whereas other sectors of the economy contribute less to the formation of this product. According to the statistics, the gross output in the district at the beginning of 2020 was worth TJS 931.4 million, which is 47.8% higher than in 2012. The gross production output of the district is about 20% of the GRP.

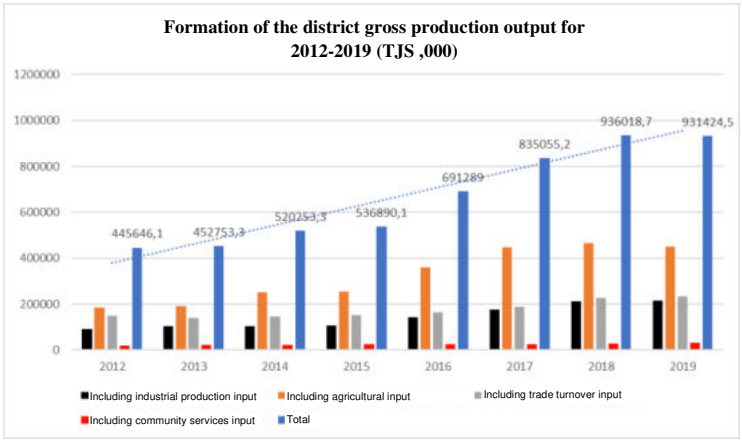


Figure 35. Formation of the district gross production output for 2012-2019 (in TJS ,000)[18]

71. **Area and condition of irrigated lands.** The total land area of the Zafarabad district is 44 097 hectares. According to the evaluations carried out in the district, the area of land potentially amenable to irrigation is equal to 35 540 hectares. Over the period of development and establishment of the district, large-capacity cascade pumping stations and other irrigation and drainage infrastructure facilities were built to cover an area of 35 360 hectares. However, in early 2020, due to the worn-out condition of the irrigation and drainage equipment, and the breakdown of the pumping stations, according to the regional Land Management Committee, the current size of the irrigated area is 33,602 hectares. About 2,000 hectares are excluded from agricultural production operations.

[18] Source: Statistical Yearbook of Zafarabad region for 2020

72. Changes in the farmland size between 2011 and 2019 shows the tendency on withdrawal of land from agricultural circulation (Table 20 in Annex 1). In this regard, it is important to rebuild the pumping stations and other irrigation and drainage facilities, to bring the lands currently out of agricultural use back on track.

73. Moreover, 1 670 hectares of the irrigated lands in the district are in poor condition in terms of reclamation. To improve the condition of the lands, there is a need to clean up 666 km of canals and drainage networks. Also, only 41 out of the 190 reclamation wells on the books of the Zafarabad SRIA, are operational.

4. Power usage by water management infrastructure

74. Power generation in the Republic of Tajikistan" plays a leadership role in meeting the growing electricity supply needs of social and economic development stakeholders. Tajikistan possesses abundant hydropower resources, utilized only up to about 5%. The Republic of Tajikistan is one of the country's best endowed with this renewable and environmentally friendly source of energy. It ranks 8th in the world, given its potential capacity for hydropower generation estimated at 527 billion kWh/year. On average, across the territory of Tajikistan, the availability of rivers is about 0.6 km/km^2. Among the CIS countries, it is inferior only to Russia on this score.

75. Electric power is generated mainly by HPPs. The total installed capacity of the electric power generation system of the Republic of Tajikistan is equal to 6 124 MW, and that of the co-generation power plants - 718 MW.

76. The average annual output of electric power in the country is equal to 16.5 billion kWh, or 4-5% of its potential capacity. In winter, the country experiences significant power shortages of 2.2 to 2.5 billion kWh, and is forced to impose restrictions on supplies, which are particularly detrimental for rural communities, that account for at least 70% of the country's population. Annual losses of crop yields in rural areas as a result of the said power supply restrictions amount to about 30%.

77. In summer, the power supply is most reliable, because during this season a surplus of 3-7 billion kWh is available. Redundancy of water results in significant sterile spills, which potentially cause tremendous losses of electricity. Depending on the prevailing seasonal hydrological conditions, the economic cost amounts to US$ 90-225 million annually.

78. In the Sughd region on the Syr Darya River, in 1956 Kairakum HPP was put into operation. Its capacity was equal to 126 MW, and the average annual power output was 688 million kWh. It is self-evident, that such production capacity of the HPP is not sufficient to meet the needs of the Sughd region.

79. The power supply requirements, given the growing industrial production, were 14 million kWh/day in 2009, and they increased up to 17.8 million kWh/day by 2018, or 5.1-6.5 billion kWh/year. The most important power consumers are industrial facilities, population, non-manufacturing firms, agricultural producers, and water management infrastructure.

80. To address the problem, Tajikistan commissioned in 2009 a high voltage "South-North 500 kV" transmission line, 350 km long, with a capacity of 27 million kWh per day. Power, transmitted along the "South-North" line, is generated by the Nurek HPP. In addition, at this stage, work is underway to upgrade the Kairakum HPP to increase its capacity by 35%, i.e., from 126 to 174 MW.

81. According to the Sughd Electricity Grid Operation Department of OJSHC "Barki Tojik", in the first six months of 2018, debts for electricity in the Sughd region amounted to TJS 354 million, including debts of industrial companies in the amount of TJS 23.4 million, of non-industrial enterprises - TJS 33.1 million, public organizations - TJS 22 million, agricultural producers - TJS 39.7 million, water management sector - TJS 76.5 million and households - TJS 135.6 million.

82. Meanwhile, accounts payable for 2019 were up to US$2.8 billion. These include US$2.3 billion related to loans extended for funding energy investment projects and US$564.2 million pertaining to other accounts payable, including tax liabilities.

83. According to SDRI, there are 173 state-owned pumping stations in the Sughd region, equipped with 643 pump units ranging in capacity from 75 kWh to 8000 kWh, with pressure lifting from 10 to 180 m, installed capacity of 229,568 kWh (over 1 billion kWh per irrigation season), water supply capacity of 698.4 m^3/s and 35 transformer substations with an installed capacity of 145.75 thsd kWh per irrigation season. At this point in time, some of the pumping stations located in the districts and urban areas are not operational.

84. The key large-capacity cascade pumping stations are situated in the districts of Zafarabad, Mastchoh, B. Ghafurov, and Asht. In general, electricity consumption by the pumping stations in the Sughd region varies up to 1 billion kWh. For example, in 2020, it was 914 million kWh.

4.1. Available information on usage of electric power.

85. In pumping stations in the Sughd region, information on the operation of pump units and the use of electricity is collected manually. This work is delegated to the station manager and the electrician on duty. At lower-capacity pumping stations, collecting these readings is not a very time-consuming operation, since the electricity meters are located inside the station or close by. For large-capacity pumping stations, electricity meters are installed at a distance of 100 m to 2.0 km from the pumping station. Collection of readings from the meters takes 1-2 hours.

86. Before collecting the readings of the electricity meters located at the transformer stations, which are on the books of the Sughd Electricity Grid Operation Department of the OJSHC "Barki Tojik", it is important to discuss with the district power engineer of the Sughd Electricity Grid Operation Department and agree on the time of the meeting for taking the readings of the electricity meter. This would require certain time and transportation costs.

87. The electrician on duty takes 1-2 hours on a daily basis to collect the readings of the electricity meter. The round trip takes 2 hours and would cost him some transport expenses. The readings thus collected are entered into the relevant logs, and the officer on duty transmits the data by phone to the power engineer of SRIA. The SRIA power engineer performs calculations and makes a report on electricity consumption, draws up a certificate of data reconciliation with the power engineer of the power supply utility, and then passes it on to the SDRI. The SDRI power engineer, in turn, draws up 11CH and 5 BX reports and forwards them to their superior authority, which is RIA.

88. The correspondence between the pumping stations and SRIA is carried out by phone. The management information is transmitted in the format of telephoned messages. The requests of the pumping station manager addressed to SRIA, are also dispatched as telephoned messages.

89. This process is deficient in the following aspects:

– Responsibility for uninterrupted transmission of information remains vested in the person on duty (risk of "human error");

– Information received or transmitted remains passive, i.e., the use of this information later generates complications related to locating it by flipping through the logbook (e.g., for compiling reports showing comparative data with previous periods);

– Untimely and disrupted transmissions of information, as well as transportation costs.

90. Consumption of electricity is monitored by means of electric power meters. Power consumption records are available in all operating pumping stations. Electric power meters, installed at the pumping stations, are of different types: Soviet, Russian, and Chinese. These types and usage pattern are provided in percent as follows: Models SA3U-I670M and SA4U-I672M – 41,7%, Models Mercury 230 – 26,5%, Models DTSD-178 – 10,6%, DSS(x)666 – 6%, Models HXF300 – 5,3%, and other models DTS 854, DTS (x) 607, SET3, P34S02 CT, CT TOO 40374064-01-2006 и SET-4TM.03 – 9,9%.

91. To improve the quality of monitoring the consumption of electricity by pumping stations, an automated monitoring system should be implemented at the pumping stations, with data transmitted online to the control centers of the power supply utility in districts and cities, as well as in SRIA, SDRI, and RIA.

92. For example, B. Ghafurov district is already working on the implementation of an automated electricity metering system at its pumping stations. There are only 31 pumping stations in the area, of which 30 are operational, one (Oktosh-3) is broken.

93. Eight pumping stations in the area are equipped with HXF300 power consumption meters, connected to the billing system of "Barki Tojik", which enables them to be used in the ASMPE-NS system in automated mode. Based on the above, this approach should be implemented step-by-step at the other pumping stations.

CO_2 emissions by sectors

94. According to the findings of the First Biennial Report of the Republic of Tajikistan on Inventory of Greenhouse Gases under the UN Framework Convention on Climate Change, total GHG emissions in CO_2 eq. without the LULUCF sector, in 2014 were 9,131.01 Gg. Emissions.

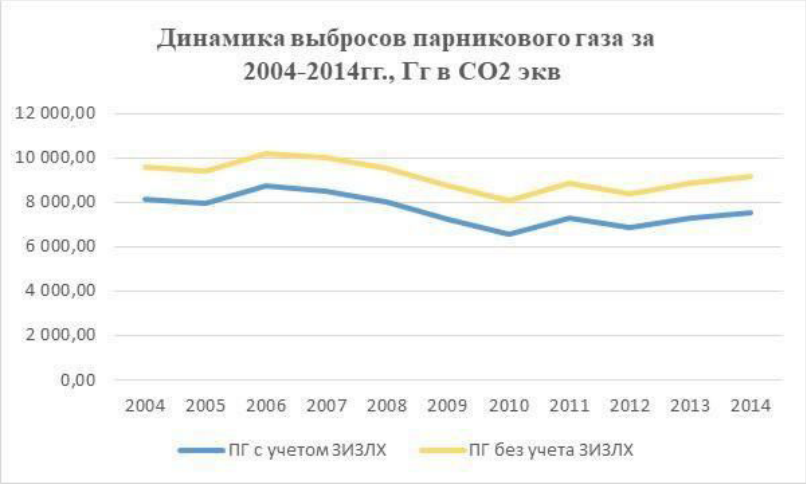


Figure 14. Dymamisc of emission during 2004-2014 in Tajikistan[19]

95. To calculate the reduction in greenhouse gas emissions, the baseline value of 1990 is taken. Total greenhouse gas emissions in 1990 were estimated at 35.53 million tons of CO2 equivalent (Figure 15.). In this diagram, the following industries are taken into account:

1) Energy: 21.37 million tons of CO2 equivalent - 60%.
2) Agriculture: 10.5 million tons of CO2 equivalent - 35%.
3) Industrial Processes and Product Use (IPPU): 3.1 Mt CO2e - 9%.
4) Land use, land use change and forestry (LULUCF) (Forestry and Other Land Use Change): -1.8 million tons of CO2 equivalent - 5%.
5) Waste: 0.50 million tons of CO2 equivalent - 1%.

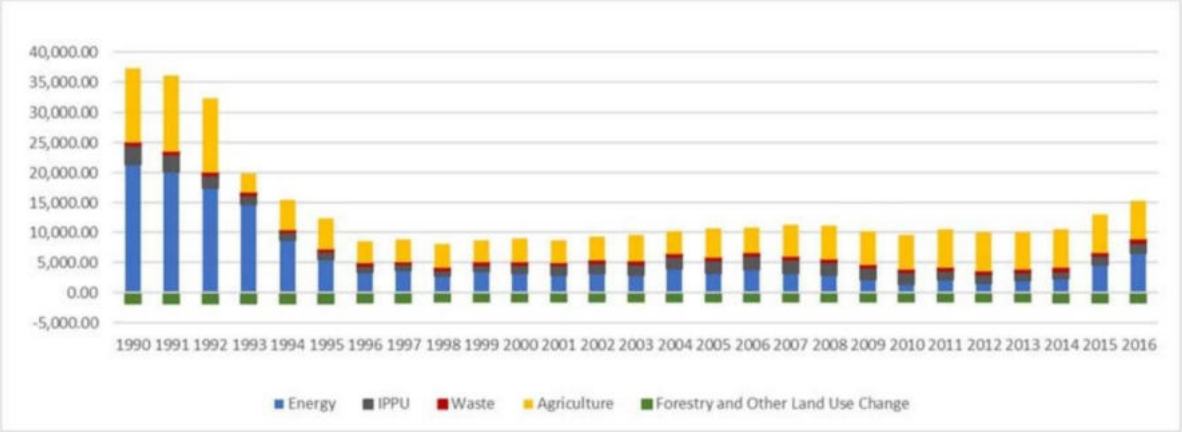


Figure 15: Inventory of greenhouse gas emissions for the period 1990-2016 including LULUCF[20]

96. According to the Greenhouse Gas Inventory, waste and LULUCF had a negligible weight in the country's total greenhouse gas emissions in 1990. In 2016, greenhouse gas emissions were only 39% of the 1990 baseline.

97. According to estimates and forecasting models, Tajikistan will maintain up to 70% of the 1990 baseline greenhouse gas emissions until 2030. These forecasting models were developed under three scenarios:

1) Base scenario (Baseline). This scenario assumes that any mitigation measure will be successfully implemented;
2) Unconditional scenario. This scenario considers all existing mitigation measures to be implemented by the country's efforts up to 2030;
3) Conditional scenario. This scenario considers additional mitigation measures for which the Republic of Tajikistan will require the full support of the international community.

[19] Source: First Biennial Report of the Republic of Tajikistan on Greenhouse Gas Inventory under the UN Framework Convention on Climate Change. Dushanbe, 2018
[20] https://unfccc.int/NDCREG

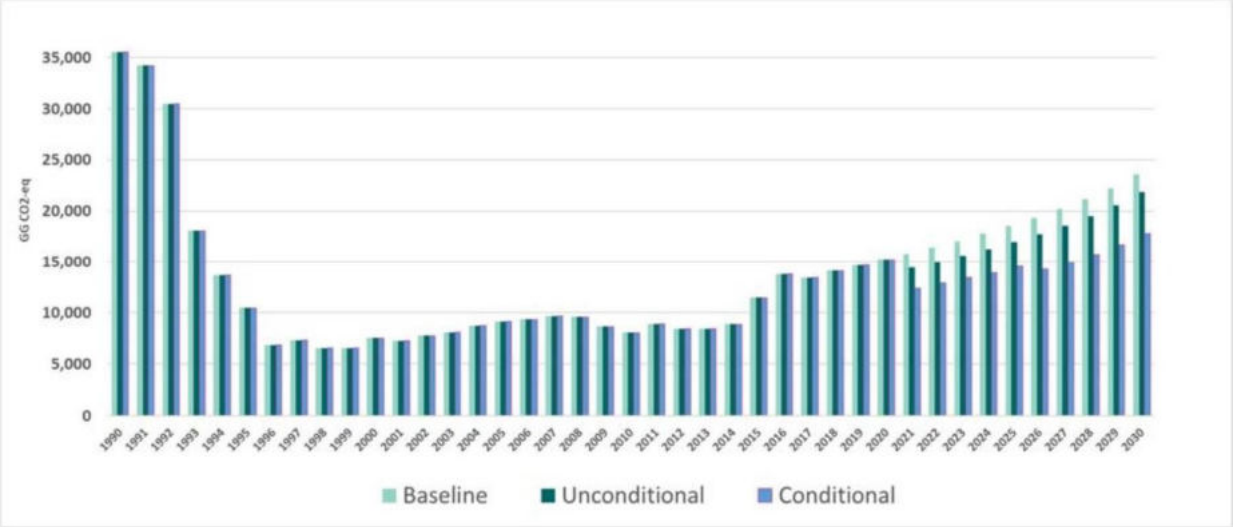


Figure 16: Greenhouse gas emissions in Tajikistan by scenario[21]

98. Under these scenarios, the expected baseline greenhouse gas emissions by 2030 are 23.54 MtCO2 eq. or 66.25% of existing greenhouse gas emissions in 1990. Under the unconditional scenario, the expected greenhouse gas emissions by 2030 will amount to 21.87 MtCO2 eq. or 61.55% of existing greenhouse gas emissions in 1990. According to the conditional scenario, GHG emissions by 2030 will amount to 17.83 MtCO2 eq. or 50.10% of 1990 GHG emissions or a 24% reduction compared to the base case.
99. However, LULUCF is also not expected to be a significant contributor to the country's total greenhouse gas emissions under the above scenario. But for this, it is recommended to plan the following actions in the agriculture and LULUCF sector[22].

➢ **Agriculture**

– Promotion of efficient irrigation technologies;
– Restoration of irrigation and drainage systems;
– Optimization of fertilizer use, i.e. reducing the use of synthetic fertilizers;
– Promotion of crop diversity;
– Integrated pest control;
– Development of nexus approaches: water, food and energy;
– Promotion and expansion of agroforestry, horticulture, viticulture, environmentally friendly and resource-saving agriculture;
– Improved pasture management planning;
– Improvement of existing carbon pools, such as pasture management, collection and use of bagasse, rice husks or other agricultural waste;
– Reduce the use of tillage practices that increase soil carbon; restoration of degraded lands, etc.;

[21] Source: Lopez Blanco, M.J., Martín Ortega, J.L., Rivas, A. 2021. Forecasting greenhouse gas emissions in key sectors and assessing the impact of climate change mitigation policies and measures. Forecasts of greenhouse gas emissions up to 2030 in Tajikistan. UNDP, https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Tajikistan%20First/NDC_TAJIKISTAN_RUSS.pdf

[22] Refer to the footnote 20 and 21

- Introduction of technologies and equipment for the collection of anaerobic systems, storage and processing of manure, as well as proper handling of bird droppings;
- Development of environmentally friendly, highly efficient and energy-saving technologies for the utilization and use of agricultural waste;
- Production of biofuels, including biodiesel and bioethanol (only if net emission reductions can be demonstrated);
- Measures to improve the system of livestock breeding (animal husbandry);
- Sustainable practices in pasture management.

➢ **In forestry**

- Natural regeneration and active restoration of forests to stabilize/prevent erosion, wood production, firewood production, production of non-timber forest products, reduction of degradation;
- Promotion of environmentally friendly solutions, restoration of forest landscapes and other approaches to improve the condition of forests;
- Promotion of forest protection and sustainable management of existing forests and ecosystem services; restoration of degraded pastures, agroforestry and rangelands;
- Promotion of integrated actions: integrated land management, improvement of the regulatory framework, strengthening of law enforcement, development of a sustainable financing system, inventory and monitoring, as well as investment in science and innovation.

100. Thus, Tajikistan can significantly reduce greenhouse gas emissions under various scenarios until 2030 in relation to the 1990 baseline, which will contribute to the achievement of common global goals to reduce global greenhouse gas emissions. The Republic of Tajikistan can achieve low carbon development with appropriate support from development partners.

5. Irrigation infrastructure

5.1. Irrigation infrastructure in the Sughd region

101. The Sughd region is basically characterized by its arid climate, and, therefore, 90% of the agricultural GRP is generated on irrigated lands, 75% of which are contingent on pumping irrigation.

102. The sources of irrigation water in the Sughd region are: the Syr Darya River basin with its tributaries Khojabakirgan, Aksu, Isfara, Isfana rivers, etc. Also, the Zaravshan River basin with its tributaries Fondarya, Kshtut, Mogiyandarya rivers, etc. The Sughd Regional Reclamation and Irrigation Department is composed of: 12 district and city state agencies for land reclamation and irrigation. They provide management services to the irrigated lands on an area of 208.0 thousand hectares, including for pumping irrigation on 159.5 thousand hectares.

Table 3. Distribution of areas for pumping and gravity irrigation services within the Sughd Reclamation and Irrigation Department, %

District and city SRIAs	Pumping	Gravity	Total
Istaravshan	1	99	100

Devashtich	0	100	100
Shahristan	17	83	100
Total for Zarinrud SRIA	4	96	100
Devashtich SRIA	0	100	100
J. Rasulov SRIA	100	0	100
Canal HB J. Rasulov SRIA	0	100	100
Canal HB B. Ghafurov SRIA	0	100	100
Total SRIAs for HB (Hojabakirgan)	0	100	100
B. Ghafurov SRIA	100	0	100
Asht SRIA	35	65	100
Mastchin SRIA	95	5	100
Zafarabad SRIA	100	0	100
Kanibadam city SRIA	80	20	100
Spitamen SRIA	50	50	100
Isfara city SRIA	27	73	100
Penjikent city SRIA	20	80	100
Ayni district	83	17	100
Total across the region	72	28	100

Source: Data of the Division on Melioration and irrigation of Sughd region

103. To provide these lands with irrigation water there are 173 state-owned pumping stations equipped with 643 pumping units with a total capacity of 698.4 m³/sec, 35 transformer substations with installed capacity of 145.75 thousand kW in the region. Some pumping stations, such as Samgar, Khoja-Bakirgan, Asht, Dalverzin, Golodnostep and Kizilinsky are furnished with unique pumping units - "nameplate" types, pumping from 1 to 6.3 m³/sec of water. Pressure pipelines with diameters ranging from 400 to 2,600 mm, with a service life of 10 to 60 years, are connected to these pumping stations.

104. However, most of the pumping stations and their pipelines are in poor condition. About half of all the pipelines are made of reinforced concrete. The pumping station equipment and technologies of the pressure pipelines have reached the limit of 3-5 times their service life, and any further operation without rehabilitation would render their performance unreliable and energy-consuming. The wear rate of the pumping stations is 40.6% of their total book service life. The problem is further complicated by the fact that the level of skills of the maintenance personnel is declining, mainly as a result of staff outflow caused by low wages and delayed payments of wages.

105. The length of state-owned irrigation canals is 1,688.14 km and that of the drainage networks - 562 km. The wear rate of the irrigation and drainage systems is 40.5% of their book life term. With every passing year, the reliability of water intake systems declines, as does the

performance efficiency of the inter-farm canals and reservoirs. The annual clean-up operations carried out on the irrigation systems and drainage pipelines, are not sufficiently effective due to the shortage of financial resources and equipment.

106. For this reason, the reliability of the water intake infrastructure of the irrigation system diminishes over time. Therefore, rehabilitation of the mainline canals has emerged as a pressing need for the following facilities: NFC in Asht district, Gulyakandoz, City and GFC in B. Ghafurov district, portions of the canals TM-1, TM-2 and TM-4 in Zafarabad district, 4MK-1, 4MK-2 and portions of the canals OK-3 and OK-4 in Kizilya range, Kattasay main canal in Istaravshan district and Basmanda canal in Ganchi district, Khalifa-Khasan canal, Margidar and Tokhsan-Korez with head structures of Penjiken district, the Khoja-Bakirgan, Shavkat, Isfara dams and the Rawat waterworks.

107. At the same time, the hydraulic engineering infrastructure together with the reservoirs, dams, 1,293 km of mainline canals, 500 km of the key drainage networks, 172 pumping stations, and 311 km of water supply pipelines, is in urgent need of rehabilitation. As an example, 68 pumping stations are not operational at all and need a complete replacement of the equipment. Owing to these factors, in 2016, SDRI managed to provide its water supply services for irrigation purposes only on 186,177 hectares or 71.3% of the total area of the irrigated lands in the region.

108. The Bahri Tojik reservoir, the Farkhad dam, and two more small but very important reservoirs, Daganasai (Zarrinrud) and Kattasai, remain the backbone of the irrigation and regulatory infrastructure, and even with silting up, macrophyte growth, leaking dams and other problems, are operating properly, yet continuously challenged by a persistent decline in water storage capacity.

109. To improve the current situation, the Water Sector Reform Program for 2016-2025 introduces the IWRM system for the basins. The hydrology environment of the Syr Darya River basin in Tajikistan was analyzed as part of the NWRMP by Helvetas, ACTED, and GIZ with the financial support of the Swiss Agency for Cooperation and Development, and demarcation of the sub-basins was carried out based on this study. Pursuant to this demarcation, carried out on the basis of "Landsat" images and in accordance with the classification of the Digital Elevation Model (DEM), only 23 sub-basins were singled out in the Tajik part of the Syr Darya River basin, which fully or partially cover the Syr Darya basin within the territory of Tajikistan. Their total area is 32,053 km^2.

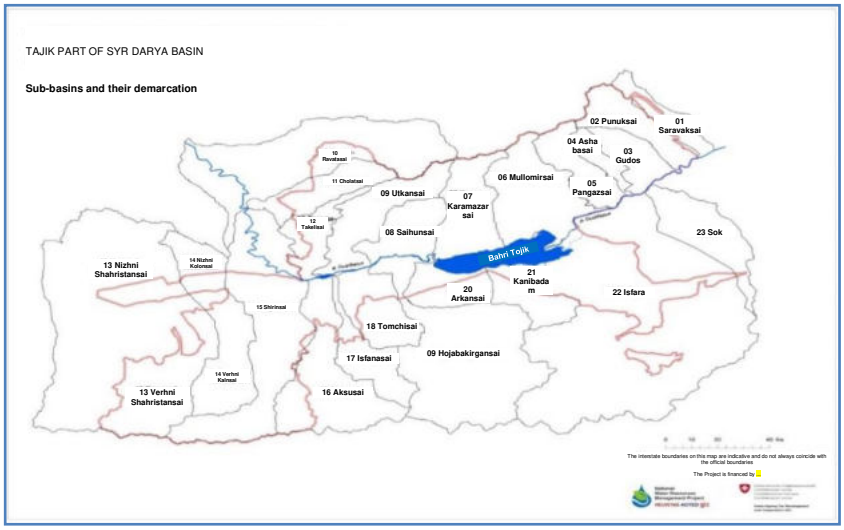


Figure 367. Map of the Syr Darya River sub-basins[23]

110. As for the Zarafshan basin, as part of the Project "Reclamation and Irrigation Management Improvement in the Zarafshan River Basin", implemented under the EU financial support through WB, a basin management team was set up in the system of RIA/SDRI in the Sughd region, in the form of the Zarafshan Basin Reclamation and Irrigation Department.

5.2. Zafarabad irrigation infrastructure

111. The basis for the irrigation and drainage infrastructure of the Zafarabad district is represented by the large-scale system built during the Soviet period, in 1950-1970. State-of-the-art irrigation and drainage systems are sophisticated infrastructure facilities based on technical equipment and maintenance technology, including water intake devices with pumping stations of various types and capacities: 14 pumping stations with 56 pump units and 3 mainline canals TM-1, TM-2, and TM-4; total length of 127 km, 666.6 km of DNW, and 190 pieces of VDWs. All the irrigated lands in the district are located within the catchment zone of the pumping stations.

112. Serious concerns are raised with regard to the condition of the pumping station units, motors, and pressure pipelines. They have been in operation for over 40 years (some even more than 50) and require replacement. For the local residents, the potential failure of the pumping irrigation poses a threat of serious socio-economic disaster, which, due to the ongoing desertification, could turn them into environmental refugees, whose problems would be more costly to fix, than the upgrading, maintenance, and operation of these pumping stations.

113. The Zafarabad irrigation system supplies water to the irrigated lands of the Zafarabad district, Istaravshan district (by means of the cascade pumping stations (CPS) and 3MK canal) and Devashtitchi district (by means of the CPS and 4MK canal). The irrigation water is provided by the diversion canal of the Farhad HPP. Water is supplied to the irrigated lands by the cascade pumping stations (CPS).

114. Schematically, in general terms, the organization of the irrigation process (water intake and water supply to the farms) in the Zafarabad irrigation system can be described as follows: systems of pumping canals TM-1, TM-2 and the cascade of pump stations GPS and CPS, as well as and DVGNS, which are supplied by the diversion canal of the Farhad HPP. Furthermore, the pumping stations that take water from the DNW, are the "Leninabad" pumping station, the "40th Anniversary of Tajikistan" pumping station, and the KV-1 pumping station.

[23] Source: River basin plan on using and protection of the water resources of Tajik part of Syr Dariya River Basin.

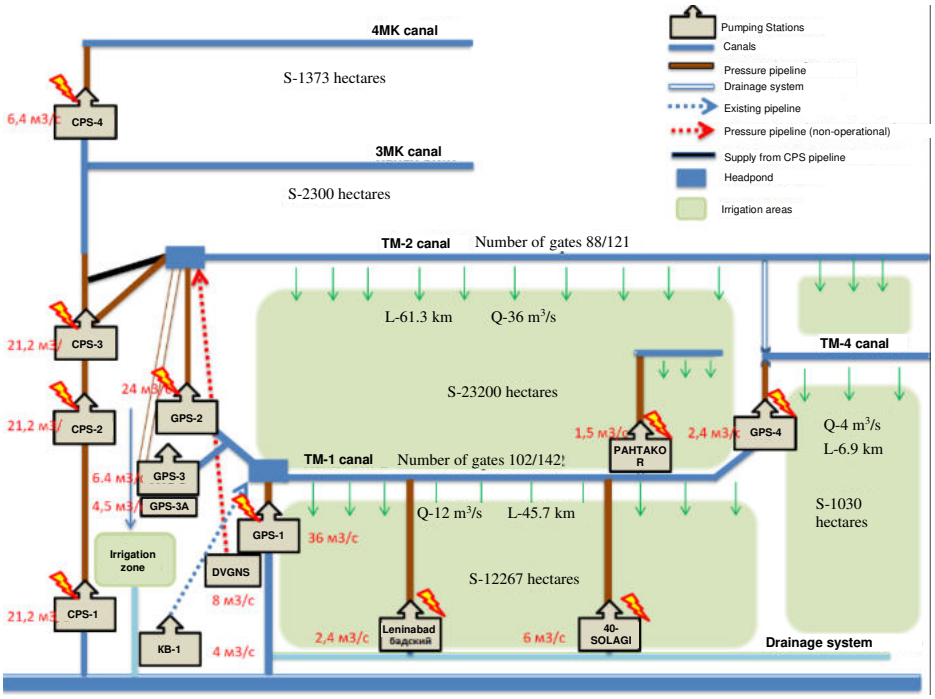


Figure 378. Zafarabad irrigation diagram

115. The principal mainline canals and inter-farm distribution systems have a seepage-control lining, and some of the on-farm and external networks are designed as troughs and underground pipelines. But due to improper operation over time they eventually fall into disrepair.

Photo 11. TM-2 canal in mid-stream

116. For example, according to the SRIA, in 2018 during the growing season, water intake from sources amounted to 430,687 thousand m³, while for the irrigation of crops 350,522 thousand m³ of irrigation water was supplied. The evaluation of water losses in the irrigation canals is given below.

Table 4. Water losses in the irrigation canals in 2018 - Zafarabad

Months	Total water intake from sources, thsd m^3	Total water supplied, thsd m^3	Losses of inter-farm network, thsd m^3	Efficiency of inter-farm network	Total water used, thsd m^3	Losses of on-farm network, thsd m^3	Efficiency of on-farm network	Total water losses, thsd m^3	System efficiency
1	2	3	4	5	6	7	8	9	10
January	0	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0	0
March	6471	4401	2070	0	3301	1100	0.75	3170	0.51
April	37181	29744	7437	0.80	22308	7436	0.75	14873	0.60
May	63167	50534	12633	0.80	40427	10107	0.8	22740	0.64
June	80592	64474	16118	0.80	57382	7092	0.89	23210	0.71
1	2	3	4	5	6	7	8	9	10
July	90049	72039	18010	0.80	63394	8645	0.88	26655	0.70
August	96498	77126	19372	0.80	69413	7713	0.90	27085	0.72
September	63200	56605	6595	0.90	50944	5661	0.90	12256	0.81
October	0	0	0	0.00		0	0	0	0.00
November	0		0			0	0	0	0.00
December	0		0			0	0	0	0.00
Vegetation	**430687**	**350522**	**80165**	**0.82**	**303868**	**46654**	0.87	**126819**	0.71
Year	**437158**	**354923**	**82235**	**0.82**	**307169**	**47754**	0.87	**129989**	0.70

117. The table above shows that the efficiency of the inter-farm network is equal to 0.81, and that of the on-farm network - 0.87, while the efficiency of the system is 0.70. The reason for the low efficiency of the irrigation systems is the inadequate condition of both inter-farm and on-farm irrigation systems. For lack of funds, only high-priority operations are carried out annually to ensure water supply and partial improvement of the land reclamation condition.

118. According to the information provided by the Zafarabad SRIA, data on the total water intake and water supply, as well as on the efficiency of the inter-farm network for 20116-2020, are given in the following table.

Table 5. Total water intake, water supply and efficiency of inter-farm network

Years	Total water intake, thsd m^3			Total water supply, thsd m^3			Efficiency of inter-farm network	
	Estimate	Actual	%	Estimate	Actual	%	Estimate	Actual
2016	417378	442233	106	354769	354923	100	0.85	0.82
2017	418753	407949	97	355941	334518	94	0.85	0.82
2018	418753	470045	112	355941	386746	109	0.85	0.82
2019	418753	387712	93	355941	316056	89	0.85	0.82
2020	418753	372253	89	355941	297789	84	0.85	0.80

119. The table shows that in 2016, the total water supply is equal to 354,923 thousand m^3, and the efficiency of inter-farm canals stands at 0.82. In 2020, the total water supply was 297,789 thousand m^3, and the efficiency of inter-farm canals was down to 0.80. Hence, it follows that the pumping station units break down, and the repair work on them, if they can be fixed, is carried out

in the irrigation season, thereby reducing the water supply and the efficiency of the inter-farm canals.

120. In total, the irrigated lands in the district, which are monitored, occupy an area of 35,807 hectares, of which 26,813 hectares are in good condition, including 8,113 ha in satisfactory condition, and 881 hectares - in poor condition, including 141 hectares with critical groundwater table, 728 hectares of salinized soils, 12 hectares of lands with critical groundwater table and heavily salinized soils.

121. The drainage network (DNW) controls the land reclamation conditions on the area of 18,01 thousand hectares, including an open-air drainage network located on the area of 2,81 thousand hectares, a closed drainage network on the area of 7,61 thousand hectares, and a VDW (vertical drainage wells) on the area of 7,6 thousand hectares. The total length of the DNW in the district is equal to 666.6 km, including the inter-farm DNW - 127.7 km, the on-farm network of 538.9 km, including the open-air one of 44.7 km, and closed - 494.2 km.

Photo 12. Condition of the Zafarabad DNW

122. Distribution of the irrigated lands per GWT in Zafarabad district is as follows.

Table 6. Groundwater tables in Zafarabad district

Months	Groundwater levels/area, ha			
	1.0 м or less	1.0 -2.0 м	2.0 -3.0 м	deeper than 3.0 м
March	0.0	444	33131	0.0
August	0.0	386	33189	0.0

123. Distribution of irrigated lands according to the grade of groundwater salinity from 1 to 3 g/l, which in March and in August was observed on the same area of 33,575 hectares. Given below is information on the condition of the inter-farm DNW. As can be concluded based on the table, 55.42 km of the DNW (43.3% of its total length) are in poor condition.

Table 7. Condition of inter-farm DNWs

Description of DNW	Length, km	Condition	
		Satisfactory, km	Poor km
Mainline	9	2.97	6.03
MC right string	5.5	1.05	4.45
MC left string	3.5	1.212	2.288
KZ-1	9.2	4.95	4.25
KZ-11	4.33	3.21	1.12
KZ open 11	2.775	1.1	1.675
VD-1-5-6 open	3.174	1.85	1.324
VD-1-5-6 extended	1.04	1.04	
VD-2 mainline	3.361	2.01	1.351
VD-2 truncated	1.304	1.304	
VD-3-7 open	1.996	0.54	1.456
VD-5-4 closed	3.9	3.01	0.89
VD-5-4 open	2.3	0	2.3
VD-3-8	2.8	1.81	0.99
VD-2-3	1.9	0.9	1
VK-5 open	1.9		1.9
VK-5 closed	4.2	4.2	
VK-9	3.2	0	3.2
VK-10	4.4	0	4.4
VD-7-1	3.4	0	3.4
Eastern collector	13.1	3.213	9.887
Water release from KV-2 (eastern collector)	0.6	0.6	0
DV-1 sai	6	0	6
DV-1a sai	3	1.27	1.73
DV-1	3.539	1.73	1.809
DV-1a	0.83	0.83	0
Water release DV-12	4	4	0
DV-10-9	3.5	3.5	
DV-5-3-0	5.4	5.4	
Total	**104.149**	**48.729**	**55.42**
VD-9	1.7	1.7	0
VK-7-1	2.4	2.4	0
VD-7-3	2.1	2.1	0
VD-5-4	4.5	4.5	0
Storm water overflow VD-3-1	4.605	4.605	0
Water release from KV-2 into KV-1	3.845	3.845	0

VD-1-6-6	4	4	0
2	**3**	**4**	**5**
Water release to SK-2	0.397	0.397	0
Total	**23.547**	**23.547**	**0**
Grand total	**127.696**	**72.276**	**55.42**

Source: State Division of Melioration and Irrigation of Zafarabad region

124. The condition of the on-farm DNW is described below: The length of the on-farm DNW is 538.9 km, of which some are:

- open type - 44.67 km, including those in poor condition - 21.2 km; and
- closed type - 494.2 km, including those in poor condition - 112.0 km.

Unit area of the horizontal drain is 19.85 m/ha.

125. According to the data of the State Agency "Supervision over Land Reclamation Condition and Water Use" for 2018, the laboratory analysis shows that the incoming water salinity in Zafarabad district is 1.18 g/l, and the discharge water had the salinity of 1.4 g/l. The volume of water discharged into the collector during the vegetation period was equal to 57,611 thsd m^3, and with due account of the winter season, 101,066 thsd m^3.

5.2.1. Detailed analysis of operation of Zafarabad pumping stations

126. According to the Zafarabad district SRIA, three out of the 14 pumping stations, including GPS-3, GPS-3a, and KV-1, are completely out of service. The pumping station Pahtakor is not currently operated because of the lack of water in the DNW system. The data relating to the Zafarabad pumping stations are given in Table 9.

127. Out of the total number of 58 pumping units, 42 are operational (72%). In the pumping station GPS-1 for the past 5-6 years, 1 pump unit is broken and no repair work for its rehabilitation is possible in the future. Analysis during the 2021 vegetation period showed that in the pumping station GPS-2, following any routine repair work, after 2-3 days of operation, the units again break down. It means that the pump units can no longer operate with their previous efficiency. Table 8 shows that out of the available power capacity of 215,490 thsd kWh, only 176,450 thsd kWh is used, which is 82%.

Table 8. Usage of power capacity and operation of pumping units at Zafarabad pumping stations

#	Pumping station	Unit of meas.	GPS-1	GPS-2	GPS-4	CPS-1	CPS-2	CPS-3	CPS-4	DVG NS	Lenin abad	40th Anni.	Pahta kor	KV-1	GPS -3	GPS -3A	Total
1	**Total number of pump units**	pcs	6	4	4	5	5	5	4	6	4	5	2	2	4	2	58
	Total capacity	thsd kWh	48000	32000	1280	27200	27200	27200	14000	**12000**	2260	8000	1950	4000	**6400**	4000	215490
2	**Operational pump units**	pcs	5	3	2	5	5	5	4	2	4	5	2	0	0	0	42
	Power capacity	thsd kWh	40000	24000	640	27200	27200	27200	14000	4000	2260	8000	1950	0	0	0	176450
	% of power capacity usage	%	83	75	50	100	100	100	100	33	100	100	100	0	0	0	82

% of units in operation	%	83	75	50	100	100	100	100	33	100	100	100	0	0	0	72	

128. The impeller of the pump is made of cast iron and due to its long service life special welding procedures are carried out to repair and restore it, but according to experts, as a result of the high rpm during the first start-up of the unit, the welded part immediately breaks down.

129. Due to the high wear rate of parts of the engine, the pump, and electrical components, the routine repairs carried out at the beginning of the vegetation period, do not enable stable operation of the units during the vegetation season. At this point, the wear rate of the engine is close to 30-40%, and that of the pump - 40-50%. During the repairs, it is impossible to ensure adequate balancing of the engine, and during the growing season, vibration is a constant concern, as well as overheating of the motor. In 2021 such occurrences were often observed at the GPS-2, which affected the steady supply of water to the TM-2 canal. On the whole, stable operation of the pumps could no longer be ensured at the GPS-2. Thus, the following conclusion can be drawn: it is no longer possible to ensure stable operation of GPS-2 in the future without replacing the pumping units.

Table 9. Specs of Zafarabad pumping stations

#	Description of PS	Unit of meas.	GPS-1	GPS-2	GPS-4	CPS-1	CPS-2	CPS-3	CPS-4	DVGNS	Leninabad	40th Anni. Of Taj.	Pahtakor	KV-1	GPS-3	GPS-3A
1	**Year of commissioning**		1962	1962	1975	1994	1994	1994	1994	1977	1975-1990	1976-1985	1986-2003	1984	1976	1976
2	Location (urban community, village)		Zarafshon	Zarafshon	Ravshan	Zarafshon	Zarafshon	Zarafshon	Zarnisor	Zarafshon	Jami	H. Aliev	Ravshan	Zarafshon	Zarafshon	Zarafshon
3	Water source		village canal	GPS-1	TM-1	village canal	CPS-1	CPS-2	OK-3	village canal	VK-5	MK	collec. VD-3.7	Collector	GPS-2	GPS-2
4	Irrigation area	ha	10366	20264					1455							
5	Substation		Ustuvor	Ustuvor, Celin.	Dusti	Kishovars-1	Kishovars-2	Kishovars-3	Kishovars	Ustuvor	Leninabad	40th Anni. Taj.	Pahtakor	Ustuvor	Ustuvor	Ustuvor
6	Transmission lines with two or one		2	2	1	2	2 and 1 lines for GPS-2	2	1	1	1	1	1	1	1	1
7	Voltage kV	kV	110/10	110/10	36/6	110/10	110/10	110/10	110/10	110/10	36/6	36/6	36/6	110/10	110/10	110/10
8	Electric power meter		DTSD 178	DTSD 178	Mercury-230AR	DTSD 178	DTSD 178	Mercury-230AR	Mercury-230AR	DTSD 178	Mercury-230AR	DSS (X)666	N/A	N/A	N/A	N/A
9	Meter number		44051102 44051103	44051162 44051075 42050308	62293630	44051149 44051150	44051161, 44051114, 42050308.	05560174, 05560214	05560272-11	44051101	25429464	789740				
10	Seal of organization		Power grid, RIA	Power grid, RIA	Power grid	Power grid, RIA	Power grid, RIA	Power grid, RIA	Power grid, RIA	Power grid, RIA	Power grid	Power grid	N/A	N/A	N/A	N/A
11	**Total number of pumping units**	pcs	6	4	4	5	5	5	4	6	4	5	2	2	4	2
	including pump units with power capacity	pcs	6	4	4	3	3	3	2	6	2	5	1	2	4	2
		kW	8000	8000	320	8000	8000	8000	5000	2000	630	1600	1200	2000	1600	2000
	including pump units with power capacity	pcs	0		0	2	2	2	2	0	2	0	1	0	0	0
		kW	0	0	0	1600	1600	1600	2000	0	500	0	750	0	0	0

	Total number of operational pump units	pcs	5	3	2	5	5	5	4	2	4	5	2	0	0	0
	including pump units with power capacity	pcs	5	3	2	3	3	3	2	2	2	5	1	0	0	0
		kW	8000	8000	320	8000	8000	8000	5000	2000	630	1600	1200	0	0	0
12	including pump units with power capacity	pcs	0	0	0	2	2	2	2	0	2	0	1	0	0	0
		kW	0	0	0	1600	1600	1600	2000	0	500	0	750	0	0	0
13	**PS building**															
	satis.		Satis.	Satis.	Satis.	Satis.	Satis.			Satis.	Satis.	Satis.	Satis.	Poor	poor	poor
	good							good	good							
	requires rehabilitation		rehab.	Rehab.	Rehab.	Rehab.	Rehab.			Rehab.	Rehab.	Rehab.	Rehab.	Rehab.	Rehab.	Rehab.

Source: State Division of Melioration and Irrigation of Zafarabad region


Photo 13. Pumping stations GPS-3 (left) and GPS-3a (right), not operational


Photo 14. Substation of pumping stations GPS-3 and GPS-3a (left) and flooded GPS-3 (right)


Photo 15. Out-of-service pump units of PS KV-1 (left) and Pahtakor (right)


Photo 16. Out-of-service pump units of GPS-1 (left) and GPS-2 (right)

130. Down below, Table 10 shows data on power usage, costs of electric power, cost of pumped water, electricity supply charge rates, and specific power requirement per pumping stations and VDW in Zafarabad district for 2016-2020.

Table 10. Data on electric power usage, cost of electric power and water pumping for 2016-2020 (Zafarabad district)

Years	Total cost of electric power, TJS ,000	Total electric power used, thsd kWh,	Including by pumping stations			Specific requirement in kWh per m^3 of water	Including VDW				Spec. norm, kWh per 1 m^3 of water	Power charge rate
			Electric power used, thsd kWh,	Cost, TJS ,000	Water pumped, thsd m^3		Number of pcs	Electric power used, thsd kWh	Cost, TJS ,000	Water pumped, thsd m^3		
2016	8012.8	314227.9	311106.9	7933	873853	0.356	76	3121	79.6	4565.1	0.684	2.55
2017	16833.0	287252.6	283525.6	16615	806652	0.351	76	3727	218.4	6960.7	0.535	5.86
2018	22709.2	337431.7	334035.7	22481	994683	0.336	76	3396	228.6	5130.5	0.662	6.73
2019	21149.8	268739.2	264273.2	20798	765987	0.345	76	4466	351.5	9436.2	0.473	7.87
2020	20399.3	259203.7	253367.7	19940	719586	0.352	76	5836	459.3	11494.7	0.508	7.87

Source: State Division of Melioration and Irrigation of Zafarabad region

131. The Table shows that electricity was used in 2016 in the amount of 314,227.9 thousand kWh, and in 2020 its usage was equal to 259,203.7 thousand kWh, which is a reduction by 55,024.2 thousand kWh.

132. The cost of electricity used in 2016 was TJS 8,012.8 thousand, and in 2020 the cost was equal to TJS 20,399.3 thousand, up by TJS 12,386.5 thousand. The electricity charge rate in 2016 was 2.55 dirams per 1 kWh, and by 2020 it had risen to 7.87 dirams per 1 kWh.

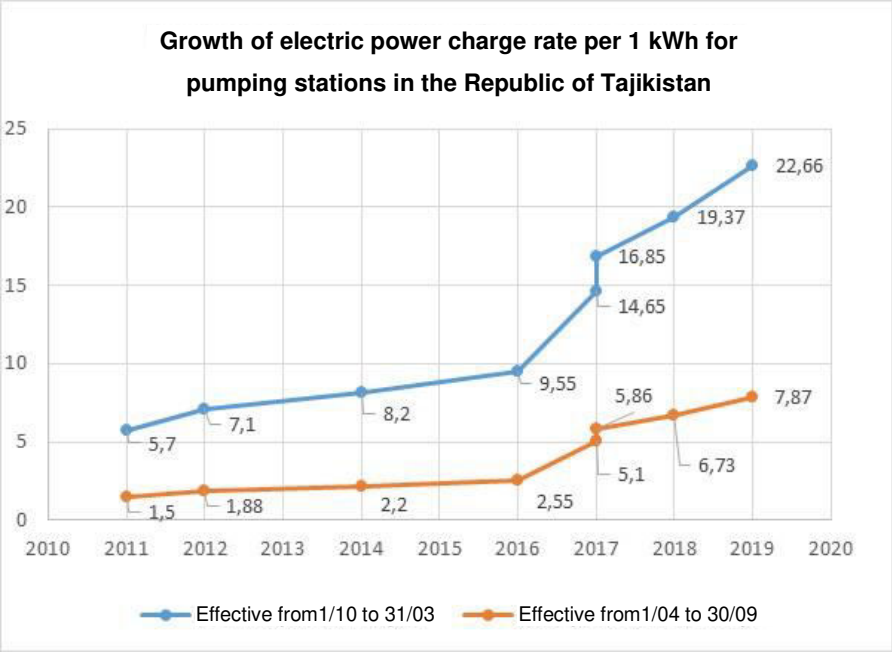


Figure 389. Growth of charge rates for electric power per 1 kWh for pumping stations in the Republic of Tajikistan[24]

[24] Data of RIA

133. It may be concluded that the cost of electricity increases on an annual basis, which affects the socio-economic status of the Zafarabad Reclamation and Irrigation Department. Table 11 provides data on pumping of water, power usage, costs of electric power for the pumping stations of the Zafarabad district for 2020.

Table 11. Data on water pumping, power usage, costs of electric power for the pumping stations of the Zafarabad district for 2020

#	Pumping station	Water pumping	Electric power usage	Cost of electricity	Specific power requirement	Electric power for VDW	Cost of electricity	Total power usage	Total cost of electricity	Electricity charge rate
		thsd m^3	thsd kWh	TJS ,000	kWh per m^3 of water	thsd kWh	TJS ,000	thsd kWh	TJS ,000	1 kWh
1	GPS-1	257577	91131	7172	0.354			91131	7172	7.87
2	GPS-2	139623.3	50078.0	3941	0.359			50078	3941	7.87
3	GPS-3			0				0	0	7.87
4	GPS-3a			0				0	0	7.87
5	DVGNS	3081.6	1050.7	83	0.341			1051	83	7.87
6	KV-1			0				0	0	7.87
	Total	400282	142260	11196	0.355			142260	11196	7.87
7	CPS-1	98891.6	38452.2	3026.2	0.389			38452	3026.2	7.87
8	CPS-2	97405.6	35413.8	2787.1	0.364			35414	2787.1	7.87
9	CPS-3	88181.4	27865.2	2193.0	0.316			27865	2193.0	7.87
10	CPS-4	22063.9	6957.0	547.5	0.315			6957	547.5	7.87
	Total	306542	108688	8554	0.355			108688	8554	7.87
	VDW	11494.7		0.0	0.000	5836.0	459.3	5836	459.3	7.87
11	Leninabad	8354.4	1138.8	89.6	0.136			1139	89.6	7.87
12	40th Anniversary of Tajikistan	4348.3	1270.0	99.9	0.292			1270	99.9	7.87
13	Pahtakor			0.0				0	0.0	7.87
14	GPS-4	59.6	10.8	0.8	0.181			11	0.8	7.87
	Total	12762.2	2419.6	190.4	0.190			2420	190.4	7.87
	Grand total	731081	253368	19940	0.347	5836	459	259204	20399	7.87

Source: State Division of Melioration and Irrigation of Zafarabad region

134. It should be emphasized that due to the deterioration of canals and pumping stations, land reclamation condition is degrading, and it has an important impact on the growth rate of agricultural production and employment in the agricultural sector.

135. The pumping station "Leninabad" with 4 units, the pumping station "40th Anniversary of Tajikistan" with 5 units, the pumping station "Pahtakor" with 2 units, the pumping station "GPS-4" with 4 units were built and put into operation in the early 1970s. Their service life has expired, and currently, they are completely worn down.

136. First of all, it is imperative to strengthen the material base of the pumping stations. Also make a plan for step-by-step replacement of worn-out parts of the pumping equipment, high-pressure pipelines, and electrical systems of the stations.

137. The pumping equipment of the large-capacity pumping stations GPS-1, GPS-2, CPS-1, CPS-2, CPS-3 require complete replacement. At the same time, complete rehabilitation is required for the medium- and small-capacity stations DVGNS, GPS-3, GPS-3A, and KV-1, which can provide minimum amounts of water during the shutdown of the GPS pumping stations.

138. Another problem that needs to be solved is the rehabilitation of the irrigation system and restoration of water measuring and hydraulic structures of the canals TM-1, TM-2, and TM-4. Until the early 1990s, all distribution units of the canals TM-1 and TM-2 were operated by means of the automatic control panel. One operator alone, sitting at the central control desk, could distribute all the water across these canals. Today, the system is completely out of service and requires restoration.

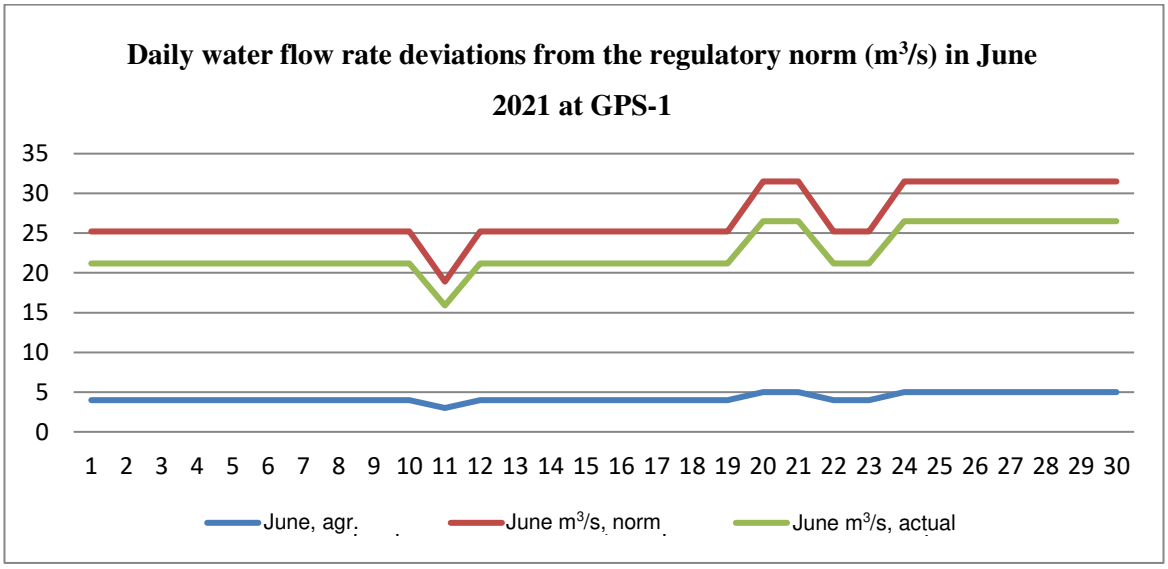
Photo. 17. Dysfunctional automated water distribution control desk on the TM-1 and TM-2 canals of the Zafarabad SRIA.

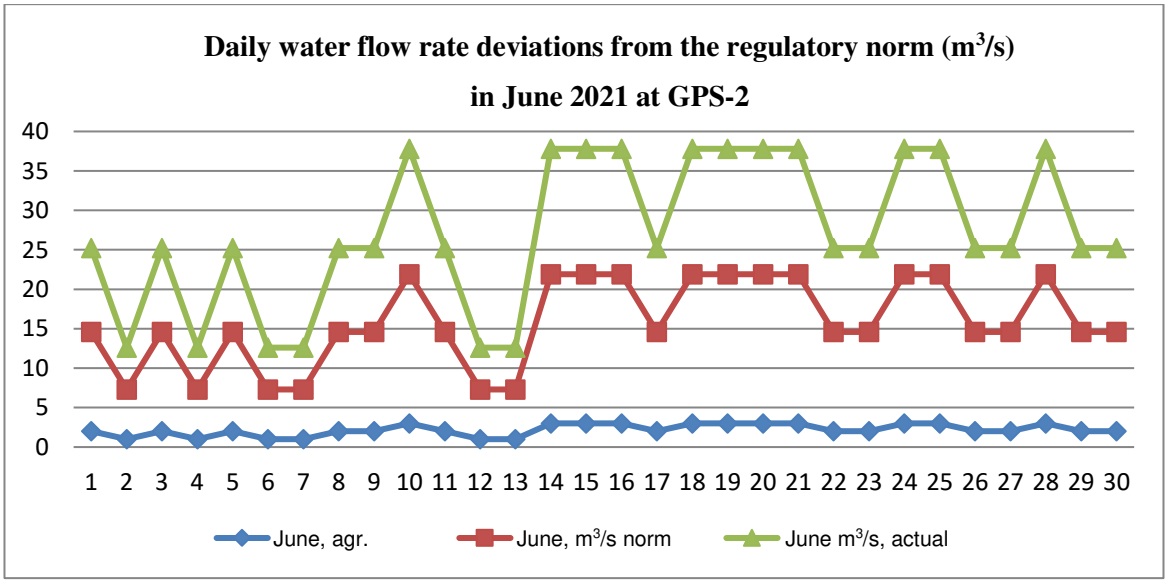
139. One important problem area to tackle is the repair of the key irrigation canals, mainline TM-1, TM-2, and TM-4 canals, their hydraulic engineering structures, as well as water-metering facilities.

Photo. 18. Failure on the TM-2 canal (left) and blowout in the GPS-1 pressure pipeline.

5.2.2. Daily water intake and delivery rate in the Zafarabad district and deviations from the limit.

140. Due to the long-term operation of the pumping units, they are worn out, as well as the electric motors. According to the specifications, the delivery rate of one pump unit is 6.3 m^3/s. According to the Zafarabad district SRIA, in recent years, the performance of the pumping units has decreased to 5.3m^3/s, with a daily deviation per unit equal to 1.0 m^3/s. As a result, the under-supply of water per day is 86.4 thousand cubic meters, for one month - 2,592.0 thousand cubic meters. Overall, during the growing season (6 months), it amounts to 15,552.0 thsd cubic meters. At the GPS-1, with 5 units running during the growing season, the under-delivery of water constitutes 77,760,0 thsd cubic meters, and at the GPS-2 with 3 units operating during the same period, the under-delivery of water equals 46,656,0 thsd cubic meters. The diagrams below show that the performance of the pumping stations GPS-1 and GPS-2 in June and July was not stable, with large fluctuations, especially apparent at the pumping station GPS-2.





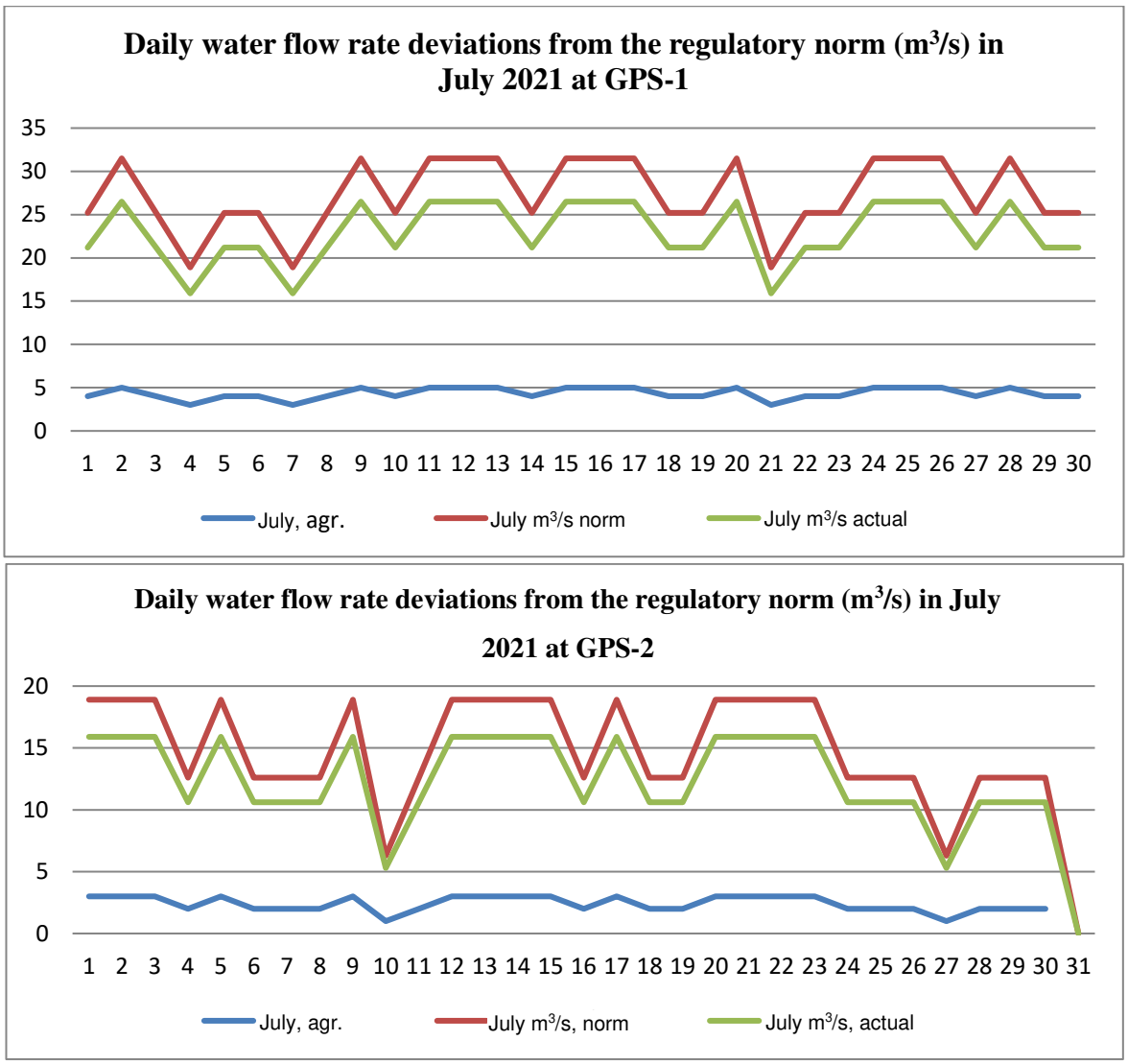


Figure 20. Daily water flow deviations in June and July 2021 at pumping stations GPS-1 and GPS-2[25]

5.2.3. Analysis of maximum and actual water intake by pumping stations and daily deviations from the limits in 2016-2020.

141. The source of water intake for the GPS and CPS pumping stations in Zafarabad district is provided by the diversion canal of the Farhad HPP on the Syr Darya River. Annually, water intake quotas are allocated for the Zafarobod district from the total water intake limits of the Republic of Tajikistan. The water intake limit, established for the Zafarabad district, is equal to 502.6 mln cubic meters. Given below are the data on the actual water intake amounts for the pumping stations.

[25] Source: State Division of Melioration and Irrigation of Zafarabad district

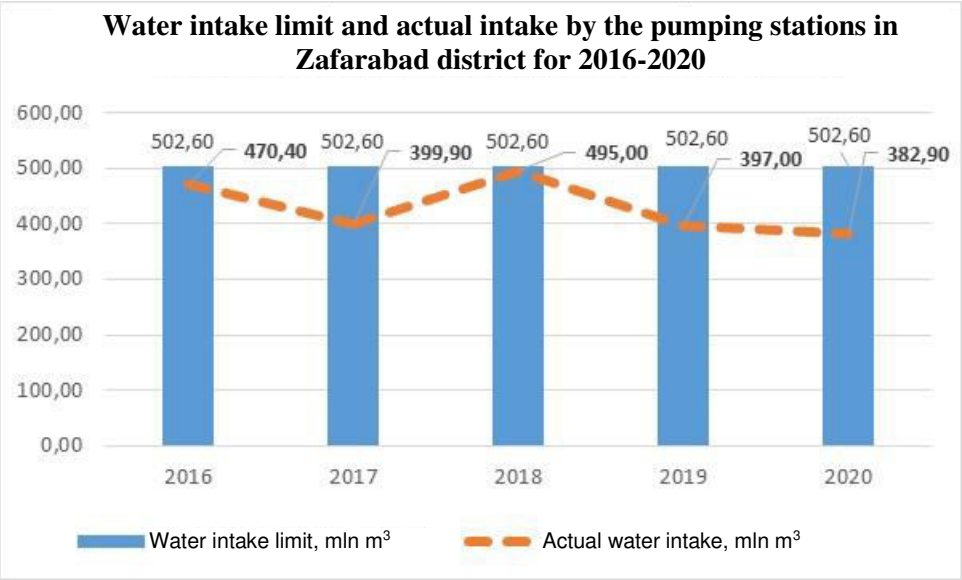


Figure 21. Water intake limit and actual intake by the pumping stations in Zafarabad district for 2016-2020[26]

142. Thus, daily deviations from the limit are as follows: in 2020 from 4m^3/s to 15m^3/s, in 2019 from 1m^3/s to 20m^3/s, in 2018 from 1m^3/s to 10m^3/s, in 2017 from 1m^3/s to 25 m^3/s, and in 2016 from 1m^3/s to 15,6 m^3/s.

143. The analysis demonstrates that the annual reductions in the actual water intake by the pumping stations in the district are associated with frequent breakdowns of pumping units and electric motors at the pumping stations GPS-1, CPS-1, etc.

144. The table below gives the analysis of maximum and actual water intake in the Zafarabad district and daily deviations from the limits for 2016-2020.

[26] Division of Melioration and Irrigation of Sughd region

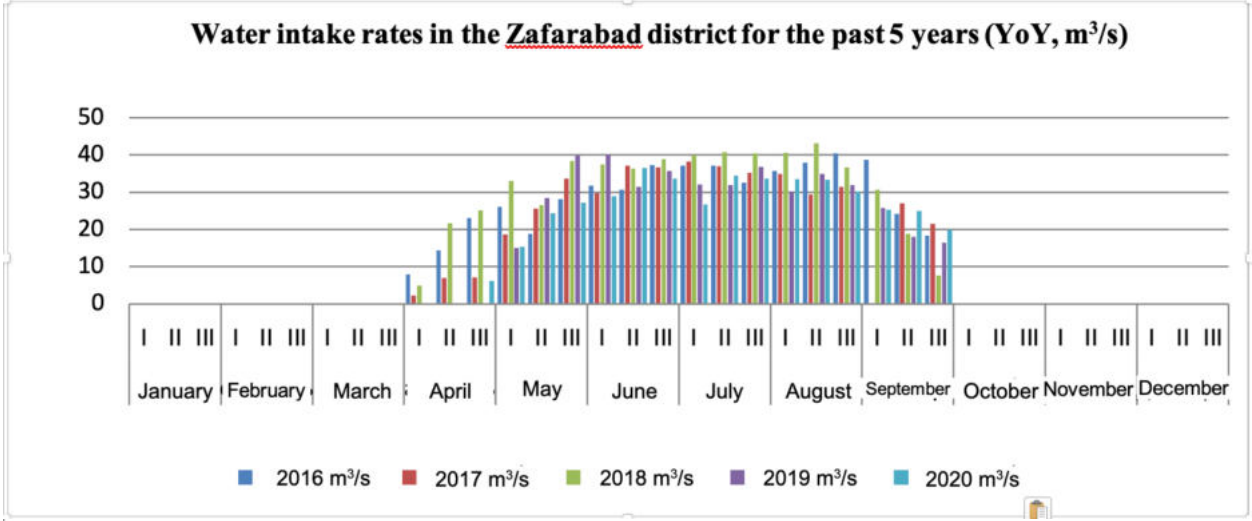
Table 12. Analysis of maximum and actual water intake and daily deviations from the limits in 2016-2020

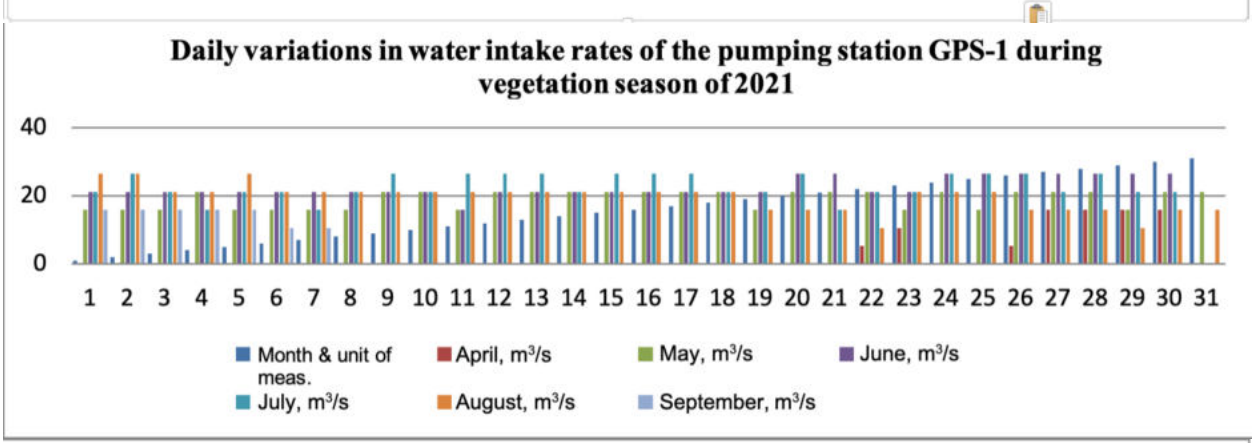
Description	Unit of meas.	April			May			June			July			August			September		
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
2020																			
Limit (max.)	m^3/s	0.0	30.0	35.0	35.0	35.0	35.0	38.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	33.0	25.0	10.0	15.0
	t/m^3	0	25920	30240	30240	30240	33264	32832	34560	34560	34560	34560	38016	34560	34560	31363	21600	8640	12960
Incremental	t/m^3	0	25920	56160	86400	116640	149904	182736	217296	251856	286416	320976	358992	393552	428112	459475	481075	489715	502675
Actual	m^3/s	0.0	0.0	6.2	15.3	24.3	27.2	28.9	36.4	33.7	26.8	34.5	33.6	33.6	33.4	30.1	25.3	24.9	20.0
	t/m^3	0	0	5340	13211	20995	25894	24970	31484	29074	23129	29843	31933	28996	28823	28624	21859	21540	17271
Incremental	t/m^3	0	0	5340	18550	39545	65439	90409	121893	150967	174096	203939	235872	264868	293691	322315	344174	365714	382985
Daily deviation	m^3/s	0.0	-30.0	-29	-20	-11	-8	-9	-4	-6	-13	-5	-6	-6	-7	-3	0	15	5
	t/m^3	0	#####	-24900	-17029	-9245	-7370	-7862	-3076	-5486	-11431	-4717	-6082.6	-5564	-5737	-2738.88	259.2	12900	4311.4
Incremental	t/m^3	0	#####	-50820	-67850	-77095	-84465	-92327	-95403	-1E+05	-1E+05	-1E+05	-123120	######	-134421	-137160	######	-124001	-119690
2019																			
Limit (max.)	m^3/s	0.0	30.0	35.0	35.0	35.0	35.0	38.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	33.0	25.0	10.0	15.0
	t/m^3	0	25920	30240	30240	30240	33264	32832	34560	34560	34560	34560	38016	34560	34560	31363	21600	8640	12960
Incremental	t/m^3	0	25920	56160	86400	116640	149904	182736	217296	251856	286416	320976	358992	393552	428112	459475	481075	489715	502675
Actual	m^3/s	0.0	0.0	0.0	15.0	28.4	39.9	40.1	31.5	35.7	32.1	31.9	36.8	30.2	35.0	32.0	25.7	18.0	16.4
	t/m^3	0	0	0	12995	24520	37921	34672	27242	30810	27700	27544	34975	26101	30240	30421	22239	15517	14152
Incremental	t/m^3	0	0	0	12995	37515	75436	110108	137350	168160	195860	223404	258379	284481	314721	345142	367381	382899	397051
Daily deviation	m^3/s	0.0	-30.0	-35	-20	-7	5	2	-8	-4	-8	-8	-3	-10	-5	-1	1	8	1
	t/m^3	0	#####	-30240	-17245	-5720	4657	1840.3	-7318	-3750	-6860	-7016	-3041.3	-8459	-4320	-941.76	639.36	6877.4	1192.3
Incremental	t/m^3	0		-56160	-73405	-79125	-74468	-72628	-79946	-83696	-90556	-97572	-100613	######	-113391	-114333	######	-106816	-105624
2018																			
Limit (max.)	m^3/s	0.0	30.0	35.0	35.0	35.0	35.0	38.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	33.0	25.0	10.0	15.0
	t/m^3	0	25920	30240	30240	30240	33264	32832	34560	34560	34560	34560	38016	34560	34560	31363	21600	8640	12960
Incremental	t/m^3	0	25920	56160	86400	116640	149904	182736	217296	251856	286416	320976	358992	393552	428112	459475	481075	489715	502675
Actual	m^3/s	5.0	21.6	25.2	33.0	26.5	38.4	37.5	36.4	38.9	40.0	40.8	40.5	40.7	43.1	36.7	30.7	18.9	7.6

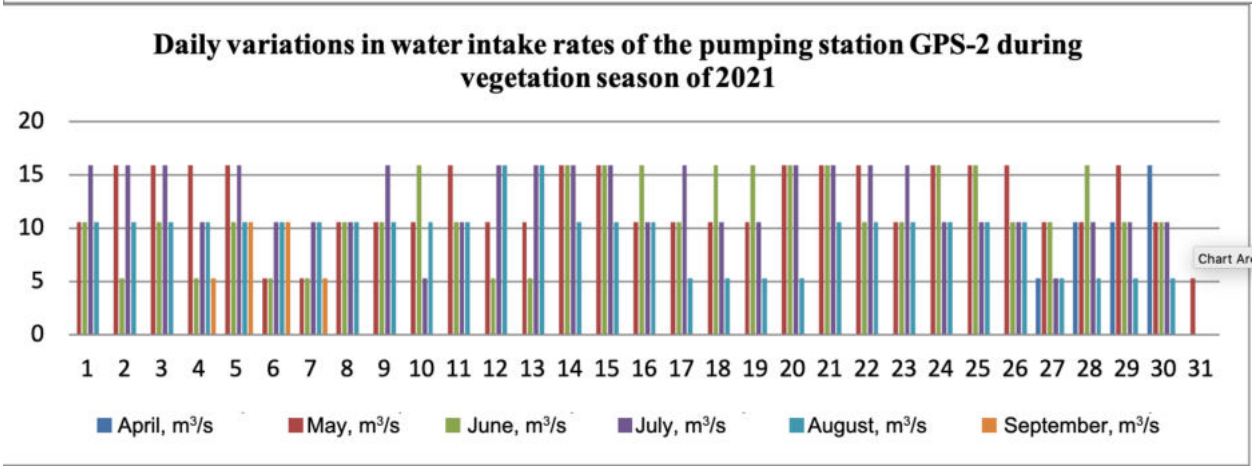
	t/m³	4303	18680	21730	28486	22905	36461	32409	31476	33584	34595	35254	38483	35148	37255.7	34880	26490	16295	6592
Incremental	t/m³	4303	22982	44712	73198	96103	132564	164972	196448	230031	264626	299880	338362	373510	410765	445645	472135	488430	495023
Daily deviation	m³/s	5.0	-8.4	-10	-2	-8	3	0	-4	-1	0	1	0	1	3	4	6	9	-7
	t/m³	4303	-7240	-8510.4	-1753.9	-7335	3196.8	-423.4	-3084	-976.3	34.56	693.79	466.56	587.52	2695.68	3516.48	4890.2	7655	-6367.7
Incremental	t/m³	4303	-2938	-11448	-13202	-20537	-17340	-17764	-20848	-21825	-21790	-21096	-20630	-20042	-17347	-13830	-8940	-1284.8	-7652.4
2017																			
Limit (max.)	m³/s	0.0	30.0	35.0	35.0	35.0	35.0	38.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	33.0	25.0	10.0	15.0
	t/m³	0	25920	30240	30240	30240	33264	32832	34560	34560	34560	34560	38016	34560	34560	31363	21600	8640	12960
Incremental	t/m³	0	25920	56160	86400	116640	149904	182736	217296	251856	286416	320976	358992	393552	428112	459475	481075	489715	502675
Actual	m³/s	2.2	6.9	7.1	18.7	25.6	33.7	29.8	37.2	36.7	38.3	37.0	35.2	35.0	29.3	31.5	0.0	27.1	21.4
	t/m³	1866	5953	6160	16157	22153	31985	25747	32124	31735	33083	31968	33497	30249	25349.8	29955	0	23388	18524
Incremental	t/m³	1866	7819	13980	30136	52289	84275	110022	142145	173880	206963	238931	272428	302676	328026	357981	357981	381370	399894
Daily deviation	m³/s	2.2	-23.1	-28	-16	-9	-1	-8	-3	-3	-2	-3	-5	-5	-11	-1	-25	17	6
	t/m³	1866	#####	-24080	-14083	-8087	-1279	-7085	-2436	-2825	-1477	-2592	-4518.7	-4311	-9210.2	-1408.32	-21600	14748	5564.2
Incremental	t/m³	1866		-42180	-56264	-64351	-65629	-72714	-75151	-77976	-79453	-82045	-86564	-90876	-100086	-101494	######	-108346	-102781
2016																			
Limit (max.)	m³/s	0.0	30.0	35.0	35.0	35.0	35.0	38.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	33.0	25.0	10.0	15.0
	t/m³	0	25920	30240	30240	30240	33264	32832	34560	34560	34560	34560	38016	34560	34560	31363	21600	8640	12960
Incremental	t/m³	0	25920	56160	86400	116640	149904	182736	217296	251856	286416	320976	358992	393552	428112	459475	481075	489715	502675
Actual	m³/s	7.9	14.4	23.0	26.1	18.9	29.3	33.1	32.0	38.9	38.4	38.8	33.9	36.8	38.9	41.1	39.3	24.4	18.9
	t/m³	6808	12459	19898	22585	16286	27812	28564	27665	33584	33178	33515	32236	31821	33566.4	39096	33947	21090	16314
Incremental	t/m³	6808	19267	39165	61750	78036	105849	134412	162078	195661	228839	262354	294589	326411	359977	399073	433020	454110	470424
Daily deviation	m³/s	7.9	-15.6	-12	-9	-16	-6	-5	-8	-1	-2	-1	-6	-3	-1	8	14	14	4
	t/m³	6808	#####	-10342	-7655	-13954	-5452	-4268	-6895	-976.3	-1382	-1045	-5780.2	-2739	-993.6	7732.8	12347	12450	3354
Incremental	t/m³	6808	-6653	-16995	-24650	-38604	-44055	-48324	-55218	-56195	-57577	-58622	-64403	-67141	-68135	-60402.2	-48056	-35605	-32251

Source: State Division of Melioration and Irrigation of Zafarabad region

145. The diagrams below show daily variations in volumes of water intake by pumping stations in Zafarabad district for the past 5 years (2016 - 2020), including by pumping stations GPS-1 and GPS-2 for the growing periods of 2020 and 2021.







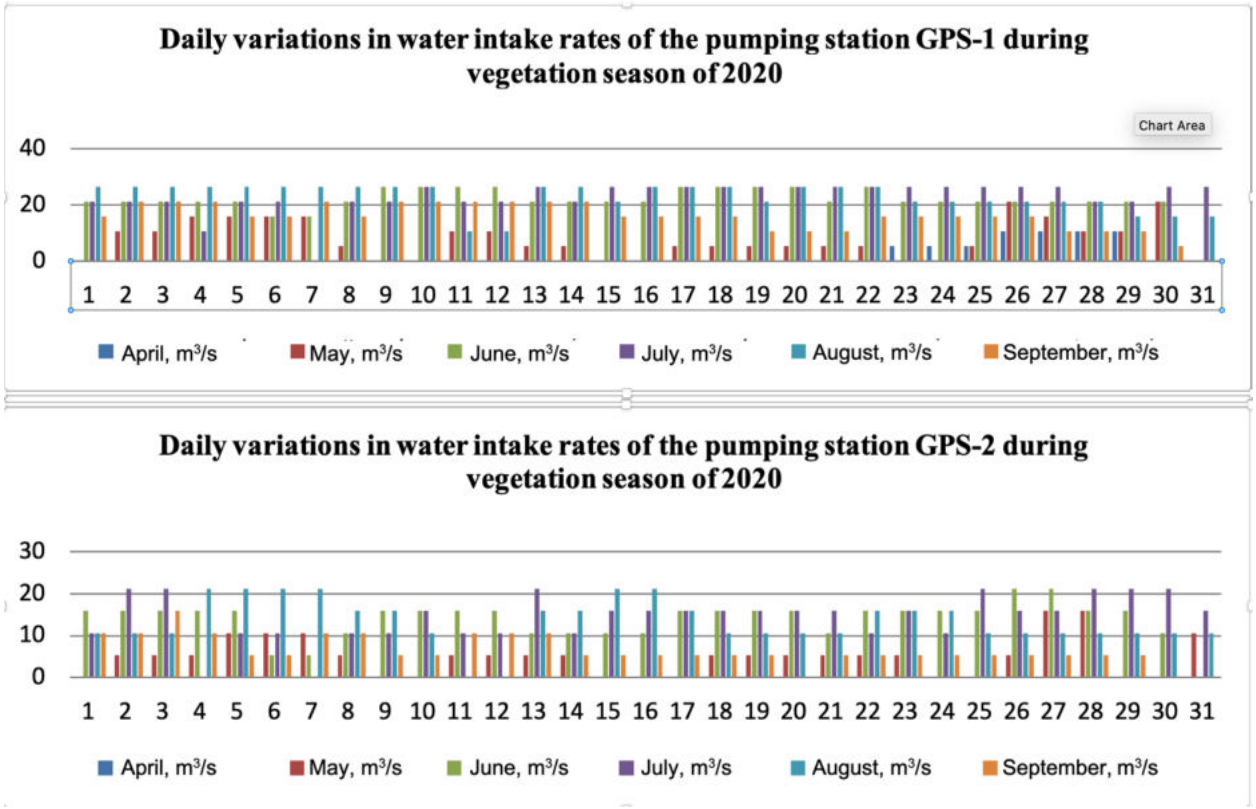


Figure 22. Water withdrawal over the past 5 years, 2016-2020 and daily fluctuations in the water intake of the pumping station GNS-1 and GNS-2 for the growing season of 2020 and 2021[27]

146. To determine the exact location of the HES in the Zafarabad district, the reference points were fixed for the pumping stations and water release outlets of the canals TM-1, TM-2 and TM-4, as well as other HESs on these canals by means of the Global Positioning System. Also, the fixation was performed to locate the point of the outlets to determine the catchment area boundaries of the WUA.

147. Since the number of dehqan (private) farms is growing in the district, and for equitable distribution of water among the water users, during 2004-2005, 37 WUAs were established in the district with a catchment area of 29.4 thousand ha, or 92% of the total irrigated lands. Based on these records, a map of the pumping stations and irrigation system was drawn up covering the catchment area of the WUAs in Zafarabad district displaying the above-mentioned canals.

[27] State Division of Melioration and Irrigation of Zafarabad region

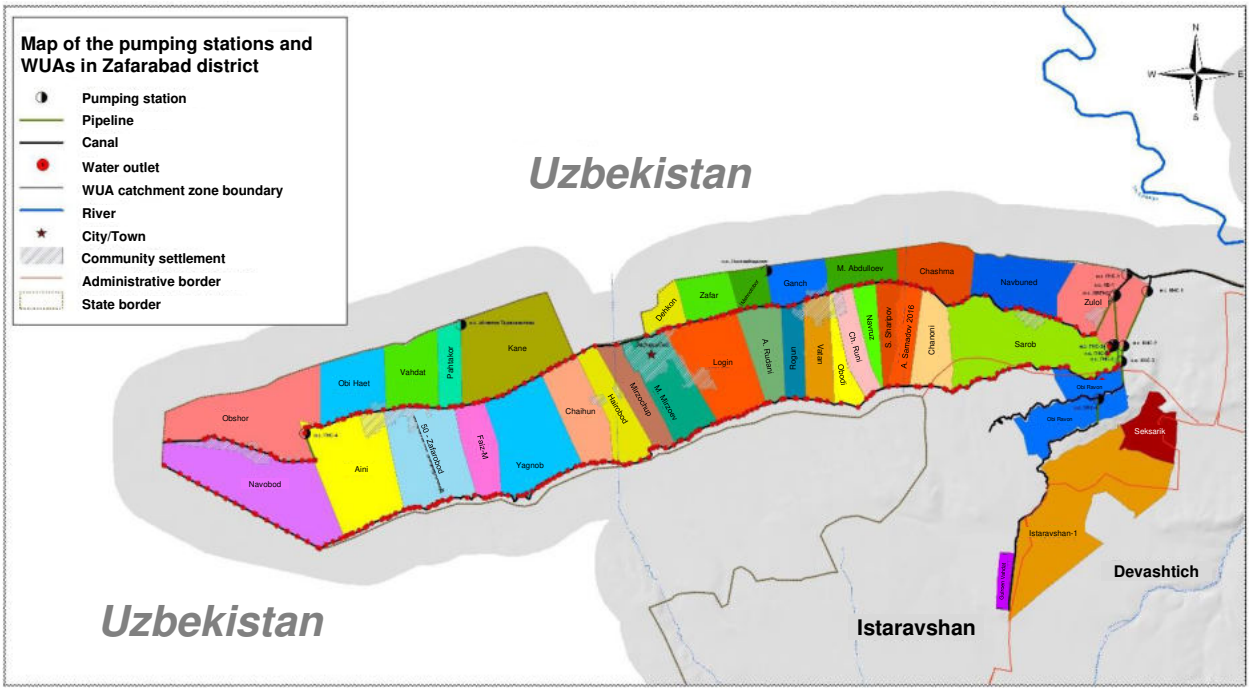


Figure 23. GIS map of the Zafarabad irrigation system and the WUA catchment area

148. Based on the findings of information-gathering on the WUA boundaries, the following steps were made:

- All the reference points were exported to ArcGIS;
- A separate WUA layer was created;
- WUA catchment area was estimated and all attribute tables were compiled per WUA-related methodologies of the World Bank.

149. The experts involved in the study were supported by the staff of the WUA Support Unit of the Zafarabad SRIA, who organized working meetings with representatives of the WUA. As a result of such meetings, the WUA representatives were able to promptly provide all the prerequisites for the collection of data on the WUA's boundaries.

150. The activities were carried out in the field, and the boundaries were picked up using a GPS receiver. The reference points were gathered and compared with the Google Earth Pro satellite images. Next, each area was imported into ArcGIS for configuration and filling in the attribute tables.

Table 13. WUAs of Zafarabad irrigation system

Zafarabad irrigation system		
1. WUA Zulol	14. WUA Sarob	27. WUA Hairobod
2. WUA Navbuned	15. WUA Chavoni	28. WUA Chaihun
3. WUA Chashma 2016	16. WUA A. Samadov	29. WUA Yagnob
4. WUA M. Abdulloev	17. WUA S. Sharipov	30. WUA Faiz
5. WUA Ganch 2016	18. WUA Navruz	31. WUA 50 years of ZAfarobod
6. WUA Mehnatobod 2018	19. WUA Ch. Rumi	32. WUA Ayni
7. WUA Zafar	20. WUA Obodi	33. WUA Navobod
8. WUA Dehqon 2014	21. WUA Vatan	34. WUA Istaravshan -1
9. WUA Kanz	22. WUA Rogun	35. WUA Seksari
10. WUA Pahtakor	23. WUA A. Rudaki	36. WUA Obi Dier
11. WUA Vahdat	24. WUA Login	37. WUA Gulrezi Vahdat
12. WUA Obi Haet	25. WUA M. Mirzoev TM-2	
13. WUA Obshor	26. WUA Mirzochul	

151. In total, 37 WUAs provide services to dehqan farms in the irrigation system of the Zafarabad district, 33 of which are located in the Zafarabad district.

152. In addition, the Zafarabad SRIA, apart from supporting WUAs, located within its own administrative jurisdiction, also provides services to several WUAs situated in the city of Istaravshan and in the Devashtich district. The below WUAs are geographically accessible for irrigation from the pumping stations CPS-3 and CPS-4. They are:

1. WUA Urateppa-1 (Istaravshan-1) - 560 hectares
2. WUA Seksary - 700 hectares
3. WUA Obi-Dier - 195 hectares
4. Gulrezi Vahdat village

153. Overall, the WUA catchment area for the Zafarabad cascade pumping stations covers 32,085 hectares, including the Zafarabad district (30,630 hectares), Istaravshan (755 hectares) and Devashtich district (700 hectares).

154. It should be pointed out that, compared to other districts of the Sughd region, Zafarabad has the highest concentration of WUAs in the Syr Darya River basin. The catchment areas of some of them range from 150-170 hectares to 2,000 hectares. At the moment, discussions are underway among SRIAs, Jamoats, and WUAs about the proposed expansion of the WUAs with a catchment area of at least 5,000 hectares.

155. Numerous WUAs concentrated in one district create constraints for water distribution along the main canals TM-1 and TM-2. For example, the canals TM-1 and TM-2 have a total of 251 outlets. Among them, 130 water outlets were identified on the TM-1 canal, including 52 additional outlets. And on the canal TM-2, 121 water outlets were found, including 28 subsidiary outlets. That means that the additional outlets were built in breach of the design plan for the construction of the canal. Furthermore, the canal TM-4 has 16 water outlets.

156. The additional outlets adversely impact on the water passage down to the tail of the TM-1 and TM-2 canals. Water availability in the tail reach of the canals is within just 10-20%, whereas in their heads it is 120-130%.

Photo. 19. The tail portion of the TM-2 canal and lands, excluded from agricultural production processes in the jamoat Ravshan of the Zafarabad district (photo, July 2021).

157. As a result, uneven distribution of water along the canal is observed, especially for those WUAs that are located in the tail area of the canal, and which suffer from acute shortage of water, causing exclusion of the irrigated land from the agricultural sector.

158. The current situation has forced the dehqan farms located in the tail part of the canal, to engage in the drilling of private vertical drainage wells. In total, more than 400 private vertical drainage wells have been drilled in this area of the jamoat Ravshan.

Photo. 20. Drilling of wells in the jamoat Ravshan in July 2021 and one previously drilled well.

159. On the one hand, the drilling of new vertical drainage wells by farmers has led to the depletion of groundwater reserves. It results in reduced groundwater tables and shrinking well flow rates with every coming year, given the absence of adequate groundwater inflows, which leads to the drying up of some wells. On the other hand, without any proper post-drilling geologic surveys, some farmers fail to hit the underground aquifers and incur unanticipated costs. The costs related to such drilling operations range from US$ 20,000 to US$ 25,000.

160. To address this issue, restoration of the automatic distribution system is needed on the TM-1 and TM-2 canals to rule out any human error-related impacts resulting from unauthorized water intake, and to ensure reliable water distribution from the head to the tail reaches of the canals.

161. Annex 3 provides the names of the water outlets on the catchment area of the WUA per jamoats in the district and by the canals TM-1 and TM-2.

7. Analysis of economics, charge rates and subsidies

7.1. Policy for water supply from source to farmers

162. Irrigation crop farming is the key consumer of water resources in the Syr Darya River basin, which is due to the large irrigated land area and specific climate conditions of the Fergana Valley. Irrigation management in the Tajik part of the Syr Darya River basin is the responsibility of the SDRI, which operates via the SRIA and the Zarafshan River sub-basin organization.

163. In Sughd province, the SDRI comprises 11 SRIAs and one Department of Land Reclamation and Irrigation for the Zarafshan River sub-basin, to deliver water to agricultural farms and other water users. According to the RIA, the country has 762,198 hectares of irrigated land, including 547,458 hectares on which RIA can be contracted for water delivery services.

164. For the Sughd region, these parameters are 293,439 hectares, or 38.4% of the total irrigated area in the country, and 205,365 hectares, or 37.5% of the total irrigated area in the Sughd region, including for the Zafarabad district 35251 hectares or 12% of total irrigated area of the Sughd region, and 32,100 hectares or 15.6% of the total catchment area of the SDRI.

165. The irrigation infrastructure facilities and water outlets were built and put into operation in 1930-1980, and 50% of them are already obsolete. The hydrology of the Tajik portion of the Syr Darya River basin is very complex, including because of the overabundant irrigation networks, built during the Soviet Union. The erection of large-scale irrigation systems and reservoirs has significantly altered its hydrological profile, by changing river runoffs and by connecting several sub-basins in their downstream zones.

166. Water intake from natural sources is carried out in accordance with the Permit for Use of Water, which is issued by the Committee on Environmental Protection of the Government of the Republic of Tajikistan for a term of 3 to 25 years.

167. Water is distributed mainly by open-air canals of different levels: mainline, inter-farm, on-farm. Irrigation water supply to WUAs and dehqan and other farms, where no WUAs have yet been established, is mainly provided by the Zarafshan SRIA and the sub-basin organization. They are primarily in charge of the mainline and inter-farm canals. The on-farm canals are basically controlled by the WUAs.

168. The SRIAs ensure water supply to the consumers on the basis of the duly approved water use plan. SRIAs draw water from the sources to supply it to the inter-farm irrigation systems, which are on their books, and deliver water to the WUA catchment area boundary for the on-farm canals. WUAs in turn distribute water among their members within relevant catchment zones.

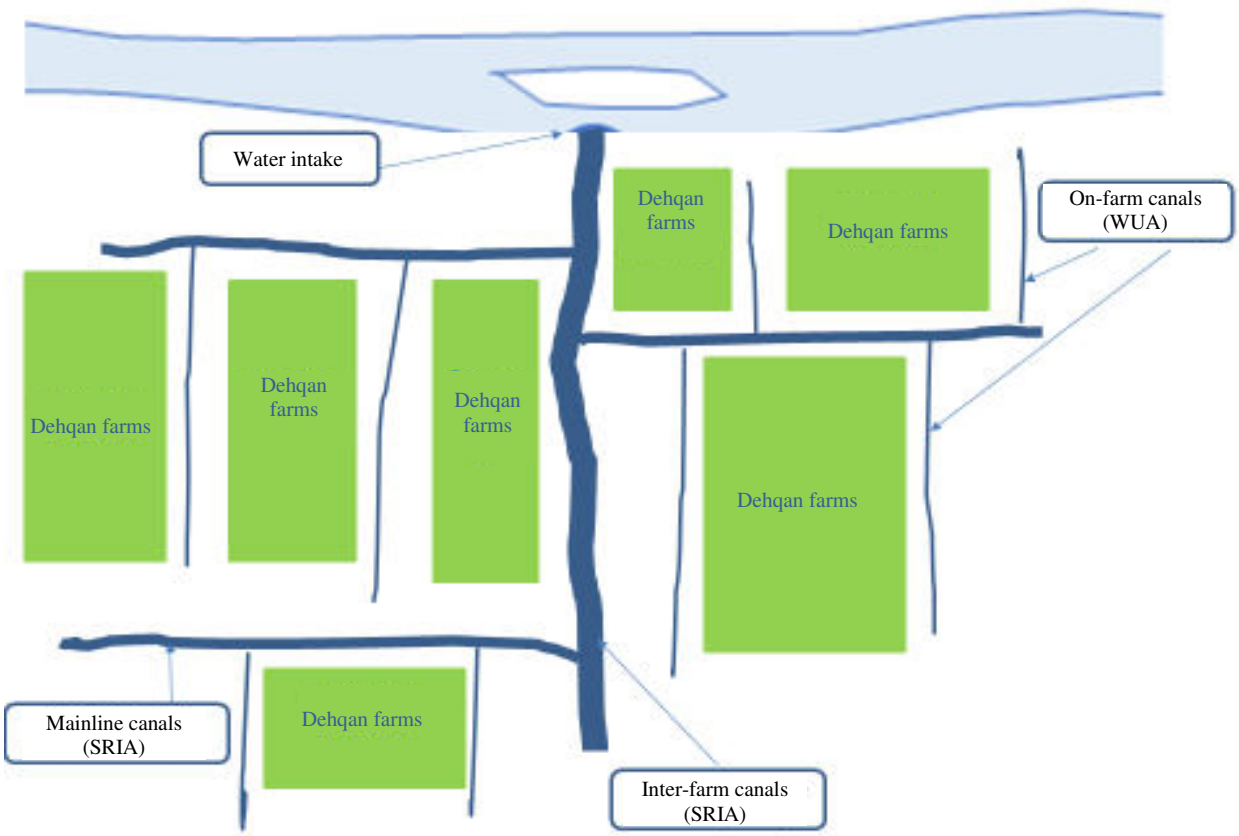


Figure 404. Water distribution by SRIA and WUA

7.2. Charge rate for irrigation water supply

169. With a view to ensuring sustainable maintenance and operation of land reclamation and irrigation facilities in the WUA system, pursuant to the Resolution of the Government of the Republic of Tajikistan # 281 of 25 June 1996, charges were introduced for the use of water supplied from the state-owned irrigation and watering systems.

170. However, from the very first year of its introduction, the system of fee-based services of water delivery to water consumers triggered some problems related to the collection of payments for water supply services. Annual collection of payments, at the current water supply charge rates, is only 8-10% of the basic maintenance requirements for the system, and it only covers a small portion of the maintenance costs of the irrigation networks.

171. A flat charge rate has been set for services of water supply for irrigation by gravity and by pumping stations at 2.0 dirams per 1 cubic meter of water, including VAT. For zones where water meters are not installed, or where it is not possible to install them, the volumetric method is used for the measurement of irrigation water consumption by agricultural crops per 1 ha based on the relevant norms of water consumption by agricultural crops.

172. This tariff was established on the basis of the Order of the Antimonopoly Service under the Government of the Republic of Tajikistan dated May 30, 2018, No. 62, “On Amendments to the Order of the Antimonopoly Service under the Government of the Republic of Tajikistan dated April 23, 2018, No. 50 “On Approval of Tariffs for Water Supply and irrigation from irrigation systems” per 1 m3 of water in the amount of 2.0 diram, including VAT.

Table 14. Averaged irrigation rates established for agricultural crops

Agricultural crops	Irrigation rate, m^3/ha	Price in TJS, including VAT
Cotton	10000	200
Winter wheat	2200	44
Dredge corn, 1st harvest	9000	180
Dredge corn, 2nd harvest	7800	156
Green corn, 2nd harvest	3500	70
Rice	37000	740
Vegetables	12000	240
Alfalfa	12500	250
Gardens	9500	190
Potatoes	6500	130
Melons and gourds	5000	100
Tobacco, citrus fruits and feed crops	5500	110

173. The current charge rates payable by agricultural producers for water supply services do not fully cover the costs of RIA. It should be mentioned that from 2008 until May 2018, despite the RIA's proposals to increase the charges for water supply services, the rates remained unchanged.

174. Meanwhile, higher charges for water supply services are commercially unsustainable, because they could push up the price of agricultural products, weaken the competitiveness of domestic products on the domestic market and undermine the standards of living.

175. The principle of maintaining low charge rates systematically leads to increased debts and credits, including arrears of the RIA to OJSHC "Barki Tojik" in payments for electricity and to the Tax Committee of the Government of the Republic of Tajikistan in payments for VAT and contributions to the Social Security Fund.

176. Thus, the charge rate for water supply services since 2008 has been increased, inclusive of VAT, by only 13%.

7.3. Charge rate for electric power used by the pumping stations

177. In order to improve the situation in the energy sector, the relevant ministries were requested to develop, in accordance with international best practices, a new draft electricity pricing policy aimed at eliminating cross-subsidies among consumers and submit it for approval to the Government of the Republic of Tajikistan. Consider that the proposed new electricity pricing policy would take effect no later than 1 January 2017.

178. Accordingly, on 05 April 2017, the above ministries approved the Action Plan "On improving the financial condition of OJSHC "Barki Tojik" and increasing by 15% the charge rate annually up to 2022".

179. It should be observed that although the electricity charge rate for the RIA system is subsidized during the vegetation and winter periods, overall, the electricity charge for the RIA pumping stations has been increased several times since 2008 to date, including since 2016, the

pumping station rate has been raised to 208.6% for the growing season and 137.2% for the non-vegetation season.

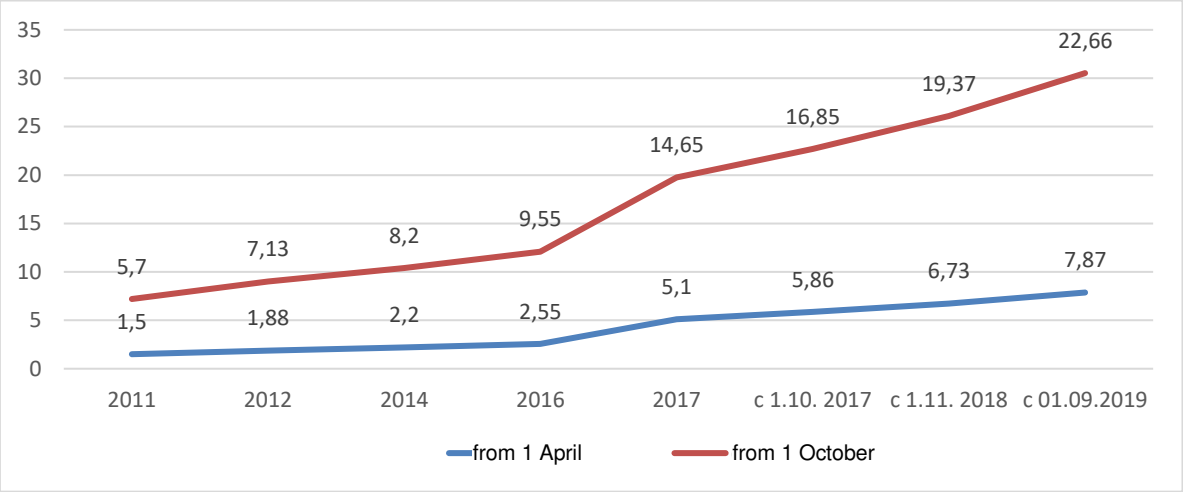


Figure 415. Increasing electricity charge rates in the RIA network. The blue curve - vegetation period from 1 April to 30 September and the red curve - winter season from 1 October to 31 March[28].

180. To improve the performance of the land reclamation and irrigation sector, in view of the failure to recover the costs incurred in providing water supply services, and due to insufficient funding allocated from the national budget, pursuant to the Resolution of the Government of the Republic of Tajikistan "On government support and measures to improve the economic and financial condition of OJSHC "Barki Tojik" # 302 dated 3 May 2014, mutual settlement of debts, owed to the government for electric power supplies, was undertaken by the relevant departments of the RIA in the amount of TJS 242.8 million, as well as TJS 20.04 million in taxes due from “Barki Tojik”. Also, the debts of some of the dehqan farms due to the RIA were written off.

181. Moreover, based on the Resolution of the Republic of Tajikistan dated 29 December 2017, # 601 "On government support and additional measures to improve the economic and financial condition of the Reclamation and Irrigation Agency of the Government of the Republic of Tajikistan and "Barki Tojik"", the debts in the amount of TJS 81.95 million for electricity supplies were settled between the RIA departments.

182. In addition, subsidies are allocated annually via the Ministry of Finance to pay off some of the electricity charges billed to the RIA pumping stations.

7.4. Payments by farmers for water supply services

183. Annually, a standard agreement on water supply from inter-farm irrigation systems to on-farm irrigation systems is signed between SRIA and WUA, as well as between WUA and dehqan farms and other agricultural enterprises located within the WUA catchment area. According to sub-para 3 of para 9 thereof, to ensure repairs of water management facilities, dehqan farms must make an advance payment of 40% before the start of the irrigation season. Subsequently, the

[28] Data of RIA

volume of water drawn during the irrigation season is approved by SRIA and WUA in the form of reconciliation reports on a daily, ten-day, and monthly basis.

184. Previously, only cash payments for water supply services were practiced within the SRIA - WUA system. As part of the "Public Employment for Sustainable Agriculture and Water Management" Project with the financial support of the World Bank, a pilot Nizhnekafernigan Sub-Basin Reclamation and Irrigation Department was established within the RIA system, which brought together the three SRIAs of Shaartuz, Kabadian and N. Khisrav districts of the Khatlon region, thus establishing an integrated sub-basin management department. The system of non-cash payments was introduced in this area for collecting WUA membership fees and paying for water supply services to this sub-basin organization.

185. The same pattern was implemented for the Zarafshan River basin in the context of the project “Reclamation and Irrigation Management Improvement in the Zarafshan River Basin”, funded by the EU via the World Bank. Also, the Zarafshan Sub-basin Reclamation and Irrigation Department was set up to bring together 2 SRIAs and 3 districts and towns in the Sughd region (Penjikent, Ayni and Gorni Mastchoh). In the same basin area, a billing system was implemented for non-cash payments for water supply services to WUA and SRIA.

186. However, in other towns and districts of the country cash payments are still in place. In the case of water supply to farmlands, dehqan farms pay their membership fees and water charges in cash to WUA, and WUA, in its turn, pays for water delivery services to the cash office of SRIA. In the districts, where no WUAs have been established, the dehqan farmers pay for water supply services in cash directly to SRIA.

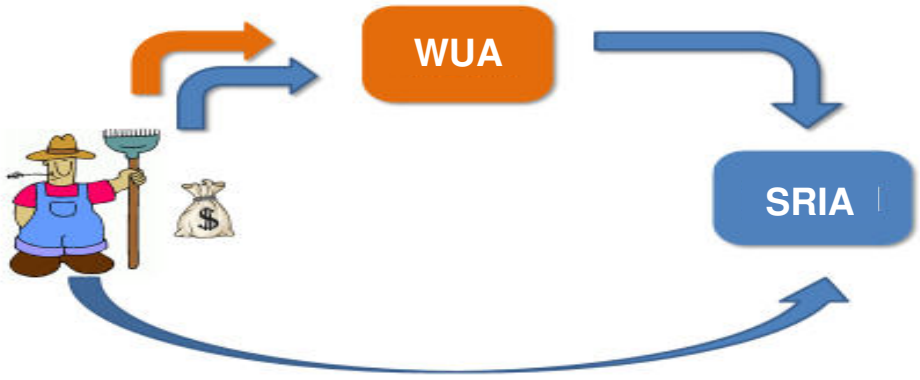


Figure 26. Payments by dehqan farmers for water supply services via WUA and directly to SRIA.

187. As mentioned above, two basin departments of land reclamation and irrigation were established pursuant to the order of the RIA managing director as part of the implementation of the relevant WB and EU projects. Software tools for non-cash payments were developed and implemented for the two newly established basin departments. Under this program, the dehqan farms pay for water supply services and their WUA membership fees directly to the bank. The bank, in its turn, allocates the funds in an automated mode and transfers them to the accounts of WUA and SRIA.

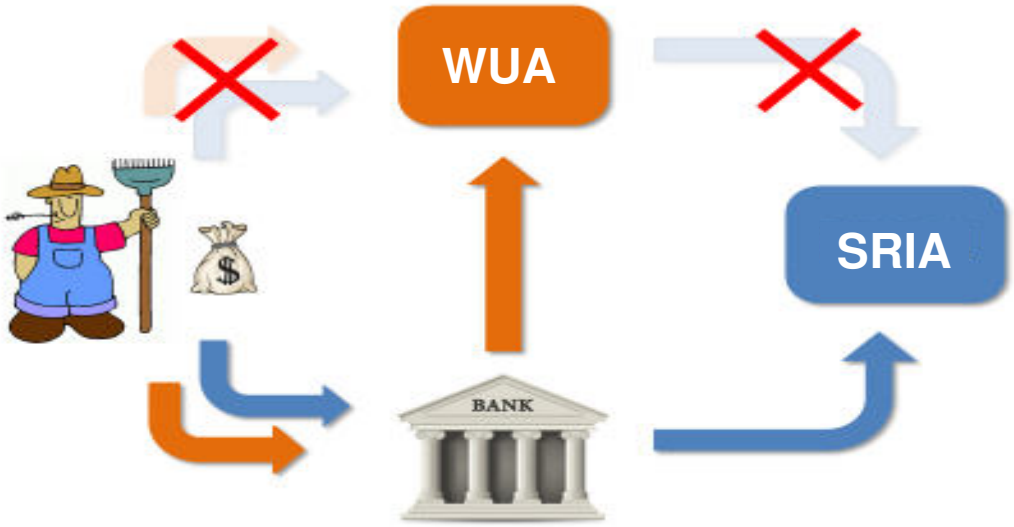


Figure 27. Non-cash payments (via bank transfer) by dehqan farmers for water supply services and their WUA membership fees.

188. If WUAs or dehqan farms have pumping stations or other equipment that consumes electricity, they enter into a separate contract with Barki Tojik.

189. Payment for consumption of electricity by RIA is provided from two sources: charges collected for water supply services and funds from the national budget.

190. Payments for electricity from collections for water supply services are carried out directly by the SRIAs of the cities and districts. The Figure below shows how it is related to the payments for water supply services by the dehqan farmers.

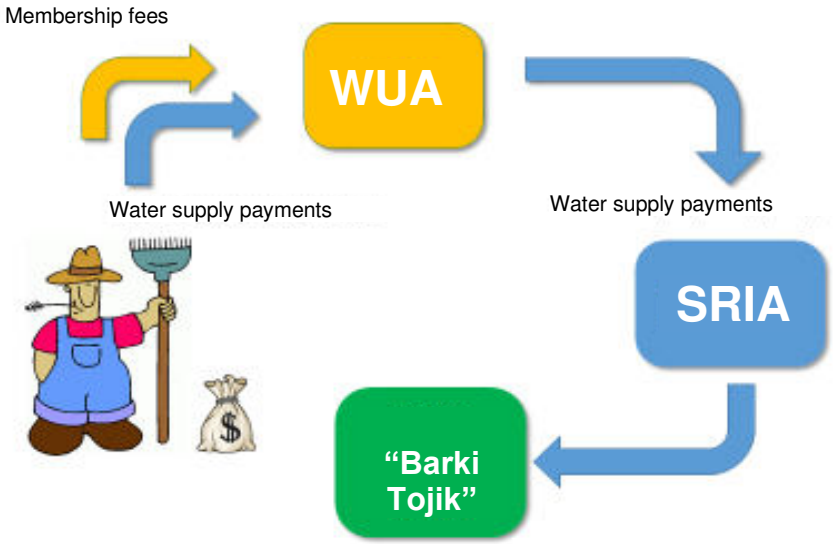


Figure 428. Payments for electricity from collected water supply charges.

191. Payments for electricity from the national budget are carried out directly by the RIA.

192. The Ministry of Finance of the Republic of Tajikistan on an annual basis allocates funds to RIA for payment of electricity charges. In its turn, the RIA transfers the said funds allocated for payments of electricity bills, back to the Ministry of Finance of the Republic of Tajikistan toward settlement of the debts of OJSHC "Barki Tojik".

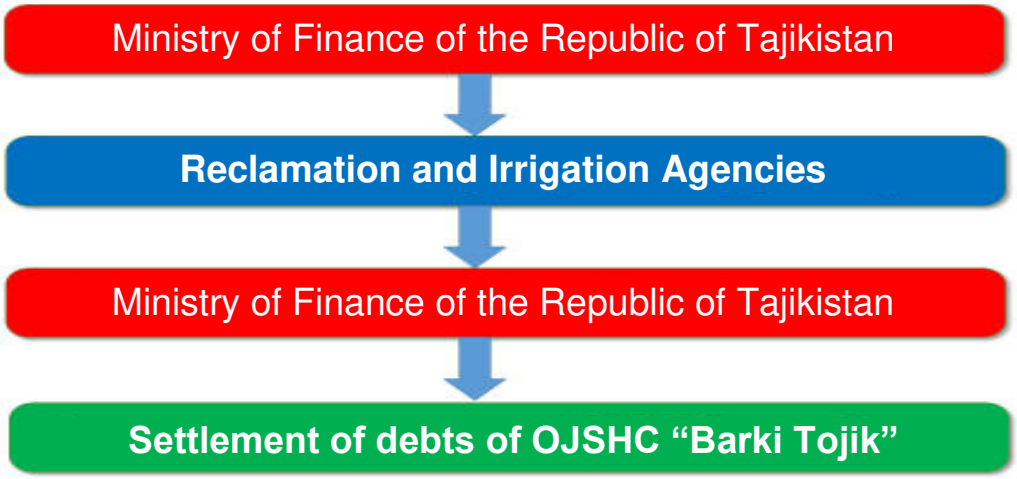


Figure 439. Payments of electricity bills from budget subsidies.

7.5. Types and sizes of annual subsidies allocated from national budget

193. Overall, the organization structure of RIAs comprises 76 subordinate entities, which employ 7,553 workers and professional staff. In order to provide irrigation services for the national cropland, the RIAs have on their books 26.7 thousand km of irrigation networks, 11.4 thousand km of drainage pipelines, 7,099 hydraulic engineering structures, 390 pumping stations (total length of the pressure pipelines is 624.67 km) with 1,500 pump units, 505 vertical drill wells, 169 culverts, 110 aqueducts, 5,455 water distribution posts, 3,858 water gauge stations, 3,858 water flow gauging stations.

194. In order to engage the foothills in commercial usage, large-capacity cascade pumping stations were built, reaching 2-7 stages. Overall, there are 228 cascade pumping stations equipped with 922 pump units, which supply water that irrigates 213.2 thousand hectares of farmland.

195. As mentioned above, the irrigation and drainage infrastructure facilities were built and put into operation in 1930-1980. About 50% of them are already obsolete. Most river dams are built on rivers with no hydraulic engineering structures, which annually results in disruptions in water intake operations during floods and stream flow shifts, as well as during lower river water levels.

196. According to estimates, the RIA's annual funding requirements are TJS 421.6 million needed for the maintenance of the irrigation systems, hydraulic engineering structures and pumping stations, whereby the cost of water supply services equals 10.2 dirams/m^3.

197. For maintenance of the irrigation systems and hydraulic engineering structures, funding is mainly provided from three sources of income: from the national budget, the local budget, and collections of payments for water supply services. Also, the Government of the Republic of Tajikistan borrows funds and receives grants from international financial institutions to be used for the rehabilitation and upgrading of the irrigation systems.

198. Annually, the national budget allocates funds for the maintenance of RIAs and SRIAs in towns and districts. In addition, money is allocated from the local budgets directly to the SRIAs for the maintenance and repairs of the pumping stations and hydraulic engineering structures. The amounts of the annual subsidies allocated for RIAs are given in the below tables.

Table 15. Subsidies allocated from national budget to Sughd region and Zafarabad district in 2016-2020.

TJS ,000

Years	Sughd region	Zafarabad district
2016	5950.0	1350.0
2017	1939.8	1114.8
2018	1700.0	1000.0
2019	5400.0	1300.0
2020	4200.0	1900.0
Grand total	**19189.8**	**6664.8**

Source: RIA data

199. Subsidies are allocated from the national and local budgets directly to SRIA for purposes other than payments for electricity. Payments for electricity consumption are charged to the Utilities Expense account.

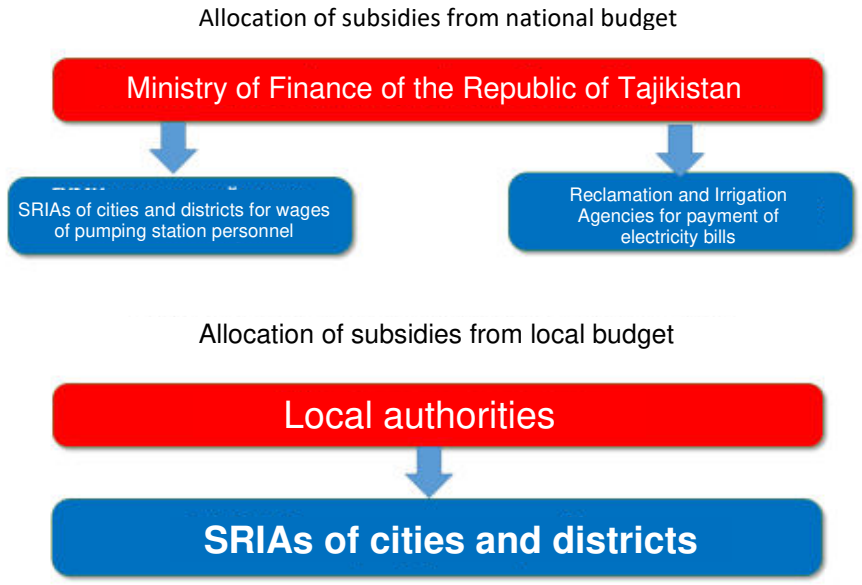


Figure 30. Allocation of subsidies from national and local budgets to RIAs

Table 16. Subsidies allocated from national budget to Sughd region and Zafarabad district in 2016-2020.

TJS ,000

Items of expenditures	RIA	Including Sughd region	Zafarabad SRIA	RIA	Including Sughd region	Zafarabad SRIA	RIA	Including Sughd region	Zafarabad SRIA	RIA	Including Sughd region	Zafarabad SRIA	RIA	Including Sughd region	Zafarabad SRIA
	2016	2016	2016	2017	2017	2017	2018	2018	2018	2019	2019	2019	2020	2020	2020
Wages and salaries	28207.8	9040.9	1311.5	30533.3	9401.3	1351.5	18720.0	4840.9	647.0	22805.5	5928.9	647.0	22946.0	5928.9	647.0
Social Security Fund	7052.0	2260.2	327.8	7633.2	2350.3	337.8	4679.9	1210.1	161.7	5694.5	1482.1	161.7	5736.2	1482.1	161.7
Stationery and office supplies	199.7	33.9	2.4	199.7	33.9	2.4	15.0	0	0				27.5		
Fuel and lube materials	1265.0	80.9	10.0	1264.1	80.0	10.0	80.8	0	0				170.0		
Travel expenses	252.3	66.7	1.7	218.3	32.7	1.7	18.0	0	0				30.0		
Routine maintenance	2151.5	45.1	20.0	2186.5	150.1	20.0	120.0	0	0				292.0		
Professional services	20.5	5.3	5.3	21.6	5.3	5.3	3.0	0	0				8.0		
Public utility services	901.4	175.8	40.0	994.7	210.8	39.7	26300.0	11164.8	3172.0	31500.0	9654.4	2328.3	40147.0	7795.0	1472.4
Miscellaneous	37.8	4.6	0.0	38.9	4.6	0	3.6	0	0				3.5		
Communication service	216.9	51.4	7.8	217.1	51.4	7.8	9.5	0	0				14.0		
Procurement	1690.9	70.5	0	1690.9	100.5	0	50.2	0	0				408.0		
Total	**41995.8**	**11835.3**	**1726.5**	**44998.3**	**12420.9**	**1776.2**	**50000.0**	**17215.8**	**3980.7**	**60000.0**	**17065.4**	**3137**	**69782.2**	**15206**	**2281.1**

7.6. Analysis of economic condition of Zafarabad SRIA

200. The chargeable irrigation water supply was introduced in 1996 in the context of the economic reform and transition to market development fundamentals. Pursuant to the Executive Order of the President of the Republic of Tajikistan on the introduction of payment for water supply services provided by the state-owned facilities of 25 June 1996, and the Resolution of the Government of the Republic of Tajikistan # 281 of 25 June 1996 "On approval of the Policy on the procedure for charging fees for water supply services provided to consumers from state-owned sources", the costs incurred in maintenance and operation of the irrigation and drainage networks must hereinafter be covered by the farms-recipients of water supplies.

201. However, from the very first year of its introduction, the system of fee-based services of water delivery to water consumers triggered some problems related to the collection of charges for water supply services. The annual collection of payments, given the current water supply charge rates, covers only a portion of the maintenance costs of the irrigation networks. The estimated costs of services provided in the Zafarabad district according to the established charge rates (2.0 dirams per 1 m³) for 2018 were equal to TJS 7581.0 thousand, whereas the actual collections for water supply services in this district brought only TJS 3570 thousand (47% of the estimated costs).

202. Thus, the actual expenditures outweigh the estimated costs of the services. For example, in 2018 the expenditures amounted to TJS 25,352.8 thousand, including the electricity bills (net of VAT) equal to TJS 17,146.2 thousand, salaries TJS 2,223.4 thousand, social contributions TJS 555.8 thousand, and maintenance works TJS 4,896.3 thousand. Losses of the Zafarabad SRIA reached TJS 17,188.0 thousand (25,352.8-7734.0 = TJS 17,188.0 thousand).

203. According to the SRIA, the overall collections service charges for water supply in 2016-2020, averaged 53%, and the arrears of the dehqan farms and other agricultural enterprises amounted to TJS 20.7 million. This was due to the fact that the pumping units and motors of the pumping stations were worn down and were unable to deliver water to the farmers in a steady and reliable mode. Moreover, at times unannounced power outages cause damages to pumps and electric motors.

Table 17. Subsidies allocated from local budget of Sughd region and Zafarabad district in 2016-2020.

Years	Water supplied, thsd m^3	Total service charge, TJS ,000	Amounts paid, TJS ,000	Collections, %	Charge rate per 1 m^3 of water, dirams	Arrears, TJS ,000	Arrears cumulative, TJS ,000
2016	354923	6282.1	3206.0	51	1.77	3076.1	9365.6
2017	334518	5920.9	3288.6	55	1.77	2632.3	12113.2
2018	386746	7581.0	3425.9	45	2.0	4156.0	16144.1
2019	316056	6321.1	3280.6	51	2.0	3040.5	18664.0
2020	297789	5967.0	3782.9	63	2.0	2184.1	20717.7

Source: Data of Division of Melioration and Irrigation of Zafarabad region

Table 18. Analysis of economic condition of Zafarabad SRIA for 2020

Description	Unit of meas.	2020
Actual water supplied	thsd m^3	297789
Actual charge for service (based on 2.0 dirams per 1 m^3, net of VAT)	TJS ,000	5967
Actual costs	TJS ,000	26733.8
Including electricity bills	TJS ,000	20399.3
Wages and salaries	TJS ,000	2410.2
Social contributions	TJS ,000	602.5
Losses ("+" and "-")	TJS ,000	-20766.8
Actual charge rate per 1 m^3 of water (cost of water)	dirams	8.97

Source: Data of Division of Melioration and Irrigation of Zafarabad region

204. As can be gathered from the table, the actual collections based on the established charge rate (2.0 dirams per 1 m^3, net of VAT), do not cover the actual costs. According to this table, the total actual costs of the SRIA were equal TJS 26,733.8, including the cost of electricity - TJS 3,399.3 thousand, or 76.3%, wages and salaries - TJS 2,410.2 thousand, or 9.0%, and the social contributions - TJS 602.5 thousand, or 2.2%.

205. The total actual costs for 2020 were equal to TJS 5,967 thousand, including the cost of electricity - TJS 20,399.3 thousand, or 341% of the water supply services, wages and salaries - TJS 2,410.2 thousand, or 40.4%, and social contributions - TJS 602.5 thousand, or 10 %. In fact, the Zafarabad SRIA is making losses. The previous experience has shown that the economics of the water sector operations have not been fully elaborated to run in the market environment, because the actual costs incurred by the water management organizations, are significantly higher than the proceeds from the service collections used for the maintenance and operation of the reclamation and irrigation systems.

206. Accounts payable of the water management organizations grow with every coming year owing to the delays in payments by the water users for water supply services. Today, the payables of the district SRIA account for TJS 87.6 million.

207. In this case, the bulk of the debts represents the electricity bills, since pumping irrigation in the district accounts for 100%. The debts include taxes, social contribution and unpaid wages and salaries of water sector workers and professionals, which leads to considerable outflow of personnel to other more lucrative industries.

8. Activities of farmers in the Republic of Tajikistan

208. The following entities operate in the agricultural sector: dehqan farms, agricultural cooperatives, dehqan collective farms, agricultural firms, and associations of dehqan farms.

209. The regulatory framework and activities of these farms are regulated by the Civil Code of the Republic of Tajikistan, the Law of the Republic of Tajikistan "On dehqan farms" dated 15 March 2016, # 1289 and the Law of the Republic of Tajikistan "On cooperatives" dated 22 July 2013, # 991.

210. **Dehqan farms.** Dehqan farms are business entities engaged in the production, storage, processing and sale of agricultural products based on personal efforts of one person or joint activities of a group of individuals on a land parcel and their own property.

211. Dehqan farms are established in due procedure as defined by laws of the Republic of Tajikistan, and registered by one person or a group of individuals in the following formats: unincorporated business with a membership of 1 to 50 people, and as legal entity regardless of the membership count. Dehqan farms, established as an unincorporated business by one and/or 2 to 50 individuals in accordance with a memorandum on joint activities, operates from the date of official registration as an individual entrepreneur with a reference to "Dehqan farm" as the business name of the individual.

212. The official registration of a dehqan farm is executed in compliance with the procedure established by the Law of the Republic of Tajikistan "On state registration of legal entities and individual entrepreneurs" # 508 dated 19 May 2009.

213. Pursuant to the Law of the Republic of Tajikistan "On dehqan farms", the farmer defines his/her own business structure and areas of activities, as well as the scope of production, storage, processing, sale of products, and other matters relevant to the farm operation. Dehqan farms may open bank accounts with credit organizations, have a seal and letterheads with their name. The specifics of establishing and operating dehqan farms are defined in the format chosen by its founder(s) and are regulated by this Law, the Civil Code of the Republic of Tajikistan, and other regulatory and legal instruments of the Republic of Tajikistan.

214. Dehqan farms established as unincorporated businesses by more than one person, operate on the basis of a memorandum on joint activities, which, in addition to the data required by the Civil Code of the Republic of Tajikistan, provides the following information:

- Number of members, family name, first name, patronymic of each member of the dehqan farm;
- Rights and responsibilities vested in the farm manager by the general meeting of the members of the dehqan farm;
- Rights and responsibilities of the members of the dehqan farm;
- Procedure of exit and/or eviction from the farm;
- Procedure for admission as members to the dehqan farm;
- Property and size of the share of land owned by a member of the dehqan farm on the shared land parcel, which is deemed to constitute his/her entrance contribution to the farm (certified by documentary evidence of land ownership and size);
- Procedure for convening general meetings of the farm members;
- Procedure for dispute settlement;
- Policy for product pricing, sale, and income distribution among the members;
- Termination procedure.

215. Dehqan farms may not be liable for the obligations of the government, and the government assumes no responsibility for the commitments of dehqan farms. Damage caused to the dehqan farm as a result of interference of the government authorities and public officials is indemnified in accordance with procedures defined by the legislation of the Republic of Tajikistan. Government agencies and public officials may not interfere in the activities of dehqan farms.

216. The property of a dehqan farm includes plantations on the land parcel, buildings (structures), productive livestock and draft animals, poultry, agricultural and other machinery and equipment, vehicles, implements and other items required for the operation of the farm, as well as

the title to use the land parcel and the right to dispose of it. Thus, pursuant to this law, dehqan farms are entitled to dispose of their land.

217. Matters related to the transfer of the land use rights are also addressed in the Law of the Republic of Tajikistan "On mortgage," which states that "the rules of mortgage shall apply to the lien on land use rights, with the right to transfer unless otherwise established by law".

218. The fundamental rights of the dehqan farms are as follows:

- Manage operations on their own land parcel, choose the mode of cultivation and production;
- Act as the owner of the products and the income earned from their sale;
- Lease out the land parcel or a portion thereof;
- Waive the land use right subject to the consent of the members of the farm and determine the share of land or a portion thereof for new members in keeping with the procedure established by the laws of the Republic of Tajikistan;
- Exploit conventional mineral deposits (sand, crushed rock, clay, stones), water sources, as well as other valuable assets of the land parcel of the dehqan farm in due process as prescribed by the legislation of the Republic of Tajikistan;
- Purchase, rent or use on a temporary basis property of organizations and private individuals;
- Collateralize the title to the land parcel with the right of disposal thereof incompliance with the procedures established by the legislation of the Republic of Tajikistan;
- Enter into contracts on business activities;
- Establish private right-of-way on the land parcel;
- Insure their property on a voluntary basis (crops, livestock, fixed assets, and other property), unless otherwise stipulated by the legislation of the Republic of Tajikistan;
- Draw up plans of economic activities and diversification of production, set up agricultural production facilities to serve public needs under government contracts;
- Evaluate their own agricultural products;
- Engage in foreign economic operations in compliance with the relevant policies regulated by the laws of the Republic of Tajikistan;
- Pursue seed production opportunities and engage in livestock breeding as required by the legislation of the Republic of Tajikistan;
- In case of seizure of the land parcel by the government authorities, seek and obtain compensation in accordance with the relevant laws of the Republic of Tajikistan.

219. One more important component of the legislation on dehqan farms is the construction permit for temporary structures of field camps on the agricultural lands of the dehqan farms. Field camps are temporary light-weight buildings (non-capital construction), which are erected and used on the dehqan land exclusively for farming purposes without excluding the area of the field camp from the agricultural process. Field camps may be erected on an area of up to 0.01 hectares, provided the land parcel of the dehqan farm exceeds 3 hectares, up to 0.03 hectares if the dehqan land area exceeds 10 hectares, and up to 0.05 hectares if the parcel exceeds 20 hectares.

220. **Associations of dehqan farms.** The Tajik legislation makes provision for the formation of unions (associations) of dehqan farms. The said unions (associations) of dehqan farms are non-profit organizations. The primary objective of the association of dehqan farms consists in coordinating their activities, in representation, and advocacy for common interests and rights. The dehqan farms, members of the union (association), retain their independence and land use rights.

221. In other words, to ensure comprehensive support of entrepreneurial activities, promotion of market relations, protection of rights and interests, improvement of farmers' skills, and sustainable development of farms, dehqan farmers are entitled to unite in associations of dehqan farms. Establishment of associations of dehqan farms is regulated by Articles 133-135 of the Civil Code of the Republic of Tajikistan, and Article 33 of the Law of the Republic of Tajikistan "On dehqan farms"

222. If the members of an association (union) decide to engage in business operations, such association (union) is subject to reorganization into a business entity or partnership as prescribed by this Code, or to forming production cooperatives (Article 71 of the Civil Code of the Republic of Tajikistan).

223. **Agricultural cooperatives.** Oftentimes the size of dehqan farms in Tajikistan may be as small as 0.25 ha, and they may be loss-making and non-competitive in terms of production and sales of their agricultural products. Therefore, they can be integrated into agricultural cooperatives in accordance with the Law of the Republic of Tajikistan "On cooperatives" of 22 July 2013, # 991, and the Civil Code.

224. Cooperatives are independent and voluntary associations, registered in due procedure and organized based on membership of individuals, to achieve joint economic, social, cultural, and other objectives, as well as their aspirations by pooling property (share contributions) and creating a democratically managed organization of joint ownership.

225. In other words, agricultural cooperation is defined as a system of various agricultural cooperatives and their unions created by agricultural producers to satisfy their economic and other needs.

226. Agricultural cooperatives can be established in the following two formats:

- Non-profit cooperative;
- Commercial cooperative.

227. **Non-profit cooperative:** is a not-for-profit organization, which, in accordance with its Articles, provides services mainly to its own members. Net profits of non-profit cooperatives gained from services provided to third parties are not distributed among its members and are invested in their further development. In case a non-profit cooperative provides services to third parties, it must be converted into a for-profit (commercial) cooperative.

228. **Commercial cooperative:** is a business entity, which, in accordance with its articles, provides services mainly to third parties. Net profits of commercial cooperatives may be distributed among their members in due procedure as required by this Law and their Articles.

229. The cooperative is founded by at least three individuals or legal entities. The company name of the cooperative must be consistent with the laws of the Republic of Tajikistan and should contain the word "cooperative". Other organizations, except for the duly registered cooperatives, may not engage in business operations under a name or title bearing the word "cooperative" or its equivalent in another language.

230. The key principles for the establishment and operations of a cooperative are as follows:

- Voluntary and open-ended membership;
- Mutual assistance and protection of economic benefits of the cooperative members;
- Democratic governance;
- Pursuit of the objectives of improving the economic and social conditions of cooperative members;
- Safeguarding the economic and entrepreneurial independence of the cooperative

members;

- Ensuring access to education and training for members of the cooperative;
- Transparent operations.

231. The government supports and guarantees respect for the rights and legitimate interests of cooperatives and their members, and promotes the expansion of cooperatives in the country. Government agencies, in turn, may not interfere with the activities and development of cooperatives, except in cases envisaged by the laws of the Republic of Tajikistan.

232. However, throughout the process of formation of cooperatives, their potential members encounter specific problems. For example, shared contributions of the members of the cooperative, which build its seed capital are meant to cover the costs incurred in the establishment and organization of its activities. In reality, though, not all farmers pay enough attention to this aspect.

8.1. Organization of water distribution among farmers

233. At this point, more than 80 thousand dehqan and other farms are organized in Sughd region, including 2,400 dehqan farms in the Zafarabad district. In order to provide irrigation water for them, 170 WUAs with a catchment area of 169873 ha operate in the Sughd province, and 2,9107 contracts had been signed for 2020 with dehqan and other private farms, including 33 WUAs in the Zafarabad district with a catchment area of 27,616 ha and 2,400 contracts signed for 2020.

234. Water is allocated to farmers based on the approved water-use plans of the Reclamation and Irrigation Agency of the Government of the Republic of Tajikistan (RIA). The water-use plans are developed based on the Basin plans, annual quotas allocated by the Inter-state Commission for Water Coordination of Central Asia, the Committee for Environmental Protection of the Government of the Republic of Tajikistan, with due regard to the needs of dehqan farms. In turn, the Basin water management plans are developed on the basis of the existing patterns of comprehensive management and protection of water resources, water balances, water intake quotas, and water-use norms.

235. There are two basin zones in the Sughd region: the Syr Darya basin zone and the Zarafshan basin zone.

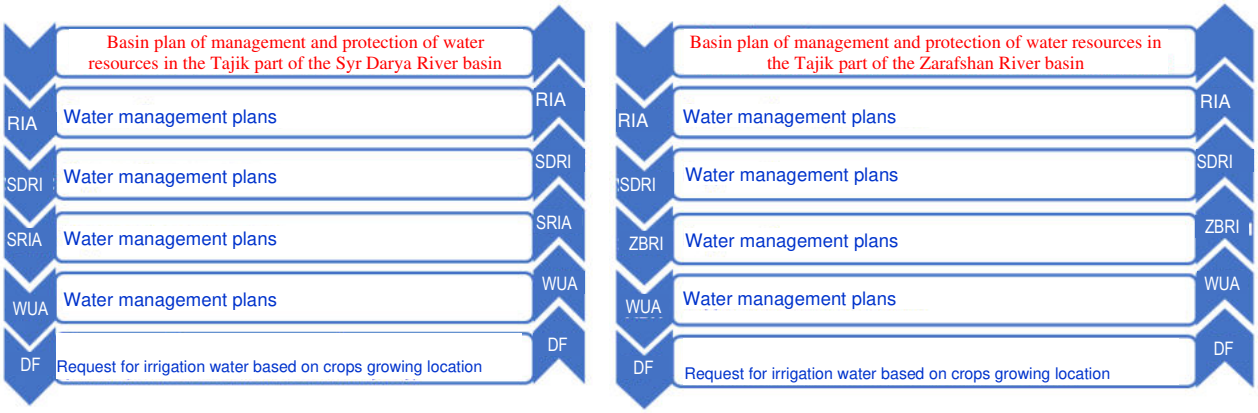


Figure 31. Development of water management plans

236. Water allocation in the Sughd region pursuant to the water management plans is carried out at the inter-farm level by the SDRI through the Zarafshan Basin Organization for Reclamation

and Irrigation (ZBRI), and by the SRIA - for districts and urban areas. WUA is responsible for the on-farm allocation. Where dehqan farmlands are not within the WUA catchment area, water supply is provided directly by the SRIA.

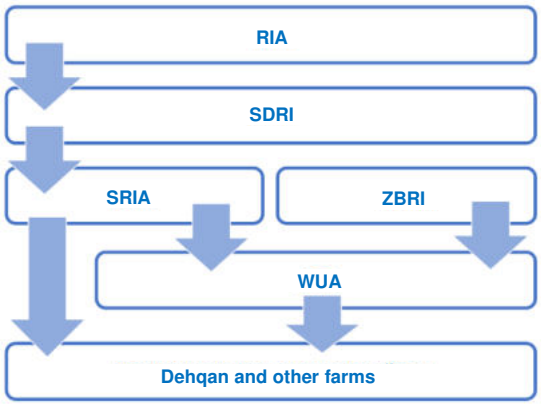


Figure 32. Water distribution among farmers

237. Development of water management plans is based on the Water Code, adopted 2 April 2020, Res. # 1688, as pursuant to Article 94 thereof, the Water Code of the Republic of Tajikistan of 29 November 2000, Res. # 34 was thereby rendered null and void.

This Water Code has codified regulation of public relations regarding possession, management and disposal of water and water bodies, protection and rational use of water resources, and legal protection of water users, as well as defined the terms of reference of authorized agencies for government regulation of usage and protection of water resources in the Republic of Tajikistan and of the agencies empowered to implement and execute the relevant government policies.

238. Article 16 of the Water Code authorizes RIA to develop water management plans and approve them in due procedure. As per Article 67 of the Water Code,

239. Water management plans are approved: by the Water Users Associations - for individual farms (on-farm level), by State Reclamation and Irrigation Agencies - for several farms (inter-farm level), and by the relevant River Basin Department - for the basin level.

240. To enable regulation of water allocation by on-farm systems in 2006, the Law of the Republic of Tajikistan "On water users associations" of 21 November 2006, # 213 was passed. Subsequently, it became invalid, and the new Law of the Republic of Tajikistan # 1668 "On water users associations" was adopted on 2 January 2020.

241. The said law defines the economic, organizational, and legal framework for the activities of water users associations and is aimed at ensuring water conservation and efficient use of hydraulic engineering structures in their catchment areas.

242. Under this Law, dehqan and other farms, as well as different agricultural entities, are organized into WUAs for collective use and maintenance of land reclamation systems in their respective catchment areas, for ensuring supplies of irrigation water, for coordination of activities, representation, and advocacy of their common interests in a particular territory.

243. WUAs are established pursuant to the relevant decision of the founders. The founders of water users associations are individuals and legal entities, including dehqan and other private farms using water for irrigation of their agricultural lands and satisfaction of farming and household needs.

244. The procedure for establishing a WUA is as follows: the founders set up an action team and determine the date for convening the first general meeting. The above Action Group shall:

- Determine the catchment area and the number of water users located therein;
- Clarify for the water users the relevance of the association, rights and obligations of its member;
- Develop a feasibility study for the creation of the Water Users Association;
- Draw up the catchment area map with designation of all existing hydraulic engineering structures and land parcels owned by the water users subject to approval of the duly authorized local government agency;
- Develop a draft Articles of association of the WUA.

245. The decision on establishing the Association and on setting up management boards is adopted by the General Meeting. The WUA starts it activities upon its official registration as a legal entity, in compliance with the procedure established by the Law of the Republic of Tajikistan "On state registration of legal entities and individual entrepreneurs". WUA members pay their dues to ensure eligibility for water supplies. Moreover, WUA members pay through the WUA offices the established fee for water supply services in the amount of 2 dirams per 1 m^3 to the SRIA or to the Zarafshan Basin Reclamation and Irrigation Organization (ZBRI).

246. Water is allocated to dehqan and other farms based on the water management plans drawn up at the year-end by the WUA for its catchment area. Dehqan and other farms at the end of each year, submit a request to the WUA for the required amounts of water drawn up according to their crop planting pattern and irrigation norms, or for the volumes needed for livestock watering and other water-consuming facilities. Household gardens within the WUA catchment area, also file requests through their respective jamoats for household water consumption.

247. Upon completion of the water-use plans, dehqan and other farms sign contracts with the WUA for water supply services. The contract specifies the amounts of membership dues to be paid to the WUA and the price of the water supply payable to SRIA or ZBRI through the WUA. The dehqan and other farms located outside of the WUA catchment area, sign contracts for water supply services with the SRIA. Every month, in accordance with the signed contracts, a reconciliation report on water supply and acceptance is drawn up between the dehqan and other farms and the WUA or SRIA, as well as between the WUA and SRIA or Zarafshan Basin Reclamation and Irrigation Organization (ZBRI).

248. As per Article 14 of the Law of the Republic of Tajikistan “On water users associations”, members of the association shall:

- Comply with the provisions of the Articles of the WUA, implement decisions of the Council and the General Meeting, as well as the meetings of the detached areas of the Association (if such areas have been established);
- Submit, by the end of each year, requests to the WUA for the required amounts of water, drawn up according to their crop planting pattern and irrigation norms;
- Pay their dues on a timely basis to the bank account of the WUA, as well as their fees for the water supply services to the relevant duly authorized local government agency;
- Comply with the schedule of water distribution among the WUA members and other water users, as well as observe the irrigation, agro-technical and land reclamation norms of water use in the catchment area;
- Maintain the land reclamation system in the catchment area and the operating hydraulic engineering structures, and prevent deterioration of the reclamation condition of the land;

- Compensate for any damage caused to the Association's property and other water users;
- Keep records of water and land use, and submit reports in a timely manner and in proper format to the relevant authorities;
- Not interfere with repair and rehabilitation operations on hydraulic engineering structures located on their land parcels.

249. According to Article 56 of the Water Code, water users must comply with the established requirements and terms and conditions of the water use agreement signed with the water supply provider.

250. Also pursuant to the Regulation on procedure for collection of payments for water supply services provided to consumers from state-owned irrigation and watering systems, approved by the Government of the Republic of Tajikistan on 25 June 1996, # 281, the amounts of water intake within the regulatory norms are paid for by the consumer in accordance with the existing charge rates. Any amounts of water intake in excess of the regulatory norms are subject to a surcharge factor of 1.2, and any unauthorized water intake is subject to a surcharge coefficient of 3.

8.2. Direct and indirect analysis of stakeholders in development of dehqan farms.

251. It is the Government of the Republic of Tajikistan, hereinafter local government authorities, that is primarily interested in developing the dehqan and other farms, associations of such farms, farming cooperatives, and other agricultural enterprises. Since their development determines the labor market in the agricultural sector, ensuring the supply of agricultural products and goods to the market, competitiveness, and, in general, ensuring food security in the country.

252. To this end, the National Development Strategy of the Republic of Tajikistan until 2030 defines food security and employment as the strategic goals and priorities for the period up to 2030.

253. In particular, regarding the development of the agricultural sector, the national strategy sets the following objectives:

- Promotion of the agricultural and water management reforms;
- Ensuring affordability and accessibility of food based on the sustainable growth of the agro-industrial sector;
- Diversification of agricultural production, including the introduction of innovations, which minimize the impact on the environment and quality of soil, the development of measures to replace poisonous chemicals with alternative less hazardous substances, enhancing the attractiveness of the sector, especially for dehqan farms by establishing and strengthening the value-added chains;
- Improving access to better seeds and fertilizers in the domestic market, increasing agricultural production by motivating farmers to use innovative agricultural methods and technologies.
- Building an efficient system of risk management and monitoring food security and adequate nutrition (support to the production and import of vital foodstuffs, setting up nutrition monitoring systems, early warning, emergency stockpiles);
- Promotion of an effective multi-sectoral approach to improving nutrition through coordination of policies in agriculture, health care, social security, raising awareness of the nutritional values and effective funding policies;
- Development of land-and-water management systems based on equitable and

sustainable distribution of land and water resources for growing valuable crops;

- Sustainable operation and maintenance of the irrigation and drainage infrastructure as the basis for the stability of irrigated agriculture and food security, rural population employment and poverty reduction in local communities;
- Rehabilitation of irrigation and drainage systems to ensure better water availability for irrigated lands, and to improve the reclamation condition of the salinized and waterlogged lands;
- Improvement of economic mechanisms to ensure coverage of costs of maintenance and operation of the irrigation and drainage infrastructure, optimization of the system of public subsidization of payments for electricity supplies to irrigation pumping stations, reduction of the adverse impact of the pricing policies in the irrigation and drainage sector on the sector performance.
- Development of the agricultural produce market and removing the barriers to ensure direct access to the market for agricultural producers;
- Addressing the issues related to the handover of former on-farm irrigation and drainage facilities to WUAs, and strengthening government support for the development and sustainable performance of such WUAs;
- Introduction of efficient systems of government incentives for the development of new and return to the agricultural sector of saline, waterlogged, and previously fallow lands.

254. The processes of development of dehqan farms are governed by the following programs and strategies: The National Development Strategy of the Republic of Tajikistan for the period up to 2030, the Medium-Term Development Program of the Republic of Tajikistan for 2021-2025, and the Socio-Economic Development Programs of regions, districts, and cities for 2021-2025.

Table 19. Stakeholders in development of dehqan and other farms

#	Stakeholders	Interested in:
	Government of the Republic of Tajikistan	Realization of food security and employment of rural population
	Local government authorities	– Implementing policies of agricultural development; – Development of sectoral programs; – Generation of the agricultural share of GDP; – Mobilization of domestic and international investments for agricultural development projects; – Expansion of public-private partnership practices; – Ensuring supplies of agricultural goods and products to the markets; – Budget revenue formation through tax collections; – Soft lending facilities provided to the agricultural sector; – Development of irrigation and drainage infrastructure facilities; – Expansion of farmlands;
	Local government authorities	– Improvement of well-being of local population in districts and urban areas; – Population employment; – Development entrepreneurship activities; – Production and sales of agricultural goods and products; – Tax revenues; – Formation of budgets of cities and district communities;

	Associations of dehqan and other farms;	– Skill upgrade programs for farmers; – Representation and advocacy for collective rights and interests; – Assistance in securing soft loans, ensuring access to sales markets;
	Agricultural and other cooperatives.	– Association of small-sized dehqan farms; – Work management in agricultural cooperatives; – Supply of high-quality seeds for cultivation of valuable crops; – Implementation of innovative technologies; – Boosting the production, storage, and marketing of agricultural goods and products; – Development of business projects, access to external markets;
	Dehqan and other farms;	– Development of farming business; – Increasing crop yields and production capacity; – Harvesting, storage and sales of agricultural goods and products; – Benefiting from business operations; – Ensuring job security and wages for farm workers;
	Workers employed by dehqan and other farms;	– Seasonal workers; – Full-time workers guaranteed permanent employment.
	Women	– Monitoring performance of dehqan and other farms, promote gender equality and balance;

8.3. Baseline performance indicators and analysis of resources management

255. Availability and management of resources is an important driver for the development of dehqan and other farms. Over 80 thousand dehqan and other farms have been created in the Sughd region as part of the ongoing land-use reform.

256. As a general rule, large-scale dehqan and other farms own agricultural machinery or can afford to acquire equipment on a leasing basis, they employ workforce and have the opportunity to purchase high-quality seeds. In addition, by means of mechanized production facilities, they can be competitive in terms of sales of agricultural products, which is not the case for small-sized and individual dehqan and other farms.

257. Their farmland areas may be between 0.2 hectare (about 88%) and 1.8 hectares (about 12%). These farms are managed by the household. Such farms tend to suffer permanently from shortage of financial, technical and human resources, as well as from the limited access to high-quality seeds and mineral fertilizers. These constraints reduce yields at these farms and prevent them from competing successfully in the agricultural markets. Tajik banks may extend loans to them, but only subject to testing the prospects for future harvest.

258. To improve the current situation in the Sughd region, 62 points of sale for seeds have been opened, as well as 100 points of sale for spare parts for agricultural machinery, 71 points of sale for mineral fertilizers. Also 114 consultancy offices were put in place for the dehqan and other farms. Yet, these appear to be insufficient to improve production capacity the farms. Therefore, it seems appropriate to step up to production diversification.

259. To proceed with diversification programs, the legislation provides some enabling prerequisites in terms of business planning and diversification for streamlining sustainable agricultural production facilities to serve public needs under government contracts. Diversification of agricultural production is highlighted in the National Development Strategy of

the Republic of Tajikistan for the period up to 2030, in the Medium-Term Development Program of the Republic of Tajikistan for 2021-2025, as well as in the five-year Programs of Socio-Economic Development of regions, cities and districts.

260. Diversification of agricultural production, consists of the implementation of innovations, which minimize the impact on the environment and quality of soils, the development of measures to replace poisonous chemicals with alternative less hazardous substances, enhancing the attractiveness of the sector, especially for dehqan farms by establishing and strengthening the value-added chains;

261. It would require development by the dehqan farms of a coherent mechanism for implementation of the agricultural production diversification system.

8.4. Analysis of investment requirements

262. Investments are needed for the development of dehqan and other farms. They are especially important for the procurement and production of high-quality seeds, storage, and processing of agricultural products, as well as mineral fertilizers and specialized agricultural equipment.

263. Large-scale dehqan and other farms are eligible for credit facilities or can afford to acquire equipment on a leasing basis. According to FAO 2018, over 85% of dehqan and other farms in the country run their farming business on an area 0.2 hectares, on average. All the other farms have approximately 1.95 hectares. On average, the small-sized farms deliver to the market about 20% of their products, the rest remaining on the farm for their own needs.

264. Tajik banks may extend loans to the farmers, subject to the land use rights or the total expected harvest volume (after testing), pledged as collateral. However, in the context of the escalating climate change risks, the farmers may suffer losses from droughts, plant diseases, locust invasions, hail storms, mudslides, floods, and other natural disasters. In 2014, the country has passed the Law of the Republic of Tajikistan "On insurance activities", but the types of insurance provided therein, do not include insurance of dehqan and other farms against any risks of natural disasters. Following below is an overview of some commercial banking institutions.

265. **Closed Joint-Stock Company “Humo".** It is a progressive and leading microcredit depository organization. It offers an agricultural credit facility. The loans may be used by farms to finance crop-growing operations, to buy seeds, fertilizers, pesticides, and fuel. Movable and immovable property must be pledged as collateral to obtain a loan. The loan amount may vary between TJS 80,000 and TJS 250,000. The loan maturity may range from 3 to 24 months. Lending terms: Eligible borrowers are: legal entities, dehqan farms; experience in this area at least 6 months; compliance of the business with the legislation of the Republic of Tajikistan; no liabilities to third parties; the business must be cost-effective.

266. In addition, GEFF Tajikistan via CJSC “Humo” provides financial and technical assistance, as well as investment grants to private sector businesses to promote sustainable development of the country. GEFF Tajikistan is a project funded by the European Bank for Reconstruction and Development in cooperation with the European Union, the Green Climate Fund and the Republic of Korea. The Project is implemented through Local Participating Institutions (Partners) to support transition of the country to ‘green economy’ by investing US$ 25 million in energy and resource efficiency projects. GEFF Tajikistan helps Tajik farmers and agribusinesses adopt technology solutions and best practices that can enhance competitiveness of the agricultural value chains and reduce costs of energy and resources.

267. In partnership with the European Union, GEFF Tajikistan provides investment grants to farmers and other businesses operating in the agricultural value chains, and investing in state-of-the-art high-performing technologies and equipment. Technical assistance is provided by the local GEFF team at various stages of the Project development, investment evaluation and project implementation. It helps identify the best solutions and ensure the technical eligibility of the project for GEFF financing.

268. The following categories of borrowers may apply to GEFF: Agricultural value chains: micro, small and medium enterprises operating in agriculture and food-related industries and services across the agricultural value chains such as plant growing, production of agri-food, food and beverages processing, packaging, storage and transportation.

269. Examples of eligible technologies, including but not limited to the following core eligibility criteria:

- Intensive orchards (with drip irrigation).
- Irrigation pipes (diameter of pipes not less than 50 mm).
- Water pumps (minimum Efficiency Index of a pump not less than 0.1).
- Greenhouses (glass, polyethylene >100 mm).
- Agricultural machinery (specific energy consumption maximum torque less than 233.57 g/kWh)
- Drip irrigation systems.
- Efficient agricultural processing equipment (subject to assessment – energy or water savings not less than 20%)
- Cold storages (thickness of insulation not less than 100 mm, COP of chiller not less than 1.7)

270. **Limited Liability Company "Microcredit Depository Organization "FINKA"".** "FINKA" LLC provides loans for agricultural development projects. The loan amount varies between TJS 8,000 and TJS 60,000. Loan maturity - up to 48 months. Grace period - up to 9 months. Lending terms: Surety or collateral. The farming business must be cost-effective.

271. **National Savings Bank "AMONATBONK".** AMONATBONK extends loans in the framework of the "Kishovarz-2021" agricultural program. The bank clients are eligible for soft terms of lending within the range of TSJ 3,000 to TJS 500,000, both in the national and foreign currencies for a term of 6 - 36 months at 18% per annum in national currency, 8% per annum in foreign currency. The monthly interest rate on loans in national currency is equal to 1.5%, in foreign currency - 0.66%.

272. Thus, in developing mechanisms of identification of investment requirements of dehqan and other farms, there is a need to establish a mechanism of insurance in the agricultural sector.

8.5. Brief summary of problem areas and institutional and technical guidelines

273. **Main problems:** Prior to 1991, the agricultural sector in Tajikistan had a significant potential of production facilities, agricultural equipment, and maintenance base, as well as large-scale infrastructure and public amenities, extensive networks of irrigation and drainage systems and structures, roads, and power transmission lines. Important organizations such as "Selkhoztekhnika" and "Selkhozkhimia" were active in the sector. But after the disintegration of

the Soviet Union, all the production facilities and farming machinery were privatized. Most of the dehqan and other farms were set up without sufficient material support.

274. The weak banking system, the underdeveloped structure of the sector logistics, the lack of a mechanism for subsidizing agricultural production, the new system of contracting (aggregate volume of supply and demand) for specific products, the absence of adequate infrastructure for agricultural marketing and the deficient regulatory framework, fail to ensure the right pace of development of the agricultural sector.

275. As for the sector's institutional framework, there are two organizations at the lower level: the Association of Dehqan Farms (ADF) and the Water Users Association (WUA). If the role of WUA in water allocation is clear, the responsibilities of ADF remain imperceptible as regards its advisory services to farmers.

276. The current agricultural production is neither cost-effective nor productive and fails to create sustainable jobs, which results in massive migration. Agricultural entities employ mostly women. children and old people.

277. The subsidies allocated by the government for agricultural development are insufficient. Farmers stay away from the decision-making processes. Although farmers are entitled to make a choice of crops for cultivation, they are not aware of the agricultural production plans. For example, at times it happens that not enough onions have been planted and their prices soar, and the following year almost all farmers would rush to grow onions, and the price would plummet. The same sort of thing happened to carrot growing in 2021, when carrot prices rose to TJS 10.

278. Rising prices for energy and other material resources required in the agricultural sector limits the ability of agricultural producers to carry out expanded replication and implementation of innovative projects, as well as the transition to new resource-saving technologies to ensure the implementation of models of accelerated economic development.

279. The territory of the Republic of Tajikistan is exposed to repeated natural disasters (such as droughts, floods, landslides), combined with the consequences of years of intensive application of fertilizers and chemicals, which leads to salinization and soil erosion, along with the illegal and intensive felling of trees and bushes throughout the country.

280. The adverse effects of climate change are most acutely experienced by the most vulnerable segments of the population, such as suffering from gender-related issues (especially in families where women are the breadwinners), age-specific factors, and disabilities. With this in mind, adaptation to climate change should be aimed primarily at reducing crop losses and increasing food production (by households and dehqan farms), mainly through improved natural resource management and energy conservation in rural areas with full-fledged participation in decision-making by vulnerable groups.

281. **Institutional and technical recommendations:**

1. With a view to strengthening the capacity in the field of institutional development, one of the priorities of agricultural policies should be the development of cooperative forms of activities, both for agricultural production and other areas of business, as well as creating the conditions for dehqan and other farms to learn from best practices in joint activities.

2. One more important point regarding institutional development consists in the need to set up a water-land association, which should have agrotechnical and irrigation services. Furthermore, this association should have services for marketing, processing, and sales of agricultural products. Communication with other water-land associations can be channeled through the Union of Water-Land Associations.

3. It is essential to introduce insurance coverage against natural disasters into the agricultural sector.

4. Long-term loans of up to 5 years with a grace period at low interest rates should be made available, as well as tax subsidies for the agricultural sector and improve storage and processing facilities for farming products.

5. Promote access of private farms to high-quality seeds, fertilizers and staple chemicals, as well as better availability of veterinary services and agricultural outreach services (plant protection, pest and disease control), while the government would monitor the quality of works and services.

6. Improve pasture management and expand forage crops planting areas.

7. Key measures for climate change adaptation.

- Broad-based application of successful practices of cooperative management of pastures and forests centered on rehabilitation and protection of natural resources, as well as recycling (reuse).
- Practical experimentation with sustainable methods of land cultivation (with minimized or zero tillage, lateral tillage on slopes, contour terracing, cover crops, the extensive use of organic fertilizers) to improve soil fertility and reduce the impact of chemicals and mineral fertilizers;
- Propagation of inexpensive water-saving and moisture-saving technologies, such as rainwater collection (by households, dehqan, and other farms), drip irrigation, mulching, etc.;
- Promotion of low-cost and locally available energy-saving technologies in rural areas, preservation of the ecosystem and creation of conditions for increased use of manure in lieu of its usage for fuel, and thereby contribute to increased agricultural productivity;
- Transition from single-crop farming to diversification and agrobiodiversity;
- Introduction of alternative (drought- and pest-resistant) crops;
- Improved livestock breeding (by using breeds resistant to temperature fluctuations);
- Interaction between grain crops and livestock production;
- Agroforestry;
- Integrated Pest Management (IPM);
- Development of home nurseries to produce the necessary seedlings and plantlets, with a special emphasis on cultivation of local (drought-resistant) species.

9. Climate change in Tajikistan

282. The global process of climate change is having strong negative impacts on the Republic of Tajikistan. The World Bank lists the Republic of Tajikistan as the most vulnerable country in Central Asia, which ranks first among Eastern European and Central Asian countries in terms of climate change vulnerability, given its low level of adaptation.

283. The Republic of Tajikistan ranks 111th among the 180 countries listed on the University of Notre Dame Global Adaptation Index. Tajikistan holds the 78th position among the most vulnerable countries and 52nd place amidst countries, less prepared for global climate change impacts. On the long-term climate risk index, Tajikistan comes in 29th[29].

284. Between 1940 and 2017, Tajikistan was exposed to temperature surges of 0.1ºC-0.2ºC each decade of the period. Days with temperatures of +40ºC and higher are growing in number. The

[29] National Strategy for Adaptation to Climate Change of the Republic of Tajikistan for the period up to 2030

strongest temperature hikes were registered in Dangar (1.2ºC) and Dushanbe (1.0ºC). The highland areas experienced a temperature increase of 0.3ºC-0.5ºC, while in the alpine zones it rose by 0.2ºC-0.4ºC[30].

285. The latest trends in warming recorded between 2001 and 2010, show that the average temperature in each decade was 0.8ºC higher than the average for areas situated at elevations between 1,000 and 2,500 m above sea level. In the alpine zone, the temperature increase recorded was 0.2ºC above normal. The temperatures were on average 0.1ºC-1.1ºC higher in winter, and 0.1ºC-1.3ºC above normal in spring. Autumn temperatures in all mountainous areas were 0.6ºC-1.1ºC above average.

286. Thus, by 2030, the average temperature increase is projected to reach 2.3°C. Average precipitations are expected to rise by 8 percent in areas over 2,500 m above sea level and drop by 3 percent in the highlands[31].

287. The Republic of Tajikistan, given its mountainous terrain, is more prone to natural disasters. More than 80% of natural disasters in Tajikistan are triggered by climate change. According to the official records, the total damage caused by natural disasters over the past 10 years, amounts to more than US$ 600 million. The analysis shows that the annual damage from climate change may increase from US$ 50.4 million in 2016-2020 to US$ 132.3 million by 2030[32].

288. Climate change risks and mitigation measures to reduce their impact on the population and the key sectors of the economy are important elements of the National Development Strategy of the Republic of Tajikistan for the period up to 2030.

289. The Republic of Tajikistan welcomes the international initiatives to combat climate change and has signed the Paris Agreement on the UN Convention on Climate Change in 2016 and ratified it in 2017 (SDG 13.a)

290. Given the high vulnerability of Tajikistan to climate change and natural disasters, the relevant strategic documents are currently being implemented, such as the National Strategy for Adaptation to Climate Change of the Republic of Tajikistan for the period up to 2030 and the National Strategy for Disaster Risk Reduction for 2019-2030, which outline the priorities and the key vectors of activities.

291. In this context, continuous and proactive risk management is required, including for the medium term, to reduce the expected risks associated with climate change. Hence, the Medium-Term Development Program of the Republic of Tajikistan for 2021-2025, which was developed on the basis of the National Development Strategy of the Republic of Tajikistan for the period up to 2030, envisages the realization of climate change adaptation plans laid out in the Action Plan for the implementation of the Medium-Term Development Program of the Republic of Tajikistan for 2021-2025.

9.1. Analysis of climate change in Sughd region

292. The Sughd region is an administrative province of the Republic of Tajikistan located in its northern part. The Sughd region was originally established 8 March 1938 as Leninabad district, from 1970 it existed as Leninabad region, and since 2000 - as the Sughd region within the Republic of Tajikistan with its administrative center in the city of Khujand. Its total land area is equal to

[30] Refer to the footnote 27

[31] Refer to the footnote 27

[32] National Strategy for Adaptation to Climate Change of the Republic of Tajikistan for the period up to 2030

25.4 thousand sq. km. To the north, north-east and west the region borders on the Republic of Uzbekistan, to the east - on the Kyrgyz Republic.

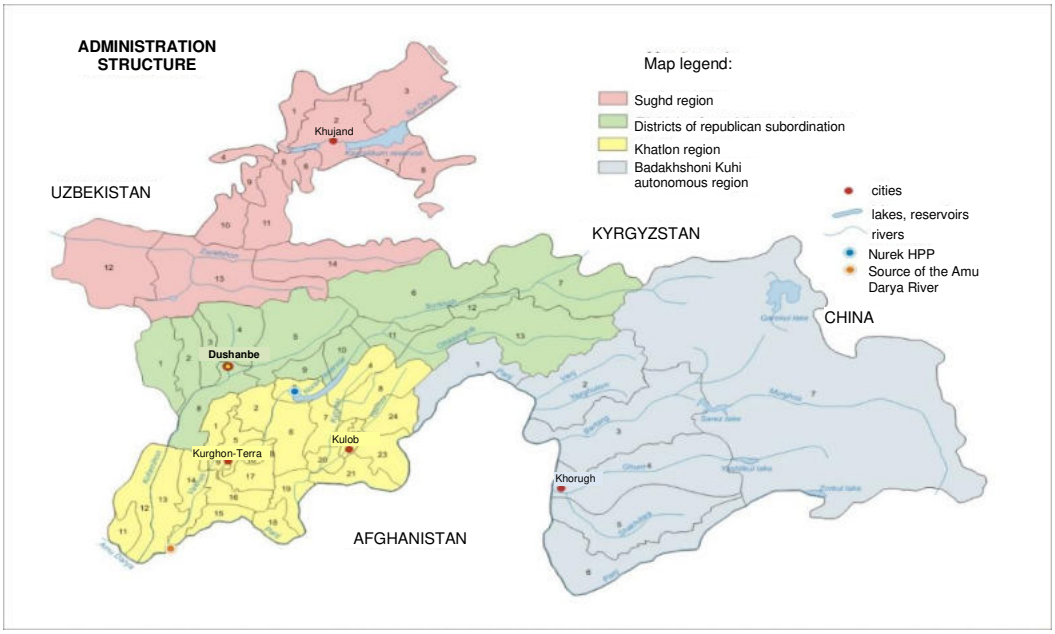


Figure 443. Map of the Republic of Tajikistan with regions and districts of republican subordination

293. The Sughd region consists of 18 cities and districts: Ayni, Asht, Bobojon Ghafurov, Devashtich, Zafarobod, Isfara, Istaravshan, Kanibadam, Mastchoh, Guliston, Gorno-Matchinsky, Penjikent, Spitamen, Khujand, Buston, Jabbor Rasulov, Shahristan and Istiklol. Population size of the region is 2,753.7 people.

294. The Sughd region is situated in the midst of the Tyan-Shan, Gissar and Alai Mountain ranges. In its northern part, there is the Kurama Range with an altitude of 3,769 m and the Mogoltau Mountains, in the southern part is the Turkestan Range with an altitude of 5,509 m, the Zarafshan Mountains, and somewhat to the north is the Gissar Range. The Zarafshan Valley divides the Zarafshan and Turkestan ranges.

295. The climate in the region is continental, dry, and varies with altitude. The average temperature in the valley for January is -1°C, in July +28 ... +29°C. At an altitude of 1,000 m, it is -4°C to +26°C. Precipitation in the mountains (up to a height of 1,000 m) is 400-500 mm; the average temperature in January (at an altitude of 2,500-3,000 m) is -9°C and in July +15°C, the total annual precipitation is up to 800 mm and more.

296. The main rivers running across the Sughd region are Syr Darya, Zarafshan, and Isfara, as well as the Khojabakirgan, Aksu, and Isfana rivers. There are reservoirs in the region. They are: Bakhri Tojik, Farkhad, Daganasay and Kattasay reservoirs.

297. According to the Water Code of the Republic of Tajikistan, the Sughd region is divided into the following two basin zones, including: Syr Darya and Zarafshan basin zones.

298. In accordance with the Basin Water Resource Management and Protection Plan for the Tajik part of the Syr Darya River Basin, the Syr Darya Basin Zone, in turn, is divided into 6 basin sub-zones, which cover the areas shown in the below table.

Table 20. Distribution of districts in Syr Darya River sub-basin zones

#	Sub-basin zones	Districts
1.	Asht-Syrdarya	Asht
2.	Samgar-Mirzoravat	B. Ghafurov
3.	Matcha-Syrdarya	Matcha
4.	Istarafshan	Istaravshan, Devashtich, Shahristan, Zafarabad
5.	Khojabakirgan-Isfana-Aksui	B. Ghafurov, J. Rasulov, Spitamen
6.	Isfarin	Isfara, Kanibadam

299. The Zarafshan Basin zone in turn encompasses the following districts: Gorno-Matchin, Ayni and Penjikent.

300. **Syr Darya Basin zone.** The climate in the Syr Darya Basin zone is dry, sharply continental, and prolonged frost-free periods. The warm period (with air temperatures above 5°C) lasts 270 days at altitudes of 300-400 m, and drops to 200 days at an elevation of 2,000 m. The period with a temperature of 10°C extends for 230 to 160 days, respectively. The average monthly temperatures in July range from +27° to +30° C, with maximum levels as high as +46°C.

301. The cold period (below -5° C) lasting from 90 to 140 days can be observed at altitudes of 300 to 2,000 m. Real winter with temperatures below 0°C, lasts from 30 to 100 days. Moderate to medium frosts of -17° to -22° C prevail. In areas at altitudes of 900 - 1,000 m, winter is very mild, moderately frosty, with little snowfall. Average temperatures in January range from -4° to -5°C. Winter is characterized by volatile weather, with minimum temperatures dropping down to between -25 and -30°C, but in some winter days warm weather sets in, and daytime temperatures may rise to +14 - +20°C. The snow cover is short-lived, about 30 days per year.

302. One distinctive peculiarity of the valley is its insufficient availability of precipitations. Their annual volume is 230-270 mm in the valleys and more than 500 mm on the mountain slopes. In terms of the average annual moisture content (humidity), the region, in its areas located at altitudes of 800-900 m, is classified as dry, while at higher elevations it is characterized as semi-arid. During the year, humidity conditions vary strongly. The most humid period is late fall-winter-early spring, and the driest season is summer-early autumn.

303. Soil dryness in the lower valley areas sets in as early as in the first decade of May, with higher altitudes shifting the start of its onset to a later date. One unwelcome feature of the local climate is the strong winds that occur in the gorge of the Fergana Valley in the Khujand district. The winds blow at 30-35 m/s. On average, there are from 23 (in Buston) to 42 (in Khujand) days with strong winds (≥15 m/s). In Khujand, the maximum duration of strong winds is 85 days. Only 30-36 days without sunshine are observed in a year.

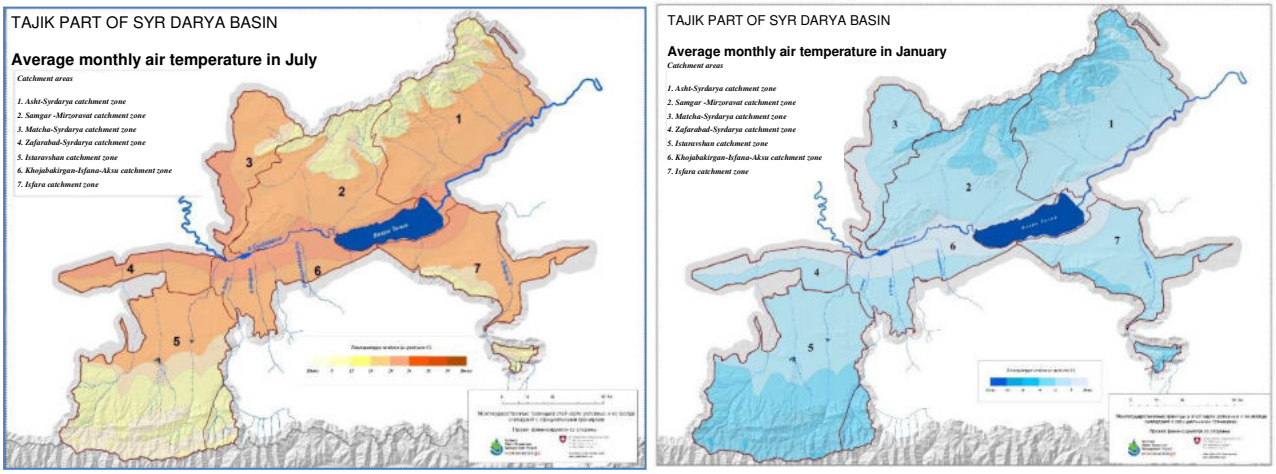
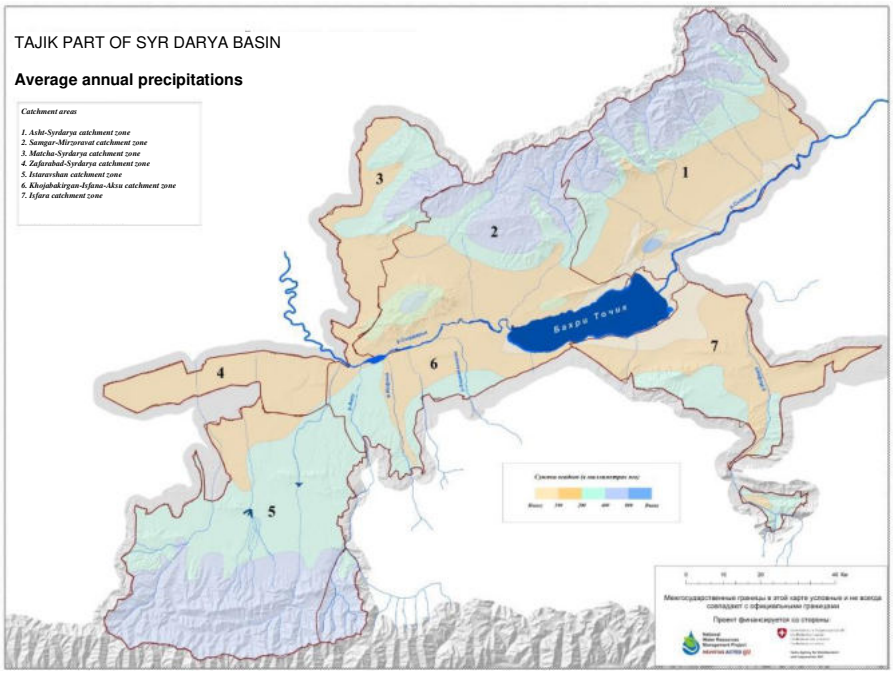


Figure 454. Average monthly air temperature in July and in January[33]

304. In accordance with the Basin Water Resource Management and Protection Plan for the Tajik part of the Syr Darya River Basin, the analysis during the period of instrumental monitoring shows that in 1961-2010 progressive increases in air temperature were observed. The trend to air temperature growth demonstrates the rates of 0.2^0C to 0.5^0C. In Khujand the pattern of temperature increases is registered at about 0.8°C to 1.0°C.

305. The evolution of precipitation rates in the valley part of the Syr Darya River basin during the period of instrumental observations escalated from 10 to 90 mm. This increase was mainly observed in the Asht-Syrdarya, Samgar-Mirzaravat, Matcha-Syrdarya, Istaravshan, and Isfara sub-basin zones. In the area of the Khojabakirgan-Isfana-Aksu sub-basin zone, a decline down to 10 mm, was registered in the precipitations. A particularly noticeable drop in precipitations of down to 40 mm was observed in the Istaravshan sub-basin zone.



[33] Source: River Basin Plan on using and protection of water resources of Tajik part of the River Basin of Syr Dariya River

Figure 465. Average annual precipitations in the Syr Darya River basin[34]

306. According to the National Communication on climate change in Central Asia, climate change scenarios for the period up to 2030 were elaborated.

Table 21. Climate change scenarios for the period up to 2030

Scenarios up to 2030	Temperature changes	Precipitation changes
Hot-dry	$+4^0$C	-5.4%
Medium	$+3^0$C	2.7%
Warm-humid	$+1.5^0$C	9.2%

307. According to the climate forecasts for the period up to 2030, gradual increases of air temperature from 0.5°C to 3°C will be observed in the Syr Darya River basin. Climate change models show precipitations increased by 5 to 20% over the period up to 2030 for the entire Syr Darya River basin. Due to an increase in air temperatures, an added precipitations will be observed during the cold period of the year. The likelihood of heavy local precipitations also increases in spring and summer. Scenarios and conclusions presented in the National Communications on Climate Change of all Central Asian countries suggest that the flow modes of the most important rivers may change as a result of warming, and the water resources may shrink by 10-20% or more, by the middle or late twenty-first century.

308. Under this pan-out, the following changes in runoff volumes should be expected in the Syr Darya basin.

- The "Hot & Dry" scenario: by 2030 the temperatures are expected to increase by +4°C, and precipitation rates - to drop by 5.4%, while the expected runoff of the Syr Darya River would decline by 171.5 million m³ (by 5.4%) by 2030.
- The "Medium" scenario: by 2030 the temperatures are expected to increase by +4°C, and precipitation rates - to grow by 2.7%, while the runoff of the Syr Darya River basin would grow by 85.6 million m³ (+2.7%).
- The "Warm & Humid" scenario: by 2030 the temperatures are expected to rise by +1.5°C, and precipitation rates - to increase by +9.2 %, while the expected runoff of the Syr Darya River basin would add another 292.1 million m³ (+9.2 %).

309. **Disaster risks, attributable to climate change impacts in Syr Darya River Basin.** According to the Committee of Emergency Situations and Civil Defense of the Government of the Republic of Tajikistan, during 1997-2018, approximately 3,460 cases of natural disasters were reported in Tajikistan, including 90% of natural disasters or an average of 70 cases per year caused by mudslides, with about 35 deaths every year. Next in line are avalanches, which happen 27 times each year, and account for an average of six deaths per year. Ranking third are earthquakes, which occur with increasing frequency of 23 cases, claiming 2 lives every year.

[34] Source: River Basin Plan on using and protection of water resources of Tajik part of the River Basin of Syr Dariya River

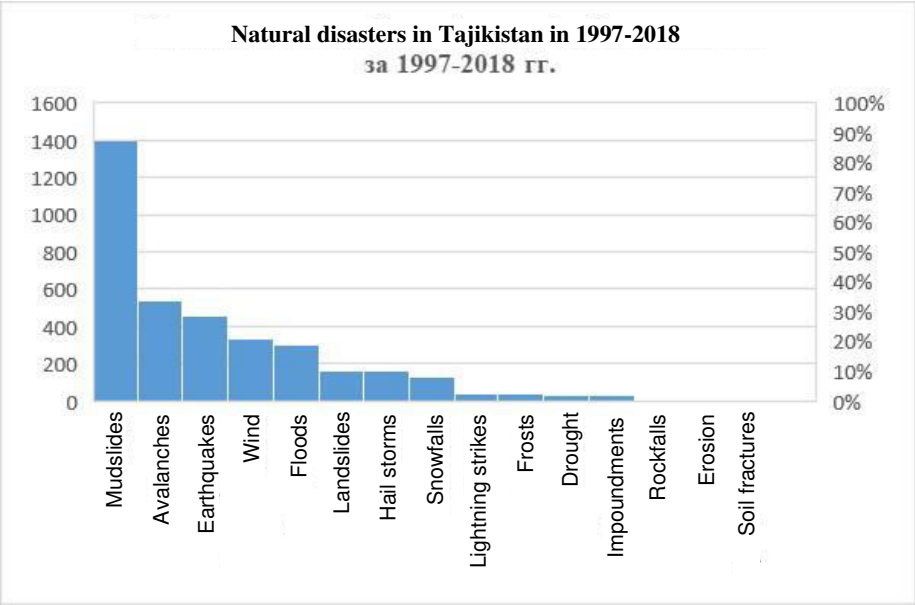


Figure 36. Natural disasters in Tajikistan in 1997-2018[35]

310. In the Syr Darya Basin zone, 77% of such events represent landslides, mudslides and floods. Most of the above hazardous geohydrological phenomena that occur in the Syr Darya River basin are observed in the foothill areas of Asht-Syr Darya, Istaravshan, Khojabakirgan-Isfana-Aksu, and Isfara sub-basin zones. Mudslides are particularly frequent events on the southern slope of the Kuramin mountain range in the Asht district. The highest mudslide activity is observed in April (35% of all mudslides) and in May (28%).

311. In the Isfara and Isfana-Khodjabakirgan-Aksu sub-basin zones, water is formed from the high-altitude snow cover and glaciers in Kyrgyzstan, hence the flooding and mudslide periods in these sub-basin zones occur from May to July months.

312. **Zaravshan Basin zone.** The Zarafshan River basin is situated in the center-western part of Tajikistan, between Turkestan and Gissar mountainous ranges. The Zeravshan valley stretches from East to West between high mountain ranges of Turkestan in the northern part, and Gissar - in the southern part. The Zeravshan mountain range passes almost in parallel along the Gissar and Zeravshan ranges.

[35] Source: National Strategy of the Republic of Tajikistan for Disaster Risk Reduction for 2019-2030.

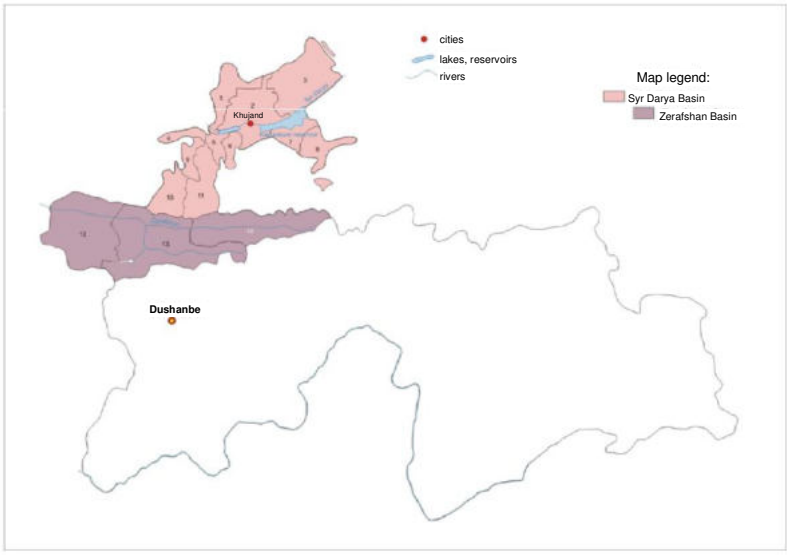


Figure 477. Syr Darya and Zeravshan basin zone in the Sughd region.

313. In terms of geography, its mountainous part (upstream Zeravshan River) is part of the Penjikent district from the West, Ayni district in the center and Gorno-Matchin district from the East. All the districts are within the southern part of the Sughd region of Tajikistan.

314. The Tajik part of the Zeravshan River Basin covers the above-mentioned mountainous areas of the Sughd region, where water resources are mainly formed, and the water dispersion zone, the valley portion of the basin is located in the neighboring Uzbekistan, where the river runoff is taken up completely for irrigation, water supply and other utility needs. The length of the Zeravshan River is 877 km, the catchment area - 12.3 thousand square km, and its annual water flow volume is equal to 5.3 billion km^3.

315. The climate in the Zeravshan Valley is subtropical intra-continental, characterized by hot summers and moderately cold winters. The average annual temperature in the lowlands is +18.0°C, while in the mountainous area it is 12.7°C. The average temperature in January in the lowlands is -1.1°C, and in the hillside, it is -3.5°C. The average temperature in July in the plains is +29.0°C, and in the mountains - +20.0°C. The absolute cold minimum temperature was registered at -35°C, the absolute maximum temperature was at +57°C. The average annual precipitation rate in the valley ranges from 114 to 400 mm, incremental from west to east. Most of the precipitations occur in spring and in autumn. The vegetation period lasts within 215 to 220 days.

316. Based on the assessment of the climate change risks and vulnerabilities at the local level - Zeravshan River Basin - Tajikistan D-1.7, as part of the Climate Adaptation and Mitigation Program for Aral Sea Basin (CAMP4ASB), with view to strengthening the adaptive capacity and resilience to climate change in Central Asia, developed for the Regional Environmental Center in Central Asia, the following two climate change impact scenarios were analyzed: RCP 4.5 and RCP8.5[36].

317. RCP, or Representative Concentration Pathway, is the trajectory of greenhouse gas concentrations (not emissions) adopted by the IPCC. Four pathways were used for climate modeling and research for the 2014 IPCC Fifth Assessment Report (AR5). These pathways

[36] Source: Assessment of risks and vulnerability to climate change at the local level - the basin of the river. Zeravshan - Tajikistan. Regional Environmental Center in Central Asia (CAREC) 2021

describe different options for the future climate, all considered possible depending on the amount of greenhouse gases (GHGs) emitted in the coming years. RCPs - originally RCP2.6, RCP4.5, RCP6, and RCP8.5 - are labeled after a possible range of radiative forcing values in the year 2100 (2.6, 4.5, 6, and 8.5 W/m², respectively).

318. The climate change impact assessment is based on a comparison of the average value for the period 1960-1990 and simulated data for scenarios of 4.5°C and 8.5°C temperature increases. Classification is performed using a system of percentile classes. The score ranges from 6-1 for the most negative impact to -1 to -6 for a positive impact.

Improvement-Vulnerability-Deterioration

Figure 38. Scores of the system of percentile classes[37]

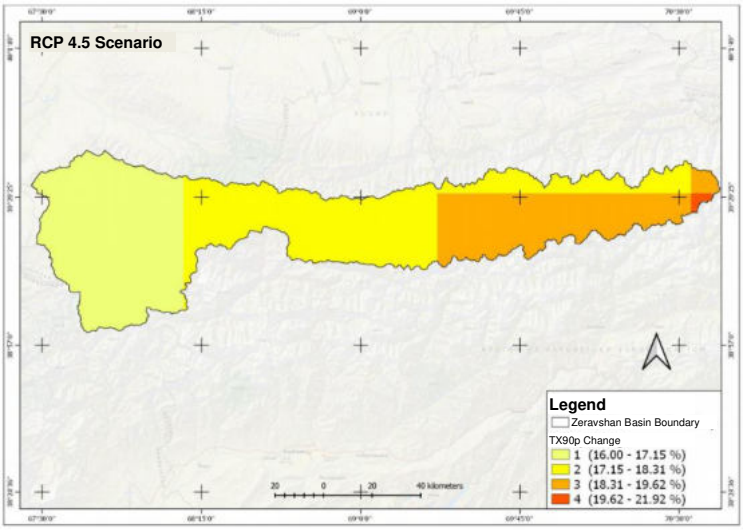


Figure 39. Change in the heat duration of the projected change in the percentage of warm daylight hours > 90% (TX90p) by 2050, compared to the baseline for 1960-1990[38]

319. According to the findings of the survey, the extreme maximum temperature in the area of Penjikent is expected to rise by up to 3°C. The duration of droughts in the area is expected to increase according to the RCP4.5 scenario by up to 4 days.

[37] Refer to the footnote 34

[38] Refer to the footnote 34

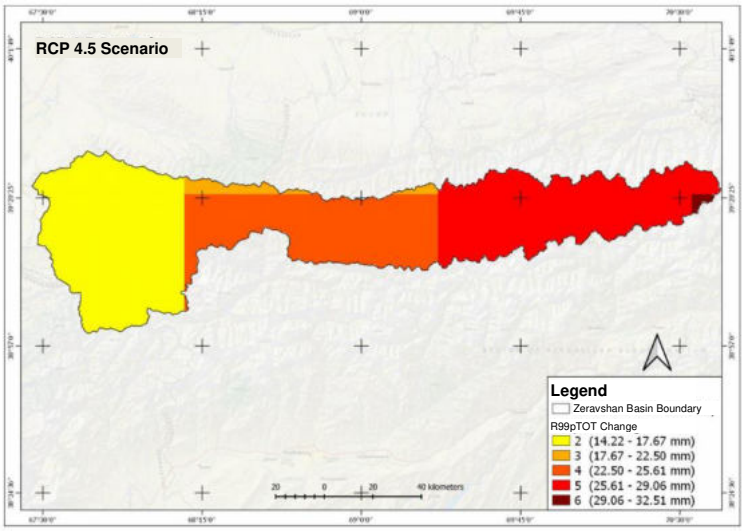


Figure 40. Extreme precipitations in the context of the projected change in very rainy days are equal to > 99% (R99p) by 2050, compared to the baseline for 1960-1990[39]

320. Increased precipitation in Penjikent and Ayni district is offset by higher heat waves and, consequently, by evaporation and longer duration of droughts.

321. Increased precipitations will hit the Gorno-Matchin district. The increase in precipitations, however, will be mostly in the form of heavy showers. The growing season duration has increased, but since heat waves and drought are the strongest constraints, no effective climate improvement can be expected from this phenomenon.

322. **Disaster risks, attributable to climate change impacts in Zeravshan River Basin.** The city of Penjikent is the most vulnerable to natural disaster risks in the Zeravshan River basin, with Ayni and Gorno-Matchin districts ranking next in line.

323. Based on long-term observations, the most frequent natural disasters in the city of Penjikent are mudslides, which are responsible for the bulk of such calamities. Mudslides are mainly generated from March to May, and when triggered they inflict tremendous damages. The area of mudslides is home to the following rural jamoats: Amondara, Voru, Shing, Yorui, Kosatarosh, Khalifa Hasan, Rudaki, Suchina, Mogiyon, Khurmi, Loik Sherali and Farob. There are more than 20 villages in these areas.

324. Heavy rains may trigger floods in the Zarafshan River, and people living in locations along the river banks will be exposed to the risk of being flooded. Landslides in the forested foothills, also represent a threat to human settlements. Landslide risks have been revealed in the rural jamoats of Mogiyon, Khurmi, Rudaki, and Voru. Populated areas situated around the Fann mountains are prone to potential rockfalls.

325. Strong winds and frosts are also frequent phenomena, which cause serious material damage to the agricultural infrastructure and population in the area. In other words, almost all rural jamoats in Penjikent are located in the zone of multiple disaster-related risks year-round.

326. According to the findings of the Commission on Emergency Situations, 51 various natural disasters occurred in the district during 2009-2019, which killed 32 people and caused damages worth in excess of TJS 39 million.

[39] Refer to the footnote 34

327. In the Ayni district, the number of natural disasters, mostly mudslides, landslides, avalanches, and frosts that occurred in 1997 - 2018, totaled 49 and resulted in 22 deaths. The areas of 36 villages of the district are located in the disaster risk zone.

328. Given its mountainous terrain, almost the entire Gorno-Mastchin district is located in the high disaster risk zone and are exposed to potential mudslides, floods, avalanches, landslides and rockfalls.

9.2. Climate change impact on basin zones

329. The sectors in the Syr Darya and Zeravshan river basins, particularly vulnerable to climate change impacts, are water management, energy, agriculture and forestry sectors, as well as transport, healthcare, education, migration, emergency response and civil defense services, which fact affects socioeconomic developments of the Sughd region as a whole.

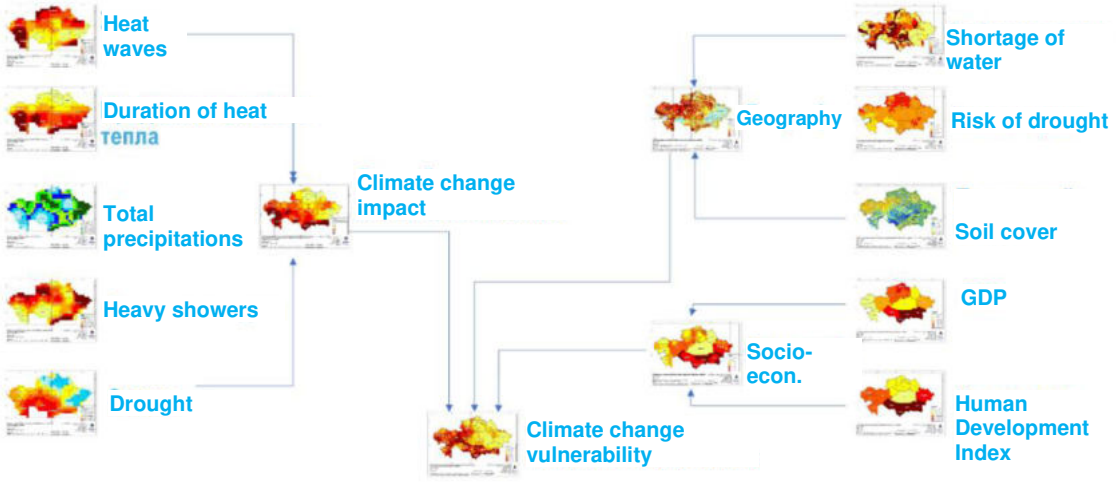


Figure 41. Assessment of climate change risks and vulnerabilities[40]

330. Given below are the key nature-induced factors of climate change impacts on various sectors.

Table 22. Nature-induced factors of climate change impact on various sectors.

Sectors	Mudslides	Floods	Landslides	Avalanches	Rockfalls	Strong winds	Heat waves	Melting glaciers	Frosts	Drought	Pests (locust, etc.)	Hail storms	Dust storms	GWL rise	Degradation of pastures
Water sector															
Energy															
Agriculture															
Forestry															

[40] Refer to the footnote 34

Transport															
Education															
Migration															
Emergency response and civil defense															

331. As can be observed in the table, almost all sectors are exposed to various natural disasters triggered by global climate change.

9.3. Climate change adaptation

332. The National Strategy for Adaptation to Climate Change of the Republic of Tajikistan for the period up to 2030 highlights 66 adaptation projects for all above-mentioned sectors, in particular 15 projects for the water sector, 8 projects for the energy sector, 13 projects for the agricultural sector, 14 projects for the transport sector, 16 projects for cross-sectoral activities.

333. The National Strategy for Disaster Risk Reduction of the Republic of Tajikistan for 2019-2030, adopted in 2018, is a strategic document aimed at reducing the existing and preventing new risks of natural disasters through ramping up the national disaster risk management capacity.

334. Four key tasks are addressed to ensure the achievement of this objective. For each of the tasks listed below, specific pathways are identified with relevant policy measures:

- Reduce by 2030 the number of fatalities, injured people, and damage caused by natural disasters, compared to the period 2005-2015;
- Ensure access to disaster risk information for all stakeholders;
- Integrate disaster risk management efforts into the development processes;
- Improve mechanisms of preparedness and response to natural disasters;

335. The Action Plan for implementation of the Medium-Term Development Program of the Republic of Tajikistan for 2021-2025 approved by the Resolution of the Government of the Republic of Tajikistan dated 30 April 2021, # 168, outlines the activities related to environmental protection, adaptation to climate change and disaster risk management for 5 years, specifies investment needs for each year and designates the ministries and agencies responsible for the implementation of their relevant program components. The sources of funding are specified as the national budget, donors, and private sector investors.

336. Overall, for the activities related to environmental protection, adaptation to climate change, and disaster risk management for the period 2021-2025, 55 activities are envisaged to be carried out with funding provided in a total amount of TJS 600.7 million, including TJS 36.5 million (6.1%) coming from the Government of Tajikistan and TJS 564.2 million (93.9%) from the donors. No financial contributions are expected from the private sector.

Table 23. Activities and national budget allocations of the Republic of Tajikistan for environmental protection, adaptation to climate change and disaster risk management

#	Activity	Number of activities	Total budget for 5 years, TJS ,000,000	Incl. government funds, TJS ,000,000	Incl. donor funds, TJS ,000,000	Incl. private funds, TJS ,000,000
1.	Environmental Protection and adaptation to climate change	27	532.3	12.2	520.1	0.0
	Including in percentage, %		100.00	2.3	97.7	0.0
2.	Disaster risk management	28	68.4	24.3	44.1	0.0
	Including in percentage, %		100.00	35.5	64.5	0.0
	Grand total	**55**	**600.7**	**36.5**	**564.2**	**0.0**
	Including in percentage, %		**100.00**	**6.1**	**93.9**	**0.0**

Source: Medium-term development programs of the Republic of Tajikistan for 2021-2025

337. In accordance with the Medium-Term Development Program of the Republic of Tajikistan for 2021-2025, districts, cities and regions must develop their own 5-year plans for the socio-economic development. The medium-term development program will be the main performance indicator in achieving certain objectives for the districts, cities, and regions.

10. Conclusions and recommendations

338. Based on the above analysis, it can be concluded that the reclamation and irrigation sub-sector plays a key role in the development of the agricultural and manufacturing industries in the Sughd region. However, the irrigation and drainage infrastructure facilities in the region, built in the 60-70s of the past century, can no longer operate steadily and require urgent rehabilitation and upgrade. It is particularly relevant to the pumping stations, whose coverage area in the region accounts for about 75% of the entire irrigated area.

339. The pumping stations in the region annually consume about 1 billion kWh of electric power, which, given the systematic growth of charge rates for electricity, requires the implementation of an automated system for metering power consumption by the pumping stations.

340. Moreover, the global climate change impacts increase this sector's vulnerabilities amid the population growth and the need to ensure food security in the region and nationwide.

341. The reclamation and irrigation sub-sector is not cost-effective; on the one hand, farmers have debts on payments for water supply services, while on the other hand, amounts collected for water supply services do not cover the costs of maintenance and operation of the water management facilities and electricity bills.

342. The Government of the Republic of Tajikistan subsidizes some portion of payments for electricity and also borrows funds from international financial institutions in the form of grants and loans for rehabilitation and improvement of the pumping stations and other water management facilities. However, to improve the current situation, there is a need for drawing up a development plan for the reclamation and irrigation sector, complete with a financial plan for the rehabilitation of water management facilities.

343. For the Zafarabad district, the following observations should be made:

- Unstable operation of the pumping stations in the Zafarbad district, owing to the long period of service, the pumping and power installations wear out and break down.
- Growth of population contributing to increased food and water consumption.
- Low efficiency of irrigated agriculture, degradation of some of the irrigated lands persists reducing the productivity of water and land assets.
- Deteriorated condition of the irrigation systems, waterlogging, and salinization of soils.
- 3 pumping stations of the Zafarabad irrigation system are completely out of service.
- Annual growth of accounts payable to SRIA.
- Low charge rates for water supply services.
- For lack of funding, the DNWs are not cleaned up on a timely basis, which leads to deterioration of the land reclamation condition.
- Financial and economic performance indicators of the state-owned water management facilities are still in poor shape, resulting in inadequate operation and maintenance of the pumping equipment, mainline canals, DNWs, and VDWs.

344. To improve water availability in the district, the following works should be performed:

1. Strengthening of the material base of the Zafarabad SRIA.
2. Rehabilitation and upgrade of the pumping stations, as well as replace vertical and horizontal pump units and electric motors, in line with new energy-saving technologies in all pumping stations of the district. Replace the high-pressure pipes in the pumping stations.

3. Restoration of the low-capacity pumping stations KV-1, DVGNS and GPS-3/GPS-3a, which can provide water supply according to the irrigation schedule and, thereby, enable control water supply amounts both at the beginning and at the end of the vegetation period, to ensure saving of water and power consumption.

4. Refurbishment and operation of the system of automated water distribution for the TM-1, TM-2, and TM-4 canals.

5. Clean-up of the DNWs and rehabilitation of the existing VDWs.

6. Conversion of the stony lands into the category of perennial plantations.

7. Adoption of water-saving technologies (drip irrigation of orchards, etc.).

8. On high-altitude lands, replacement of crops with less hydrophilous varieties.

9. Geological surveys and evaluation of the groundwater resources should be carried out, and only based on the analysis, recommend drilling of new vertical drainage wells.

10. Merging the smaller WUAs into larger-scale associations.

345. Expected results following the completion of the above works:

1. Improved condition of the pumping station units, higher efficiency of the pumps and electric motors. More stable operation of the pumping-power plants.

2. Improved reclamation condition of the lands. Increased agricultural and industrial production output.

3. New jobs available for the population.

4. Improved water availability for irrigated lands.

5. Higher flow efficiency of the canals and uniform distribution of water among the WUAs.

6. Improve water flow metering and record-keeping systems.

7. Reduced costs of power consumption by the pumping stations.

8. Higher productivity of water and land resources.

9. Reuse of recirculated water.

10. Improved financial and economic condition of SRIAs.

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Appendix 1

Table 1. Distribution of the population between urban and rural settlements (in % for 2015-2019)

	2015		2016		2017		2018		2019	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Tajikistan	26.4	73.6	26.3	73.7	26.4	73.6	26.3	73.7	26.2	73.8
Sughd region	24.8	75.2	24.8	75.2	24.8	75.2	24.7	75.3	24.7	75.3
Zafarabad	56.8	43.2	57.3	42.7	57.9	42.1	58.2	41.8	58.5	41.5

Source: Agency on Statistics under the President of the Republic of Tajikistan, Population of the Republic of Tajikistan as of January 1, 2020

Table 2. Comprehensive per capita income of Sughd population, as of 1 January for 2014 - 2019 (in TJS)

Description	2014	2015	2016	2017	2018	2019
Total	396.35	380.01	418.52	500.60	496.15	543.11
including:						
Earned income*	193.39	196.96	244.80	271.08	256.02	306.26
Pensions, allowances, scholarships, compensatory payments, including charity aid	19.04	20.30	22.74	27.48	26.24	33.41
Income derived from property and sale of real estate	0.05	0.01	0.83	0.54	1.23	0.62
Income from household farming/gardening	65.74	70.62	51.18	68.22	51.71	51.12
Miscellaneous cash proceeds (including income from commercial activities and private professional services)	118.13	92.12	98.97	133.28	160.95	151.70

* Consumer incomes, including in-kind proceeds

Source: Statistical Yearbook of the Sughd region for 2020

Table 3. Overall summary of population migration results for 2014-2019

	2014	2015	2016	2017	2018	2019
All population of Sughd region						
Number of new arrivals	7420	7325	6183	6298	6972	7803
Number of outgoing migrants	11157	11045	9753	10009	10905	11563
Migration trend						
incoming (+)						
outgoing (-)	-3737	-3720	-3570	-3711	-3933	-3760
Urban population						
Number of new arrivals	3732	3756	3198	3043	3306	3710
Number of outgoing migrants	4634	4494	4179	4123	4483	4656
Migration trend						
incoming (+)						
outgoing (-)	-902	-738	-981	-1080	-1177	-946
Rural population						
Number of new arrivals	3688	3569	2985	3255	3666	4093
Number of outgoing migrants	6523	6551	5574	5886	6422	6907
Migration trend						
incoming (+)						
outgoing (-)	-2835	-2982	-2589	-2631	-2756	-2814

[1]*Migration of population - movement of people (migrants) across the borders of regions resulting in their relocation and change of residence.*

Source: Statistical Yearbook of the Sughd region for 2020

Table 4. Gross agricultural production output in prices of 2018 (TJS ,000)

	2014	2015	2016	2017	2018	2019
Farms of all forms of ownership						
Total, including:	6567929.9	6795608.2	7335705.3	9590397.3	9949167.9	8091657.8
Vegetable growing	5043036.0	5152572.8	5561922.3	1826471.5	1929937.1	5728504.4
Livestock breeding	1524893.9	1643035.4	1773783.0	7763925.8	8019230.8	2363153.4
Fishery	3745.5	5392.1	5442.8	6103.0	6,480	7510.5
Including the agricultural enterprises						
Total, including:	544913.8	628613.7	615738.7	484227.2	704246.0	1090807.2
Plant growing	480596.8	551506.9	542253.0	142134.4	175871.2	683820.1
Livestock breeding	64316.9	77106.8	73485.7	342092.8	528374.7	406987.1
Fishery	3327.6	3895.7	3605.7	4280.0	4543.8	5532.1
including the dehqan farms						
Total, including:	2662598.4	2693254.2	3265366.7	1412168.4	1504835.61	3496389.3

Plant growing	2593813.4	2616758.3	3180341.2	1025131.3	1143025.7	3404526.1
Livestock breeding	68785.0	76495.9	85025.5	387037.0	361809.9	91863.2
Fishery	417.9	681.0	371.4	305.0	178.7	490.1
Including households						
Total, including:	3360417.6	3473740.4	3454599.9	7694001.3	7740086.34	3504461.0
Plant growing	1968625.6	1984307.7	1839328.1	659205.8	611040.2	1640157.9
Livestock breeding	1391792.0	1489432.6	1615271.8	7034795.5	7129046.1	1864303.1
Fishery	0.0	815.3	1465.7	1518.0	1757.5	1488.3

Table 5. The cropland areas owned by all farms in the Sughd region in 2014-2019 (in thousands of hectares)

Description	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Total cropland area	264.6	268.4	270.5	270.9	272.6	274.8
including:						
Grain and legume crops	123.7	132.4	132.9	126.3	119.2	120.2
- wheat	48.3	49.9	53.1	48.5	44.9	46.5
- barley	55.0	56.6	56.3	54.1	51.6	51.0
- rice	7.3	7.8	8.8	9.1	8.5	8.9
- grain and legume crops	4.7	5.7	4.4	5.0	5.4	4.8
- Technical crops, including:	60.9	53.1	53.9	61.9	67.0	67.6
- cotton	51.9	42.8	44.2	50.8	57.2	58.4
- oilseed crops	4.9	5.6	4.2	4.1	4.7	4.1
including crown flax	0.6	0.4	0.4	0.5	0.8	0.7
Potatoes	11.9	13.9	14.9	16.1	20.3	22.4
Vegetables	11.0	14.5	15.5	16.2	17.8	15.9
Melons and gourds	6.0	7.3	6.1	6.1	4.9	5.7
Feed crops	51.1	47.1	47.1	44.3	43.2	43.0
including: perennial grass	29.2	29.8	29.9	27.4	26.3	28.5
- silo crops (net of corn)	8.3	6.8	7.2	7.0	5.9	5.1
- corn for silo and green corn	13.6	10.5	10.0	9.8	11.0	9.2
- sugar beet for livestock	0.03	0.02	0.03	0.06	0.03	0.06
Cropland for fruit and berry plantations (including citric)	62.2	63.2	66.1	64.6	70.7	69.3
Cropland for vineyards of all age groups	11.1	11.6	11.6	11.7	11.9	12.3

Source: Statistical Yearbook of the Sughd region for 2020

Table 6. Gross harvest of agricultural crops in the Sughd region for 2014-2019, thousand tons

	2014	2015	2016	2017	2018	2019
Wheat including:						
- in original - credited weight	232,7	300,2	311,6	310	272,4	331,7
- in weight after modification	227,1	295,2	298,4	295,1	268,9	328,2

Cotton - raw	100,2	76,6	87,5	120,3	113,3	130,3
Potato	325,6	335,8	334,9	324,9	416,0	450,3
Vegetables	381,5	440,3	457,9	480,3	517,3	494,9
Melons	109,0	138,4	118,5	132,9	113,8	127,5

Source: Statistical Yearbook of the Sughd region for 2020

Table 7. Gross yield and crop productivity of fruits, berries and grapes for all categories of farms operating in the Sughd region, for 2014-2019 (in thousands of tons)

Description	2014	2015	2016	2017	2018	2019
Gross harvest of fruits and berries	114.6	49.1	112.7	123.7	139.3	150.9
Grapes	59.3	51.9	55.5	57.1	61.4	61.7
Crop productivity, in hundred kilos per hectare						
- fruits and berries (including citric)	27.5	11.4	24.9	27.6	27.8	29.2
- grapes	66.3	54.7	56.5	55.6	56.9	56.2

Source: Statistical Yearbook of the Sughd region for 2020

Table 8. Average yield of agricultural crops in the Sughd region in all categories of management for 2014-2019 c/ha

Title	2014	2015	2016	2017	2018	2019
Cereal crops:	19,7	22,3	23,2	23,7	22,4	26,9
Cotton - raw	19,3	17,9	19,8	23,7	19,9	22,5
Potato	266,8	240,0	229,7	201,3	204,9	200,5
Vegetables	279,5	269,9	268,5	270,5	265,2	277,2
Melons	171,9	186,0	189,9	206,2	226,1	214,7

Source: Statistical Yearbook of the Sughd region for 2020

Table 9. Development of livestock and poultry farming by all agricultural businesses in the Sughd region over the period in 2014-2019 (in thous of chickens)

	2014	2015	2016	2017	2018	2019
Farms of all forms of ownership						
Cattle	601.8	623.9	634.3	641.9	646.9	665.6
including cows	321.6	333.0	339.9	344.2	346.4	356.3
Pigs	0.5	0.5	0.3	0.2	0.2	0.1
Sheep	980.2	1034.4	1058.9	1089.5	1100.9	1125.0
Goats	413.0	432.3	441.8	431.6	442.2	447.3
Horses	8.3	8.2	8.4	8.5	8.5	8.4
Poultry	1562.4	1684.8	1635.5	1719	2728.2	4322.1

Agricultural farms						
Cattle	7.7	5.8	5.4	5.3	5.3	5.6
including cows	2.3	1.8	1.7	1.7	1.6	1.7
Sheep	17.8	11.8	12.5	12.3	12.0	12.3
Goats	39.8	36.7	36.1	35.5	36.0	37.7
Horses	1.0	0.8	0.8	0.8	0.9	0.7
Poultry	799.1	875.3	810.9	928.7	1873.1	3534.5
Private subsistence farms						
Cattle	555.2	577.0	587.0	594.4	599.1	616.7
including cows	307.6	319.0	325.9	330.0	332.2	342.1
Pigs	0.5	0.5	0.3	0.2	0.2	0.1
Sheep	857.8	902.1	927.2	957.1	967.2	990.5
Goats	324.9	342.0	349.8	339.1	348.7	352.5
Horses	6.1	6.0	6.1	6.2	6.2	6.3
Poultry	721.3	693.2	726.5	689.5	696.1	728.6
Dehqan farms						
Cattle	38.9	41.1	41.9	42.2	42.5	43.4
including:	11.7	12.2	12.4	12.5	12.5	12.6
Sheep	104.6	120.4	119.1	120.1	121.7	122.2
Goats	48.2	53.5	55.9	57.0	57.4	58.0
Horses	1.2	1.4	1.4	1.4	1.3	1.3
Poultry	42.0	115.9	98.1	99.8	158.9	59.0

Table 10. Output of livestock products by farm categories in Sughd Region for 2014-2019.

	2014	2015	2016	2017	2018	2019
Farms of all forms of ownership						
Meat (live-weight), tons	43554	48131	53346	54584.4	56507.1	58648.6
Milk, tons	229491	239014	249779	255594.4	264901.2	269224.9
Eggs, thousand eggs	125101	142144	151144	167555.8	222707.5	429919.3
Wool (physical mass), tons	1307	1375	1469	1479	1514.3	1516.3
Agricultural farms						
Meat (live-weight), tons	1048	1056	764.6	1025.9	1055.4	2979.1
Milk, tons	2884	2343	2693.9	2844.4	2635.8	2408.5
Eggs, thousand eggs	96650	111868	111114	110658.6	163848	381785.6
Wool (physical mass), tons	62	56	45	44	44.7	44.8
Private subsistence farms						
Meat (live-weight), tons	40954	45239	50445	51378	53213.1	53621
Milk, tons	211453	220517	230239	235340.8	244467.7	248566.8
Eggs, thousand eggs	25742	27553	35223	48699.9	50948.1	43078
Wool (physical mass), tons	1072	1135	1219	1217	1245.2	1241.6
Dehqan farms						
Meat (live-weight), tons	1551	1836	2137	2180.5	2238.60	2048.5
Milk, tons	15154	16154	16846	17409.2	17797.2	18249.6
Eggs, thousand eggs	2710	2723	4807	8197	7911.4	5055.7
Wool (physical mass), tons	173	184	206	217.6	224.4	229.9

Table 11. Output of industrial production in kind in the Zafarabad district

Description	Unit of meas.	2012	2013	2014	2015	2016	2017	2018	2019
Construction bricks	thsd pcs	–	–	431.6	435.6	475.2	1103.1	117.1	1158.7
Cotton, fiber	tons	6574.3	7449.4	6374.0	5913.6	6175.2	7921.5	10223	10541.2
Meat, including by-products, 1st category	thsd tons	–	–	–	–	633.4	1069.8	1043.6	1152.0
Whole-milk products in milk equivalent	tons	–	–	89.8	159.0	148.1	239.4	355.2	136.0
Vegetable oil	tons	658.8	594.2	448.1	274.3	404.4	566.2	459.1	617.9
Confectionary products	tons	–	–	39.4	85.0	87.0	117.4	120.5	146.2
Soft drinks	dL	–	–	–	300.0	–	–	–	–

Source: Statistical Yearbook of Zafarabad region for 2020

Table 12. Gross agricultural output (in prices of each reporting year, thousand somoni)

Title	2011	2012	2013	2014	2015	2016	2017	2018	2019
All categories of farms									
In total, including:	153042	184259	189935	250378	253221	359886	445932	465947	450639
crop production	107250	133335	145507	185401	180211	291618	372221	390204	369646
animal husbandry	47792	50924	44428	64977	73010	68268	73711	75743	80993
Agricultural enterprises									
In total, including:	12318	22727	25571	25951	15673	24437	25184	43986	23642
crop production	11814	22154	24290	25636	15639	24245	25131	43850	20340
animal husbandry	504	573	1281	315	34	192	53	136	3302
Dekhkan farms									
In total, including:	76989	99741	103181	113257	115832	233312	289781	284762	321365
crop production	74993	97761	101353	110404	113017	230654	287003	281871	318219
animal husbandry	1996	1980	1828	2853	2815	2658	2778	2891	3146
Population									
In total, including:	63735	61792	61183	111170	121717	102136	130967	137199	105631
crop production	20443	13421	19863	49361	51555	36718	60087	64484	31086
animal husbandry	45292	48371	41320	61809	70162	65417	70880	72715	74545

Source: Statistical Yearbook of Zafarabad region for 2020

Table 13. Total land and farmland areas

	2011	2012	2013	2014	2015	2016	2017	2018	2019
Total land area	44097	44097	44097	44097	44097	44097	44097	44097	44097
Including farmland areas	34027	33575	33575	33575	33575	33575	33575	33577	33602
Including ploughland	31068	30909	30766	30708	30597	30573	30513	30700	30926
Including perennial plantations	642	801	960	1177	1288	1312	1140	1192	1064
Including pastures	732	732	732	732	732	732	732	732	732

Including fallow lands	1133	1133	1117	958	958	958	958	952	880

Source: Data of the Zafarabad District Committee for Land Management

Table 14. Cropland areas owned by all farms in 2012-2019 (in hectares)

	2012	2013	2014	2015	2016	2017	2018	2019
Total cropland area, including:	28150	29190	28876	29330	29586	30051	30168	30640
Grain and legume crops, including:	5851	6015	6400	7378	7307	6037	5787	5768
- wheat	2349	2136	2677	2838	3083	2874	2705	2447
- barley	2312	2440	2630	2955	2840	2125	2118	2292
- rice	206	246	205	285	335	274	205	223
- grain and legume crops	239	364	108	197	239	204	193	162
- Industrial crops, including:	13597	12848	11238	10151	11168	14341	15303	15400
- cotton	12407	11671	10310	8810	9325	12433	14056	14354
- oilseed crops	1190	1177	928	1341	1835	1908	1245	1046
including crown flax	19	7	7	8	8	5	2	–
Potatoes	77	123	129	138	135	138	188	235
Vegetables	618	901	442	634	683	541	621	571
Melons and gourds	1419	1187	1932	1888	1299	1328	1163	1223
Feed crops	6562	8106	8732	9142	8994	7666	7106	7443
- Perennial grass (mown area of past years' crops and current open sowing)	4520	5428	6243	7033	7747	6357	5387	6285
- Silo crops (net of corn)	69	22	41	62	7	–	–	–
- Corn for silo and green corn	1973	2296	2448	2044	1240	1309	1719	1158
Cropland for fruit and berry plantations (including citric) of all age groups	778	935	1107	1194	1207	1090	1175	1068
Cropland for vineyards of all age groups	122	142	188	193	198	161	194	35

Table 15. Gross yield of agricultural crops provided by all categories of farming businesses in 2012-2019 (in thsd tons)

Description	2012	2013	2014	2015	2016	2017	2018	2019
Grain by weight, as initially entered into records	5.9	10.2	12.0	13.5	14.6	12.7	12.5	14.3
Raw cotton	18.3	20.4	18.8	12.8	20.0	27.1	28.2	28.7
Potatoes	1.5	1.5	1.3	1.6	1.6	1.2	2.1	2.7
Vegetables	11.3	11.5	8.8	11.1	11.7	8.3	8.4	8.1
Melons and gourds	21.2	18.8	30.3	30.5	22.0	23.9	19.9	21.0
Gross harvest of fruits and berries	1379	1504	1505	178	653	669	1069	1210
Grapes	184	214	224	51	89	99	150	169

Source: Statistical Yearbook of Zafarabad region for 2020

Table 16. Average yield of agricultural crops provided by all categories of farming businesses in 2012-2019 (in hundred kilos per hectare - c/ha)

	2012	2013	2014	2015	2016	2017	2018	2019
Grain crops, including:	10.5	16.8	18.7	18.3	19.6	21.0	21.6	24.9
- Grain by weight as initially entered into records	10.5	16.8	18.7	18.3	19.6	21.0	21.6	24.9
- Weight after follow-up processing								
Raw cotton	15.0	17.5	18.3	14.6	22.0	21.7	20.2	20.9
Potatoes	175.5	118.4	101.4	118.3	119.2	90.2	111.7	115.9
Vegetables	169.6	126.0	197.5	175.2	170.5	153.8	135.2	143.3
Melons and gourds	153.5	157.3	156.6	161.3	165.7	179.6	171.1	171.4
- Fruits and berries (including citric)	29.7	30.7	32.2	3.9	14	14.1	16.4	17.4
- Grapes	18.9	22.3	20.2	4.6	8.5	10.6	13.5	10.4

Source: Statistical Yearbook of Zafarabad region for 2020

Table 17. Productive livestock per categories of farming businesses in Zafarabad district for 2012-2019

thsd animals

	2012	2013	2014	2015	2016	2017	2018	2019
Farms of all forms of ownership across district								
Cattle	30124	30326	30348	32217	32220	32294	32391	32867
including cows	17638	18151	18909	20001	20081	20060	20095	20146
Sheep	52220	45370	46050	50433	50016	50742	50768	51928
Goats	11580	12906	13152	13962	14409	13812	14474	14433
Horses	213	205	184	195	195	195	176	180
Poultry	77073	79209	53649	61933	54377	50761	54615	87390
Agricultural enterprises								
Cattle	55	55	57	57	51	51	9	7
including cows	17	17	16	16	15	15	4	4
Sheep	130	110	98	80	70	96	104	96
Goats	50	47	64	60	80	234	214	160
Horses	–	–	4	4	4	2	2	2
Poultry	25504	25628	–	7750	590	–	–	35000
Private subsistence farms								
Cattle	28096	28298	28365	30217	30217	30287	30376	30843
including cows	17188	17701	18489	19561	19631	19610	19645	19696
Sheep	50706	43950	44840	49207	49176	49252	49309	50395
Goats	11372	12539	12554	13367	13398	13398	13460	13468
Horses	186	178	158	169	169	169	150	153
Poultry	46210	47787	47852	47886	47990	44361	42908	43212
Dehqan farms								
Cattle	1973	1973	1926	1943	1952	1956	2006	2017
including cows	433	433	424	424	435	435	446	446
Sheep	1384	1310	1112	1146	770	1394	1355	1437
Goats	158	320	534	535	931	180	800	805
Horses	27	27	22	22	22	24	24	25
Poultry	5359	5794	5797	6297	5797	6400	11707	9178

Source: Statistical Yearbook of Zafarabad region for 2020

Table 18. Output of livestock products by farm categories for 2012-2019

	2012	2013	2014	2015	2016	2017	2018	2019
Farms of all forms of ownership								

Meat (live-weight), tons	1414	1417	1441	1548	1664	1697	1724	1905
Milk, tons	12153	12273	12574	13896	14282	14746	14924	15078
Eggs, thousand eggs	2373	3168	1835	1185	1352	1329	1416	2179
Wool (physical mass), tons	59	59	59	59	59	61	63	47
Agricultural enterprises								
Meat (live-weight), tons	9	1	5	1	8	3	5	180.6
Milk, tons	1	1	2	2	5	1	6	1.9
Eggs, thousand eggs	1209	2042	554	2	123	–	–	321
Wool (physical mass), tons	–	–	–	–	–	–	–	–
Private subsistence farms								
Meat (live-weight), tons	1365	1367	1391	1498	1613	1645	1670	1681
Milk, tons	11433	11541	11841	13150	13520	13980	14123	14265
Eggs, thousand eggs	1164	1126	1141	1155	1220	1240	1245	1412
Wool (physical mass), tons	57	57	57	57	57	59	60	44.5
Dehqan farms								
Meat (live-weight), tons	40	49	45	50	43	49	49	43.4
Milk, tons	719	731	731	744	757	765	795	812
Eggs, thsd	–	–	140	30	9	89	171	446
Wool (physical mass), tons	2	2	2	2	2	2	3	3

Source: Statistical Yearbook of Zafarabad region for 2020

Table 19. Livestock and poultry productivity in agricultural enterprises and dehqan farms across the district for 2012-2019

Description	2012	2013	2014	2015	2016	2017	2018	2019
Average milk yield per cow, kg								
Total across district	1600	1758	1765	1768	1803	1860	1916	1947
Average egg yield per bird, pcs								
Total across district	134	118	89	4	39	32	55	73
Average wool clip per sheep (physical mass, kg)								
Total across district	1.4	1.5	1.5	1.6	1.7	1.7	1.2	1.1

Source: Statistical Yearbook of Zafarabad region for 2020

Table 20. Total land area and areas of agricultural land

	2011	2012	2013	2014	2015	2016	2017	2018	2019
Total land area	44097	44097	44097	44097	44097	44097	44097	44097	44097
Of these, all agricultural land	34027	33575	33575	33575	33575	33575	33575	33577	33602
Incl. arable land	31068	30909	30766	30708	30597	30573	30513	30700	30926
Incl. perennial plantations	642	801	960	1177	1288	1312	1140	1192	1064
Incl. pastures	732	732	732	732	732	732	732	732	732
Incl. deposits	1133	1133	1117	958	958	958	958	952	880

Source: Statistical Yearbook of Zafarabad region for 2020

Annex 2

Inventory of pumping station in Sughd region and installed models of electric power meters

Total number	Number per districts	Pumping stations	Water source	Status	Year of commissioning	Models of power meters
Asht SRIA						
1	1	ANS # 1	Syr Darya River	Inter-farm	1979	Mercury 230
2	2	ANS # 2	M-1 canal	Inter-farm	1979	DSS(x)666
3	3	ANS-2D		Inter-farm	1987	DSS(x)666
4	4	ANS # 3	Intake chamber # 3	Inter-farm	1983	DSS(x)666
5	5	ANS # 3D		Inter-farm	1979	SAZU-I670M
6	6	ANS # 3V		Inter-farm	1979	SAZU-I670M
7	7	ANS # 4	Intake chamber # 4	Inter-farm	1983	DTSD-178
8	8	ANS # 5	Intake chamber # 5	Inter-farm	1987	DTSD-178
9	9	GKNS # 2R	Canal head	Inter-farm	1989	Mercury 230
10	10	Bahmal NSP # 2		Inter-farm	1991	Conservation
11	11	Chumruk-Jar	v. Syr Darya	Inter-farm	1980	DTSD-178
		SNP		Inter-farm	1995	DTSD-178
12	12	NFC Ibragimov	c. NFC	Inter-farm	1985	Conservation
13	13	GKNS-1	c. NFC # 1	Inter-farm	1982	DTSD-178
14	14	GKNS-2		Inter-farm	1988	Conservation
15	15	Etiteppa # 1	v. Syr Darya	Inter-farm	1985	Conservation
16	16	Etiteppa new	v. Syr Darya	Inter-farm	1989	DTSD-178
17	17	Etiteppa-VV		Inter-farm	1989	Conservation
18	18	Etiteppa # 2		Inter-farm	1985	Conservation
19	19	Juga	Canal	Inter-farm	1977	Mercury 230
20	20	Asht # 1	c. NFC	Inter-farm	1959	Mercury 230
21	21	Pravda # 1	c. H-1	Inter-farm	1983	Conservation
22	22	Pravda # 3	c. NFC	Inter-farm	1983	Mercury 230
23	23	Pravda # 4		Inter-farm	1983	DSS(x)666
24	24	NFC-1	c. NFC	Inter-farm	1985	Mercury 230
25	25	NFC-2		Inter-farm	1985	Mercury 230
26	26	NFC farm		Inter-farm	1992	Mercury 230
	26					
SRIA Chabor Rasulov						
27	1	Dehmoi # 1	Syr Darya River	Inter-farm	1965	SA3U-I670M
28	2	Dehmoi # 2	c. DMK	Inter-farm	1971	SA3U-I670M
29	3	Dehmoi # 3		Inter-farm	1998	SA4U-I672M
30	4	Dehmoi # 4		Inter-farm	1971	SA3U-I670M
31	5	Rodnik # 1	DIGM	Inter-farm	1961	SA4U-I672M
32	6	Rodnik # 2	Collector	Inter-farm	1972	SA4U-I672M
33	7	Tomji-Soi # 1	Syr Darya River	Inter-farm	1983	SA4U-I672M
34	8	Tomji-Soi # 2	Collector	Inter-farm	1986	SA4U-I672M
35	9	HB # 4	MK HB-2	Inter-farm	1970	SA3U-I670M
	9					
SUE Khojabakirgan						
36	1	Madaniat	c. Selkan	Inter-farm	1983	Conservation
37	2	Kara-Kamar	c. Selkan	Inter-farm	1984	Mercury 230

38	3	Selkan # 0	c. Selkan	Inter-farm	1972	Mercury 230
39	4	Selkan # 1		Inter-farm	1965	Mercury 230
	4					
SRIA Isfara						
40	1	50 Anni. Oct. Rev.	Isfara River	Inter-farm	1968	Mercury 230
41	2	Matpari # 1	Isfara River	Inter-farm	1982	Mercury 230
42	3	Matpari # 2	c. Matpari	Inter-farm	1989	CA3Y-B670M
43	4	Kirov	K-2	Inter-farm	1973	CA3Y-B670M
44	5	Isfara-Lakkon	K-2	Inter-farm	1983	CA3Y-B670M
45	6	100th Lenin Anni.	K-2	Inter-farm	1980	CA3Y-B670M
46	7	Navruz	K-2	Inter-farm	1989	CA3Y-B670M
47	8	Oftobrui # 1	K-1	Inter-farm	1964	CA3Y-B670M
48	9	Oftobrui # 2	Intake chamber	Inter-farm	1977	CA3Y-B670M
49	10	Shorsu	K-2	Inter-farm	1964	Mercury 230
50	11	Bedak	Isfara River	Inter-farm	1989	Mercury 230
	11					
SRIA Kanibodom						
51	1	Mahram-0	Syr Darya River	Inter-farm	1977	Conservation
52	2	Mahram-1		Inter-farm	1975	Mercury 230
53	3	Mahram-2V	Canal	Inter-farm	1981	Mercury 230
54	4	60 Anni. Oct. Rev.	Canal	Inter-farm	1971	Mercury 230
55	5	Poimannaya	Collector	Inter-farm	1983	SA4U-I672M
56	6	D-1	Collector	Inter-farm	1962	CE6803 VER32
57	7	D-2		Inter-farm	1979	SA4U-I672M
58	8	D-4		Inter-farm	1963	Mercury 230
59	9	D-5		Inter-farm	1964	Mercury 230
60	10	D-6		Inter-farm	1968	SA4U-I672M
61	11	D-7		Inter-farm	1966	Mercury 230
62	12	Yakkaterak	Collector	Inter-farm	1986	SA4U-I672M
63	13	Chigdalik (Nur)			2001	SET-4TTM.03
64	14	Niyozbek			1995	Conservation
65	15	Novostroika	Collector		1990	SA4U-I672M
	15					
SRIA Spitamen						
66	1	Novaya	Syr Darya River	Inter-farm	1986	Mercury 230
67	2	Nau # 1		Inter-farm	1956	SA3U-I670M
68	3	Nau # 2	MV-1	Inter-farm	1957	DSS(x)666
69	4	Nau # 3	MK	Inter-farm	1982	DSS(x)666
70	5	Tajikistan # 0	Collector	Inter-farm	1980	Mercury 230
71	6	Tajikistan # 1		Inter-farm	1980	Mercury 230
72	7	Farhod # 5	Collector	Inter-farm	1980	Mercury 230
73	8	Farhod # 6	MV-1	Inter-farm	1983	CE6803 VER32
74	9	VDK-Kalinin	VDK	Inter-farm	1971	Mercury 230
75	10	Mehnat # 1	Syr Darya River	Inter-farm	1982	SA3U-I670M
76	11	Mehnat # 2	MK-1	Inter-farm	1982	SA3U-I670M
77	12	Mehnat # 3	MK-2	Inter-farm	1983	Mercury 230
78	13	MK-Guliston	MK-1	Inter-farm	1987	SA3U-I670M
	13					

Total number	Number per districts	Pumping stations	Water source	Status	Year of commissioning	Models of power meters
SRIA Ayni						
79	1	Sangiston	Zarafshon River	Inter-farm	1977	Mercury 230
80	2	Pump. Sangiston	Zarafshon River	Inter-farm	1988	DTS 607
81	3	Varz # 1	Zarafshon River	Inter-farm	1978	Mercury 230
82	4	Pump. Varz # 1	Zarafshon River	Inter-farm	1989	Mercury 230
83	5	Varz # 2	v. Varz-Hashtsar	Inter-farm	1978	DTS 607
84	6	Karktuda	Mastchoh River	Inter-farm	1988	DSS(1980s)666
85	7	Ustoobid # 1	Zarafshon River	Inter-farm	1987	SA4U-I672
86	8	Ustoobid # 2	Zarafshon River	Inter-farm	1987	Out of service
87	9	Obburdon	Mastchoh River	Inter-farm	1990	Out of service
88	10	Shifiti Rarz	Rarz-soi	Inter-farm	2013	
	10					
SRIA Bobojon Ghafurov						
89	1	Oktosh # 0	v. Syr Darya	Inter-farm	1952	SA4U-I672
90	2	Oktosh # 1		Inter-farm	1967	HXF300
91	3	Oktosh # 2	Canal	Inter-farm	1968	SA3U-I670M
92	4	Oktosh # 3		Inter-farm	1968	SA3U-I670M
93	5	Kzil Tukai # 1	v. Syr Darya	Inter-farm	1946	SA4U-I672
94	6	Kzil Tukai # 2		Inter-farm	1976	HXF300
95	7	Farhod # 1	Collector	Inter-farm	1975	HXF300
96	8	Farhod # 2			1975	HXF300
97	9	Farhod # 3			1980	HXF300
98	10	Farhod # 4		Inter-farm	1984	HXF300
99	11	Negmatov Sumchak	Syr Darya River	Inter-farm	1987	SA3U-I670M
100	12	Sumchak # 2	MK	Inter-farm		SA3U-I670M
101	13	Sumchak-3			2014	
102	14	Samgar # 1	res. Kairakum	Inter-farm	1958	Mercury 230
103	15	Samgar # 2	MK-2	Inter-farm	1959	SA3U-I670M
104	16	Samgar # 3	MK-3	Inter-farm	1960	SA3U-I670M
105	17	Shurkul	res. Kairakum	Inter-farm	1980	SA4U-I672
106	18	Kaptulyuk # 1	Syr Darya River	Inter-farm	1972	P34S02
107	19	Kaptulyuk (New)		Inter-farm	1972	P34S02 CT
108	20	Hoja Bakirgan # 0	Collector	Inter-distr.	1974	DTSD178
109	21	Hoja Bakirgan # 1	res. Kairakum	Inter-distr.	1958	DTSD178
110	22	Hoja Bakirgan # 2	Intake chamber	Inter-distr.	1958	DTSD178
111	23	Hoja Bakirgan # 3	MK HB-2	Inter-distr.	1964	SET-4TTM.03
112	24	GFC	GFC	Inter-distr.	1956	SA4U-I672
113	25	Horizontal # 1	Collector	Inter-farm	1968	P34S02
114	26	Horizontal # 2		Inter-farm	1968	CT TOO 40374064-01-2006
115	27	Isfisor # 2	GFC	Inter-farm	1972	SA4U-I672
116	28	LZOS	MKL HB-2	Inter-farm	1976	Mercury 230
117	29	I. Kokhirov			1970	
118	30	Yava-Aral # 1	Syr Darya River	Inter-farm	1959	HXF300
119	31	Yava-Aral # 2	Intake chamber	Inter-farm	1961	HXF300
120	32	Yubileinaya # 1	Collector	Inter-farm	1987	Mercury 230
121	33	Yubileinaya # 2		Inter-farm	1987	SA3U-I670M
	33					

SRIA Zafarabad						
122	1	GPS-1	Diversion canal	Inter-farm	1962	DTSD178
123	2	GPS-2		Inter-farm	1962	DTSD178
124	3	GPS-3		Inter-farm	1976	Out of service
125	4	GPS-3a		Inter-farm	1976	Out of service
126	5	DVGNS	Canal	Inter-farm	1977	DTSD178
127	6	KV-1	Canal	Inter-farm	1984	Out of service
128	7	CPS-1	Canal	Inter-farm	1994	DTSD178
129	8	CPS-2		Inter-farm	1994	DTSD178
130	9	CPS-3		Inter-farm	1994	Mercury 230 AR
131	10	CPS-4		Inter-farm	1994	Mercury 230 AR
132	11	Leninabad		Inter-farm	1975	Mercury 230 AR
133	12	40 Anni. of Tajikistan		Inter-farm	1976	DSS(1980s)666
134	13	GPS-4		Inter-farm	1975	Mercury 230 AR
135	14	Pahtakor		Inter-farm	1986	Out of service
	14					
SRIA Istaravshan						
136	1	Sufi Orif	Mainline canal	Inter-farm	1984	
	1					
SRIA Maschoh						
137	1	BPS - old	VKD canal	Inter-farm	1958	SA3U-I670M
138	2	BPS-1a		Inter-farm	1972	SA3U-I670M
139	3	BPS-2	DMK-1	Inter-farm	1972	SA3U-I670M
140	4	BPS-2a		Inter-farm	1983	SA3U-I670M
141	5	BPS-3		Inter-farm	1983	SA3U-I670M
142	6	BPS-1b	Zhdanov canal	Inter-farm	1985	SA3U-I670M
143	7	VK-3	DMK-2	Inter-farm	1985	SA3U-I670M
144	8	VDK-Lenin	VK-3	Inter-farm	1959	Out of service
145	9	VKD-Zhdanov	VKD	Inter-farm	1986	SA3U-I670M
146	10	DM-1	DMK-1	Inter-farm	1988	SA3U-I670M
147	11	DM-2		Inter-farm	1973	SA4U-I672
148	12	BPS 0	VDK	Inter-farm	1961	SET3
149	13	YaNS-1	VDK	Inter-farm	1960	SET3
150	14	YaNS-2	YaMK-1	Inter-farm	1960	SET3
151	15	YaNS-3	YaMK-2	Inter-farm	1974	SA3U-I670M
152	16	YaNS-4	YaMK-3	Inter-farm	1974	SA3U-I670M
153	17	YaNS-5	YaMK-4	Inter-farm	1973	SA3U-I670M
154	18	YaKS	VKD	Inter-farm	1984	SA4U-I672
	18					
SRIA Penchakent						
155	1	Nilufar-1	v. Zarafshon	Inter-farm	1990	DSS(1980s)666
156	2	Nilufar-2	Canal	Inter-farm	1991	SA3U-I670M
157	3	Nilufar-3	Canal	Inter-farm	1992	SA3U-I670M
158	4	Urech	valley Urech	Inter-farm	1994	SA3U-I670M
159	5	H. Bedak	c. H. Hasan	Inter-farm	1992	Mercury 230
160	6	Novobad	c. Margidar	Inter-farm	1987	DTS 854
161	7	Rudaki	c. Margidar	Inter-farm	1991	DTS (x) 607
162	8	Chomi	v. Zarafshon	Inter-farm	1987	Out of service
163	9	Leningrad-1	v. Zarafshon	Inter-farm	1973	SA3U-470M
164	10	Leningrad-2	v. Zarafshon	Inter-farm	1986	Mercury 230
165	11	D. Kalon-1	c. Chertuk	Inter-farm	1988	SA3U-I670M

166	12	D. Kalon-2	c. Chertuk	Inter-farm	1988	SA3U-I670M
167	13	Garibak	v. Zarafshon	Inter-farm	1986	Mercury 230
168	14	Margedar-1	c. Margedar	Inter-farm	1970	SA3U-470M
169	15	Margedar-3	c. Margedar	Inter-farm	1970	SA3U-470M
170	16	Dupuli	v. Zarafshon	Inter-farm	1968	SA3U-I670M
171	17	Yori-1	v. Zarafshon	Inter-farm	1970	DTSD-178
172	18	Yori-2	c. Yori	Inter-farm	1972	DTSD-178
173	19	D. Kozy	v. Zarafshon	Inter-farm	1987	Out of service

Annex 3

Water outlets within the WUA catchment area and Jamoats along TM-1 canals in Zafarabad district

#	Sectors		Irrigated land area, ha	WUAs	Jamoats
	Old code numbers	Current code numbers			
1	B-1-1	ы/о-1	1112	Zulol	A. Jami
2	B-1-2	-//- 2			
3	B-1-3	-//- 3			
4	B-1-4	-//- 4			
5	B-1-5	-//- 5	820	Navbunyod	
6	B-1-6	-//- 6			
7	B-1-7	-//- 7			
8	B-1-8	-//- 8			
9	B-1-9	-//- 9			
10	B-1-10	-//- 10			
11	B-1-11	-//- 11			
12	B-1-12	-//- 12			
13	B-1-13	-//- 13	812	Chashma 2016	
14	auxiliary	-//- 13[1]			
15	B-1-14	-//- 14			
16	B-1-15	-//- 15			
17	auxiliary	-//- 15/1			
18	auxiliary	-//- 15/2			
19	C-1-T-1	-//- 16			
20	C-1-T2	-//- 17			
21	auxiliary	-//- 17/1			
22	C-1-T-3	-//- 18			
23	C-1-T-4	-//- 19	620	M. Abdulloev	Mehnatobod
24	auxiliary	-//- 19/1			
25	C-1-T-5	-//- 20			
26	auxiliary	-//- 21			
27	auxiliary	-//- 21/1			
28	auxiliary	-//- 21/2			
29	СГ-14	-//- 22			
30	auxiliary	-//- 22/1			
31	СГ-Т-6	-//- 23			
32	auxiliary	-//- 23/1			

33	C-1-T-6	-//- 24			
34	auxiliary	-//- 24/1			
35	auxiliary	-//- 24/2			
36	auxiliary	-//- 24/3			
37	СГ-16	-//- 25			
38	auxiliary	-//- 25/1			
39	C-1-T-8	-//- 26	287	Ganj 2015	
40	auxiliary	-//- 26^1			
41	auxiliary	-//- 26^2			
42	C-2-T-1	-//- 27			
43	auxiliary	-//- 27/1			
44	auxiliary	-//- 27/2			
45	СГ-Т-2	-//- 28			
46	СГ-18	-//- 29	550	Mehnatobod 2018	
47		-//- 29/1			
48	auxiliary at PS Leningrad	-//- 29/2			
49	C-2-T-3	-//- 30			
50	auxiliary	-//- 30/1			
51	auxiliary	-//- 30/2			
52	ВД-7-2	-//- 31			
53	СГ-19	-//- 31/1			
54	C-2-T-4	-//- 31/2			
55	auxiliary	-//- 31/3	500	Zafar	Zafarobod
56	C-2-T-K	-//- 32			
57	auxiliary	-//- 32/1			
58	auxiliary	-//- 33			
59	ВК-4-1	-//- 34			
60	C-2-7-7	-//- 35			
61	C-1-T-2	-//- 36			
62	auxiliary	-//- 37	160	Dehqon-2014	
63	СГ-2	-//- 37/1			
64	C-2-T-8	-//- 38			
65	auxiliary	-//- 38/1			
66	auxiliary	-//- 38/2			
67	auxiliary	-//- 38/3			
68	auxiliary	-//- 38/4			
69	auxiliary	-//- 38/5			
70	auxiliary	38/6	1962	Kanz	H. Aliev
71	auxiliary	38/7			

72	auxiliary	38/8			
73	P-T-1	39			
74	auxiliary (Iskandar)	39/1			
	auxiliary				
75	P-T-2	40			
77	auxiliary	41/1			
79	C-Г-12	42			
80	Л-P-3 (Chashma)	43			
81	P-T-4 (Don)	44			
82	Л-P-49 (Kyrgyz)	45			
83	P-T-5 (Jalol)	46			
84	auxiliary (village-1)	46/1			
85	auxiliary	46/2			
86	auxiliary	46/3			
87	auxiliary	46/4			
88	ЗТ-1 (Sarimsolik)	47			
89	auxiliary (village-5)	47/1			
90	auxiliary	47/2			
91	C- Г- 4 (Baraka)	48			
92	З-T-2 (Sifon)	49			
93	auxiliary (Safar)	49/1	520	Pahtakor	Ravshan
94	auxiliary (Orchard)	49/2			
95	C-Г-5	50			
96	З-T-3	51			
97	C-Г-6	52	477	Vahdat	
98	C-Г-7	53			
99	auxiliary	53/1			
100	Д-T-1 (Mastchoh)	54			
101	Д-T-2 (Rajabiyon)	55	1200	Obi Haet	
102	Д-T-3 (Hoji)	56			
103	auxiliary	57			
104	auxiliary	57/1			
105	auxiliary	57/2			
106	У-T-1 (Olimov)	58			
107	auxiliary	58/1			
108	У-T-2 (Shoim)	59			
109	auxiliary (Zafar)	59/1			

110	auxiliary (Nishon)	59/2			
111	У-Т-3 (Boshmonbobo)	60			
112	У-Т-4 (Ashurov)	61			
113	auxiliary	61/1			
114	Л-П-Т	62	1021	Obshor	
115	У-Т-5	63			
116	У-Т-6	64			
117	ТМ-1 release	65			
118	У-Т-7	62			
119	3-4-1				
120	3-4-2				
121	3-4-3				
122	3-4-4				
123	3-4-5				
124	3-4-6				
125	3-4-7				
126	3-4-8				
127	3-4-9				
128	3-4-10				
129	3-4-11				
130	3-4-12				
	Grand total		10041		

Annex 4

Water outlets within the WUA catchment area and Jamoats along TM-2 canal in Zafarabad district

#	Outlets		Irrigated land area, ha	WUAs	Jamoats
	Old code numbers	Current code numbers		Zulol	A. Chomi
	Pipelines CPS-1 to CPS-3		368		
1	B-2-1	ы/о-1	74	Sarob	
2	B-2-2	-//- -2	50		
3	B-2-3	-//- -3	50		
4	B-2-4	-//- -4	89		
5	B-2-5	-//- -5	75		
6	B-2-6	-//- -6	87		
7	B-2-7	-//- -7	59		
8	B-2-8*	-//- -8 vil.	220		
9	B-2-9*	-//- -9 vil.	110		
10	B-2-10	-//- -10	52		
11	B-2-11	-//- -11	36		
12	B-2-12	-//- -12	150		
13	B-2-13	-//- -13	172		
14	auxiliary	-//- -13/1	57		
15	B-2-14	-//- -14	222		
16	B-2-15	-//- -15	86		
17	B-2-16	-//- -16	196		
18	B-2-17	-//- -17	162		
19	B-2-18	-//- -18	41		
20	B-2-19	-//- -19	19		
	Total		**2007**		
21	C-2-T-1	-//- -20	302	Chavoni	
22	C-2-T-2	-//- -21	609		
	auxiliary		42		
	Total		**953**		
23	C-2-T-3	-//- -22 village	**393**	A. Samadov	

24	C-2-T-4	-//- -23	**656**	S. Sharipov	Mehnatobod
25	C-2-T-4/1	-//- -24	308	Navruz	
26	C-2-T-5	-//- -25 village	563		
	Total		**871**		
27	C-2-T-6	-//- -26 village	**216**	J. Rumi	
28	C-2-T-7	-//- -26/1 village	104	Obodi	
	auxiliary		10	(395 ha)	
29	C-2-T-8	-//- -27 village	334		
30	C-2-T-8/1	-//- -28	70	Vatan	
31	auxiliary	-//- -29 village	50	(170 ha)	
33	C-2-T-9	-//- -30	**370**	Rogun	
	PTU	-//- -29/1	40	A. Rudaki	
34	auxiliary	-//- -30/1	30		
35	СГ-9	-//- -31	71		
36	C-2-T-10	-//- -32	319		
37	СГ10	-//- -33	321		
38	C-2-T-11	-//- -34	497		
39	auxiliary	-//- -34/1	50		
40	auxiliary	-//- -34/2	20		
	Total		**1308**		
41	C-2-T12	-//- -35	460	Login	Zafarobod
42	СГ-11	-//- -36	134		
43	auxiliary	-//- -36/1	40		
44	C-2-T-13	-//- -37	526		
45	auxiliary	-//- -37/1	20		
46	C-2-T-13/1	-//- -38	184		
47	auxiliary Households	-//- -39 village	60		
48	C-2-T-14	-//- -40	331		
	Total		**1755**		
49	X-1-1	-//-41 village	260	M. Mirzoev	
50	X-1-2	-//- 42 village	365		
51	auxiliary	-//-42/1	28		
52	X-1-2/2	42/2 village	188		

53	X-1-3	-//43 village	30		
54	X-1-3/1	44	257		
	Total		**1128**		
55	X-1-4	45	230	Mirzochul	
56	X-1-5	45/1	266		
	Total		**496**		
57	X-1-5/1	45/2	28	Hairobod	
58	X-1-6	46	210		
59	X-1-6/1	46/1	50	Dehqan farms outside WUA catchment zone	
60	X-1-7	47	217		
61	X-1-7/1	47/1	45		
62	X-1-8	48	152		
63	X-1-8/1	48/1 village	70		
64	Total				
65	X-1-8/2	48/2	110	Chaihun-I	
66	X-1-9	49	407		
	Total		**517**		
67	X-1-9/1	50 village	224	Dehqan farms outside WUA catchment zone I. Somoni	
68	X-1-10	51	256	(890 ha)	
69	X-1-10/1	52	197		
70	X-1-11	53	213		
71	X-1-11/1	54- chute	366	Yagnob	H. Aliev
72	X-1-12	55	309		
73	X-1-12/1	56	80		
74	X-1-12/2	56/1	40		
75	X-1-13	57	409		
76	X-1-13/1	57/1	30		
77	X-1-13/2	57/2	30		
78	X-1-13/3	57/3	30		
79	X-1-14	58	419		
80	X-1-14/1	58/1	85		
81	X-1-14/2	58/2	40		
82	X-1-14-3	59	37		
83	auxiliary	59/1	30		
84	X-1-15	60	196		
85	Total		**2101**		

86	X-1-15/1	61 vil.	126		
87	X-1-16	62	113		
88	auxiliary	62/1	126		
89	X-1-17	63	287	Faiz-M	
90	X-1-17/1	64	109		
91	X-1-18	65	391		
	Total		**1152**		
92	X-1-19	66	207		
93	X-1-20	67	366		
94	auxiliary	Mebroch	180		
95	X-1-20/1	67/1	5		
96	X-1-20/2	68			
97	auxiliary	Tursunov	50	50th Anni. of Zafarobod	
98	X-1-20/3	68/1			
99	X-1-21	69	345		
100	auxiliary	70			
101	X-2-1	71			
	Total		**1153**		
102	auxiliary	71/1			
103	X-2-2	72	414		
104	auxiliary	72/1			
105	auxiliary	72/2			
106	auxiliary	72/3			
107	X-2-3	73	469		Ravshan
108	auxiliary	73/1			
109	X-2-3/1	74	220		
110	X-2-4	75	325		
111	X-2-5	76	164		
112	auxiliary	76/1		S. Ayni	
113	auxiliary	76/2			
114	auxiliary	76/3	141		
115	auxiliary	76/4			
116	X-2-6	77	190		
117	auxiliary	77/1			
118	auxiliary	77/2			
119	auxiliary	77/3			
120	ZERO	78	123		
	Total		**2046**		
121	LPT	79	**1258**	Navobod	
	Grand total		**20589**		

Annex 5

Environment Action Plan: Climate Change and Disaster Risk Management under the Medium-Term Development Program of the Republic of Tajikistan for 2021-2025

#	Objectives, tasks, activities	Indicators of impacts, objectives and tasks	Baseline performance indicators (2019)	Target indicator/Execution timeframes					Funding requirements (TJS ,000,000)	Financing (shared costs)			Executive authorities	Development partners
				2021	2022	2023	2024	2025		Govt	Donors	Private sector		
	§9. ENVIRONMENT: CLIMATE CHANGE AND DISASTER RISK MANAGEMENT													
208	Lon-term goals (NDS and SDG priorities): Sustainable environmental protection	SDG 11.6. Improve air quality: Impacts: Emissions of pollutants into the atmospheric air by stationary sources, in tons per 1 km^2, total	0.35	0.34	0.33	0.32	0.31	0.3	600.70	36.50	564.20	0.00	CEP, AS	
		including in urban areas	8.5	8.4	8.3	8.2	8.1	8						
		Harmful emissions into the atmospheric air by all polluters per 1 resident (kg/person), total	0.005	0.005	0.005	0.005	0.005	0.005					CEP, AS	
		including in urban areas	0.75	0.74	0.73	0.72	0.71	0.7						
		Reforestation, thsd ha	1.9	2	2.1	2.2	2.3	2.4					CEP, AS	
209	Medium-term objective: Development of the National Climate Change Adaptation Framework	Expected outcome: GHG emissions, tCO_2eq per capita	0.9	1	1.05	1.1	1.15	1.2	223.30	12.20	211.10	0.00	CEP, CoESCD, AS	
210	Objective: Improvement of the regulatory framework for environmental protection based on international standards	Outputs: Level of public climate change risk awareness, %, including:	25	30	35	37	38	40	59.40	7.70	51.70	0.00	CEP, AS	
		among women	15	20	25	30	33	35						

		among vulnerable groups of population	12	15	17	20	22	25						
		Summary climate change vulnerability index	10	9	8	7	7	6						
1)	Adoption of the Environmental Code of the Republic of Tajikistan	The Environmental Code of RT is developed			x				0.50	0.50			CEP	UNDP, UNEP
2)	Development of "Environmental Standard Assessment" (ESA)	The ESA is developed			X				0.20	0.20			CEP	
3)	Development of gender-sensitive indicators of response to climate change and disaster risk management	The indicators are developed and used in monitoring and evaluation systems		X	X	X			0.50		0.50		CEP, CoESCD, CWF, AS	UNDP, UNEP
4)	Development of the "State environmental outreach program of the Republic of Tajikistan for the period 2021-2030"	The State Program is developed		X	X				2.00	1.00	1.00		CEP, CoESCD, ME	UNDP, UNEP
5)	Development of the National climate change adaptation action plan	The national plan for climate change adaptation is developed		X					31.00		31.00		CEP, CoESCD	GCF (Green Climate Fund), UNDP
6)	Development of the national GHG inventory, regulatory and methodological framework for the system of monitoring, assessment and verification (MAV) of greenhouse gas emissions	The regulatory framework is developed		x	x				5.00	5.00				
7)	Development of the National strategy for municipal solid waste and recycled materials management for the period up to 2030	The regulatory framework and guidelines are developed and harmonized		X	X				3.00		3.00		CEP, CoESCD, MJ, MF	UNDP
8)	Updating the Nationally Determined Contribution (NDC) in achieving the global objective of the UN Framework Convention on Climate Change (UNFCCC) by the Republic of Tajikistan	The proposed Nationally Determined Contribution (NDC) is updated	2015	x					7.20		7.20		CEP	WFP, WB, UNDP, GIZ

9)	Building a database on climate change and disaster risk management by duly authorized key ministries and departments	The database is available		X	X	X			5.00		5.00		CEP, CoESCD, AS	WB
10)	Development of the "State environmental protection program of the Republic of Tajikistan for the period 2021-2030"	The State Program is developed		X					4.00	1.00	3.00		CEP, CoESCD, MJ, MF	UNDP, UNEP
11)	Implementation of the Environmental Standard Assessment (ESA) and Disaster Risk Management (DRM) principles in the development of strategic sectoral and regional programs	The ESA and DRM principles are implemented		X	X	X	X	X	1.00		1.00		CEP, CoESCD, MJ, MF, MEDT	UNDP, UNEP
211	Objective: Improvement of the system of coordination and cooperation on matters related to climate change and disaster risk management.	Outputs: Joint activities in the framework of the National Platform, per quarter, number of	1	2	2	3	3	3	163.20	4.20	159.00	0.00	CEP, CoESCD	
		Improved sectoral programs as they relate to climate change and natural disaster risks, number of	2	5	6	7	8	9					CEP, CoESCD	
1)	Development of a system for monitoring and evaluation (M&E) of improvements in disaster risk management, with due consideration of climate change adaptation matters	The M&E system is developed and in operation				X	X		2.00		2.00		CEP, CoESCD, MEDT	UNDP, UNEP
2)	Strengthening the material capacity of the authorized agencies (CEP, Hydromet, CoESCD), engaged in the collection and dissemination of information on climate change and disaster risk management	Material capacity is strengthened			X	X	X		155.00		155.00		CEP, CoESCD, MF, SCI	GCF, UNDP, UNEP, ADB, WB

3)	Development of an ICT-based early warning system for disaster risk management and adaptation to climate change, as well as other matters of vital importance	The system is developed and in operation		X	X	X			4.20	4.20			CEP, CoESCD, MA, MEWR	
4)	Development of an adaptation and mitigation plan to reduce the impact of climate change and disaster risks on the key sectors and to stimulate investment activity among the development partners and private sector actors	The Plan is developed		X	X				2.00		2.00		CEP, CoESCD, LGEA	UNDP, UNEP
212	Objective: Strengthen the capacity of authorized government officials and civil society staff on climate change adaptation and disaster risk management	Outputs: Number of employees of the authorized government agencies who have completed training on climate change, %	20	25	30	35	40	45	0.70	0.30	0.40	0.00	CEP, CoESCD, AS	UNDP, WB, ADB
		including women	15	20	25	30	35	40					CEP, CoESCD, AS	UNDP, WB, ADB
1)	Development of training programs for skill upgrade of staff members on climate change adaptation and disaster risk management	The training programs are developed and implemented		X	X				0.20		0.20		CEP, CoESCD, ME	UNDP
2)	Organization of training for staff members on climate change adaptation and disaster risk management	The training course are organized and running		X	X	X	X	X	0.30	0.30			CEP, CoESCD, ACS	
3)	Launching awareness raising campaigns in the media about climate change and disaster risk management	The awareness campaigns are organized on a regular basis		X	X	X	X	X	0.20		0.20		CEP, CoESCD, RTC	UNDP, UNEP
213	Medium-term objective: Strengthening the resilience of the ecosystems and existing biodiversity to climate change	Impacts: Shelter forest plantations and other woodland areas, thsd ha/year	1.5	1.5	1.5	1.5	1.5	1.5	309.00	0.00	309.00	0.00		

		Expected outcome: SDG 15: Halting biodiversity loss; Preserving genetic diversity - at least at 60% of the 2019 levels	60%	62	65	67	69	75%					CEP, CoESCD, AS	
		Protection and restoration of the aquatic ecosystems - at least at 55% of 2019 level	55%	58	61	64	67	72%					CEP, CoESCD, AS	
214	Objective: Development of a package of measures to restore impaired natural ecosystems and preserve biodiversity	Outputs: Restoration of degrading ecosystems, %	20	22	25	28	35	39	309.00	0.00	309.00	0.00	CEP, CoESCD, AS	
		Endangered species of birds	15	14	13	12	10	9					CEP, CoESCD, AS	
1)	Improvement of ecosystems and ecosystem-related services provided to rural communities to facilitate climate change adaptation	Adaptation plans are supported			X	X	X	X	103.00		103.00		CEP, CoESCD	GCF (Green Climate Fund), WB
2)	Preservation of biodiversity for climate adaptation and sustainable use of natural resources	Biodiversity improved and preserved		X	X	X	X		206.00		206.00			GEF, STAR-7, FAO
	TOTAL, TJS ,000,000								532.3	12.2	520.1	0.0		
	TOTAL, %								100.00	2.3	97.7	0.0		
215	Medium-term objective: Strengthening and development of the national capacity for reduction of the existing and prevention of any new natural disaster risks	Expected outcome: Damages incurred as a result of natural disasters, % of GDP	4	3.8	3.7	3.6	3.5	3.4	68.40	24.30	44.10	0.00		
		Strengthen early warning systems for all kinds of disasters and ensure timely transmission of useful information to the relevant national and local authorities	20	25	30	35	40	45					CoESCD	

216	Objective: Improvement of the institutional and legal framework of the disaster risk management system	Outputs: Coverage of human settlements by the early warning system, %	30	35	40	45	50	55	8.80	0.00	8.80	0.00	CoESCD	
1)	Development of regulatory frameworks to strengthen the coordination role of the National Platform for risk reduction policies pursued by government agencies in cooperation with the international community	The regulatory framework documents are in place		X	X				0.20		0.20		CoESCD, MJ	UNDP
2)	Development of a national action plan for disaster risk reduction for 2022-2026	The relevant program is developed and implemented		X					0.10		0.10		CoESCD	ADB
3)	Building an adequate database on the population residing in communities located in areas at risk of emergencies (broken down by gender, age, and disability)	The database is developed and accessible			X	X			0.50		0.50		CoESCD	GCF
4)	Integration of climate-induced disaster risk mitigation into sectoral strategies, as well as urban and district development programs	Integration of matters related to reduction/management of disaster risks are successfully integrated		X	X	X	X		8.00		8.00		CoESCD	UNDP
217	Objective: Strengthening the infrastructure capacity for disaster risk reduction to build resilient response capabilities	Outputs: Increased foreign investments aimed at strengthening the CoESCD capacity, %	1.8	2.4	2.8	3.5	4.1	6.4	27.20	10.20	17.00	0.00	CoESCD, SCI	
		The amount of funds allocated from the national budget to support the performance of CoESCD	1.2	1.22	1.3	1.5	1.6	1.8					CoESCD, MF	
		Increased capital investments to CoESCD	3	3.3	4	4.2	4.7	5.3					CoESCD, SCI	

1)	Strengthening the infrastructure capacity of the CoESCD: construction of a training center for CoESCD and auxiliary buildings.	The project is completed and commissioned		X					9.00		9.00		CoESCD	Shah Salman Saudi Fund
2)	Improvement of the physical infrastructure base of the Republican Training Center of CoESCD	Material capacity is strengthened		X	X	X	X		8.00	3.00	5.00		CoESCD	ADB
3)	Improvement of the physical infrastructure base and operating conditions for the Committee's Anti-Crisis Center and the Rescue Service Training Center in the Shahrinav district	The project is completed and commissioned			X	X			4.00	4.00			CoESCD, MF	
4)	Reconfiguration of the Anti-hail Service by installing Doppler Radars	Re-equipment of the Service completed. It is up and running.				X	X		3.20	3.20			CoESCD, MF	
5)	Setting up a national disaster risk transfer and insurance mechanism	The national mechanism is in place and operational		X	X				2.00		2.00		CoESCD, MF, SCI	WB
6)	Improving of the ICT-based early warning system for management and adaptation to climate change, as well as other aspects of vital importance	The system is developed and in operation				X	X	X	1.00		1.00		CoESCD, MF, SCI	UNDP
218	Objective: Strengthening the emergency response and rescue services and training units of the Committee for Emergency Situations and Civil Defense of the Government of the Republic of Tajikistan	Outputs: Increased number and effectiveness of the training courses in emergency preparedness, %	10	12	17	19	22	25	15.10	13.10	2.00	0.00	CoESCD	
		Number of emergency responder who were trained for the service, %	22	28	35	40	60	80					CoESCD	
		Higher level of equipment provided to divisions of the Committee for Emergency Situations and Civil Defense, %	4	7	8	10	15	20						

		Increased volume of government funding allocated to procure the equipment for the CoESCD divisions	2	4	6	7	7	9					MF, CoESCD	
1)	Establishment of Emergency Rescue Units within CoESD teams in Dushanbe, Khujand, Kurgan-Tyube, Kulyab, Khorog, and Rasht areas	Number of units is increased		X	X	X			4.00	4.00			CoESCD, MF	
2)	Objective: Creating a team of explosives professionals in the rescue service and units of the Committee for Emergency Situations and Civil Defense of the Government of the Republic of Tajikistan	The team is created		X	X	X			2.60	2.60			CoESCD, MF	
3)	Installation of state-of-the-art equipment in the Republican Chemical and Radiometric Laboratory	The Laboratory is equipped and operational				X	X		2.50	2.50			CoESCD, MF	
4)	Organization of a canine unit at the Committee for Emergency Situations and Civil Defense of the Government of the Republic of Tajikistan based in the Kharangan Training Center	The canine unit is established			X	X			2.00		2.00		CoESCD	ADB
5)	Creation of a Rescue and Rehabilitation Center at CoESCD	The Center is in place and operational			X	X			2.00	2.00			CoESCD, MF	
6)	Setting up a Center for counseling and psychological support at the Committee for Emergency Situations and Civil Defense of the Government of the Republic of Tajikistan	The Center is in place and operational				X	X		2.00	2.00			CoESCD	
219	Objective: Improvement of the disaster response preparedness	Outputs: Level of preparedness for disaster risks, with special focus on women, children and vulnerable groups (disabled and old age persons), % of the total population	20	25	30	35	40	45	17.30	1.00	16.30	0.00		

1)	Upgrading the existing system of preparedness and response at all levels of those exposed risks of natural disasters: introduction of the hotline “112”to the Emergency Committee	The hotline is established and in operation			X	X			0.90		0.90		CoESCD, MF, SCI	WB
2)	Improvement of the mechanism and current procedure for damage assessment used by government agencies, by putting them into compliance with international best practices	The mechanism is compliant and operational				X	X		0.10		0.10		CoESCD, MJ, MF	UNDP
3)	Improvement of the institutional and regulatory mechanisms for recovery, rehabilitation and development in the aftermath of disasters	The mechanism is improved and operational				X	X		0.10		0.10		CoESCD, MJ, MF	UNDP
4)	Enhancing the disaster response capabilities of new and existing infrastructure facilities of vital importance	The response capability is enhanced				X	X		0.20		0.20		CoESCD, MJ, MF	UNDP
5)	Establishment of Crisis Management Centers to be based at the Emergency Management and Civil Defense Centers and within the System of Emergency Call and Response Centers	The Crisis Management Centers are established and operating				X	X		2.00		2.00		CoESCD	WB
6)	Upgrading the technical capacity of the Information and Analytical Center of the Committee for Emergency Situations and Civil Defense of the Government of the Republic of Tajikistan	The technical capacity is upgraded				X	X		4.00		4.00		CoESCD	WFP (World Food Program)
7)	Improvement of the regulatory requirements to ensure stronger coordination in the system of search and rescue operations	Coordination system is reinforced			X	X	X	X	10.00	1.00	9.00		CoESCD	WB
	TOTAL, TJS ,000,000								68.4	24.3	44.1	0.0		
	TOTAL, %								100.00	35.5	64.5	0.0		
	GRAND TOTAL, TJS ,000,000								600.7	36.5	564.2	0.0		
	GRAND TOTAL, %								100.00	6.1	93.9	0.0		

Contacts:

Regional Environmental Centre for Central Asia
40, Orbita-1 microdistrict
050043, Almaty, Kazakhstan
+7 (727) 265 4333
+7 (727) 265 4334
info@carececo.org
https://carececo.org/