UDC 504.453

WORLD EXPERIENCE OF TERRITORIAL REDISTRIBUTION OF WATER RESOURCES AND APPLICABILITY OF THE METHOD IN MODERN KAZAKHSTAN

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Water distribution systems have a very long and rich history. Since the third Millennium BC, mankind has used water distribution and water supply systems. The oldest of them is the Grand navigable Grand Canal in China, connecting the basins of the yellow river, Huaihe and Yangtze from Beijing in the North to Hangzhou in the South. Its construction began in the seventh century, and individual sections were completed over several centuries [1].

The current length of the canal is 1,782 km, including branches to Beijing, Hangzhou and Nantong. The total length is 2,470 km. The construction and operation of this canal is a clear example of how water resources management contributes to the development of a strong economy and the state as a whole. Since most historians believe that the Chinese state at one time was established as a prosperous Empire thanks to this channel. According to China's strategic plans, the reconstruction of the Great canal is planned in the near future due to the increasing consumption of fresh water by the population, industry and agriculture, and measures are also planned to transfer some of the water from high-water rivers to areas with a lack of them.

The «Turn of the Chinese rivers» project is another major project of the people's Republic of China. A powerful economic potential, a unified, well-thought-out state water management system that has absorbed centuries of experience allowed China to start implementing one of the largest water management projects in the history of mankind in 2002. The implementation of this huge project worth 62 billion dollars will allow for the annual transfer of about 45 km^3 of water from the South of the country to various regions of the North by 2050, thus providing 300 million people with water. population and active economic growth. Three 1,300 km long canals should be built each [2].

In the United States of America in the 50s of the XX century, a water transfer plan «North American Water and Power Alliance (NAWAPA)» was developed. According to this project, it was planned to transfer 175 km^3 per year to provide water to thirty-three US States, as well as parts of the territories of Canada and Mexico. The architects planned the construction of a reservoir with a length of 800 kilometers between the ridges of the Rocky Mountains, with a complex network of hydraulic structures with a total length of 10.8 km, and tunnel length 2.9 thousand km. However, this project was not implemented for a number of reasons. The cost of the project was initially estimated at 100 billion dollars, the construction period could stretch for 30 years. The next major problem was the density of the affected territories, which necessitated the relocation of 60 thousand people. Another difficulty was the acute geopolitical conflict, which consisted in the different interests of the partners in the project. The United States and Mexico lobbied for the project, and the water resources proposed for redistribution were mostly located in Canada. This forced experts to refrain from redistributing water resources from the North of the continent to the South.

Projects to transfer river flow were also developed in the Soviet Union. The first projects for transferring river flow were developed in 1868. The project «Transfer of part of the flow of Siberian rivers to Kazakhstan and Central Asia» – a Soviet project aimed at providing water to arid regions of the country, one of the most ambitious engineering and construction projects of the XX century, which was never implemented. The project was suspended in construction due to discovered flaws in the project. The project provoked the processes of soil erosion and salinization of soils, the emergence of new foci of water-borne diseases, for example, outbreaks of tularemia in Kalmykia, the project also caused disruption of the migration routes of saigas, the death of sturgeon juveniles in the place of water intake, etc.

The «Irtysh-Karaganda Canal». In the late 1940s, problems of water scarcity in Central Kazakhstan began to be raised more often. 2174 rivers flow through the territory of Kazakhstan, including the full-flowing Irtysh, Esil, Ural, Syr Darya, Or others. However, only 5.5% of the rivers' water came from Central Kazakhstan. The canal was constructed between 1962 and 1974. The issue of water scarcity in the city of Karaganda was immediately resolved, and machine-building, chemical industry, heat and electricity, and irrigated agriculture began to develop rapidly. The canal became an important strategic water management facility, on the basis of which the expansion and creation of new industries began. The total length of the canal is 458 km, of which 272 km passes through the territory of the Pavlodar region and 186 km-through the Karaganda region. The main structures of the canal are: 22 pumping stations, 14 reservoirs and 34 sections of the canal. In addition, the canal has spillways, spillways, rainwater pipes, bridges, and blocking structures. The estimated water supply of the canal in its current state is 1200 million m^3 per year. The construction of the Irtysh-Karaganda canal contributed to the active development of metallurgical production while preserving local water resources.

Based on world experience, it can be noted that large-scale transfers do not always justify themselves for a number of reasons, such as significant environmental impact, geopolitics, and high project implementation costs. However, a large number of wastewater transfer systems are currently being designed, built and operated in the world. Their total volume in the world is about 400 km^3/year. In combination with flow regulation, they provide large regions, while simultaneously solving problems of energy, transport, irrigation, recreation, and employment. Design and management of such systems is one of the most urgent water management tasks.

The need for territorial redistribution of runoff in Kazakhstan lies in the uneven distribution of natural waters, inconsistencies in the distribution of water and other natural resources, the geography of the location of water-intensive sectors of the economy. In particular, the Northern and Central regions of Kazakhstan, where favorable agro-climatic resources are concentrated, are insufficiently provided with water. Table 1 shows the total runoff for water management basins in Kazakhstan [2].

Table 1 – Distribution of water resources by economic river basins of the Republic of Kazakhstan

№	Water basin	Total flow, million m^3/year	Average annual population, thousand people	Total flow per 1 person, thousand m^3/year
1	Aral-Syr Darya	17990	3174	5,7
2	Balkhash-Alakol	27681	3544	7,8
3	Irtysh	33660	2010	16,7
4	Esil	2820	1969	1,4
5	Zhaiyk-Caspian	11238	2370	4,7
6	Nura-Sarysu	1365,7	1245	1,1
7	Tobyl-Torgai	1926	932	2,1
8	Shu-Talas	4244	1078	3,9

According to the international classification of water availability, shown in table 2, regions with water resources less than 1,700 m^3 per person per year are considered to be water-scarce [3].

Table 2 – Indicators of water resources availability

Water availability indicator (thousand m^3/year per person)	Water resource availability category
> 1,7	no stress
1,0-1,7	stress
0,5-1,0	scarcity

< 0,5	absolute scarcity

In accordance with the forecast of socio-economic development in the Central Northern regions of Kazakhstan, intensive development of economic sectors is planned.

The agro-industrial complex, metallurgical and coal industry, electric power industry, and oil refining in the Pavlodar region are identified as promising economic specialization of the Northern and Central regions [4-5].

Planned measures for development of agriculture in the Central region: the construction of new processing plants, large dairy farms and livestock farms in all the districts; establishment of procurement and marketing cooperatives for the purchase and implementation of livestock production, large complexes or feedlots for rearing and fattening of cattle, obtained from private farms in each area; construction of plants for deep processing of grain and production of gluten and starch; construction of poultry farms, production complexes for processing meat products, production of sausages and semi-finished products, canned food; expansion of sown areas of grain and oilseeds, creation of appropriate vegetable and grain storage facilities [6-9].

It is assumed that by 2030, the joint development of the region will contribute to the growth of the gross regional product by 5.5 times, the volume of investment in fixed assets and industrial production by 3.1 times, and the volume of gross agricultural output by 4.6 times.

For the successful implementation of the planned development parameters, it is necessary to provide the economy with water resources. Meanwhile, based on water management balances developed within the framework of integrated use and protection of water resources of the Esil, Nura and Tobol rivers, which cover the territory of Northern and Central Kazakhstan, the availability of local water resources in the future is no longer sufficient [10].

On the territory of Kazakhstan, the only source that can increase water availability in the Esil basin is the Irtysh donor river, where up to 33% of the country's total surface runoff is formed.

According to the recommendations of the Committee on water problems of the United Nations economic Commission for Europe, it is considered that the intensity of water use, at which less than 10% of river flow is withdrawn, is satisfactory, 20% – requires restrictions on water use and implementation of measures to regulate flow, if exceeded 20% – the water body will not be able to ensure the socio-economic development of the territory [11].

With equal water allocation of this flow with the Russian Federation, it is possible to take water from the Irtysh river for transfer to the Central and Northern regions of the country up to 4.5 km^3, which is less than 15% of the flow [12].

The circuit of the projected channel is shown in figure 1.

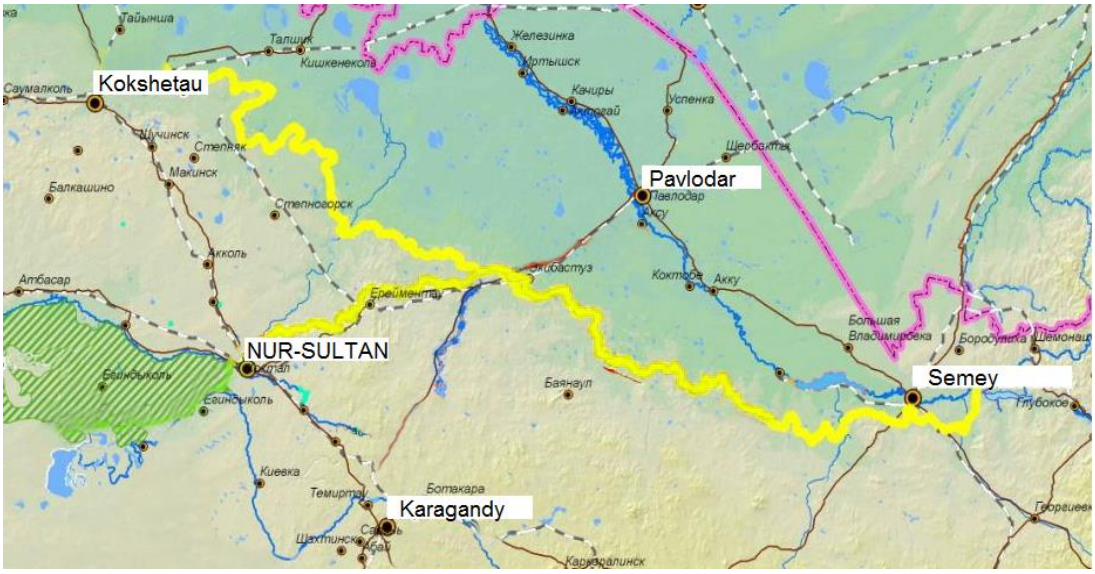

Figure 1 – Circuit of the projected channel

Water intake of the proposed channel will be carried out from the Shulba hydroelectric power station (hereinafter – HPP). The construction of the second stage of the Shulba HPP will increase the level of the normal retaining level to 252.5 meters with a useful reservoir capacity of 7.5 km^3. The proposed channel to provide the Central and Northern regions of Kazakhstan can be laid within the Kazakh shallow forest, which is characterized by a General elevation of the territory with a range of heights from 200 to 1500 m. The route of the channel will mostly run along the Western part of the Kazakh small-mound, where two low-mountain massifs are distinguished-the Kokshetau upland (947) and Ulytau (1133), separated by a vast Tengiz-Kurgaldzhinsky depression with a flat plain terrain [13]. These conditions make it possible to implement a self-flowing option, which reduces the cost of building pumping stations and subsequent operating costs for machine water supply.

Literature

1. Alekseeva N.N.. (2000). Modern landscapes of foreign Asia. M.: GEOS. 414 p.
2. Ryabcev A.D.. (2019). The international experience of transferring river flow. «Kazgiprovodhoz Institute». 27 p.
3. Yasinskij V.A., Imamniyazova G.A.. (2013). Current trends in improving water resources management in the CIS member States. Eurasian development bank. Almaty. ISBN 978-601-7151-40-9. – URL: http://www.cawater-info.net/library/rus/eabr_19_ru.pdf
4. The program of development of the city of Nur-Sultan for 2016-2020, Annex to the decision of the Maslikhat of the city of Nur-Sultan dated October 31, 2019 No. 442/56-VI, Nur-Sultan, 2019 – 45 p.
5. Program of development of the territory of the Pavlodar region for 2016-2020, Annex to the decision of the Pavlodar regional Maslikhat (XXV session, VI convocation) dated November 21, 2018 No. 275/25, Pavlodar, 2016 – 167 p.
6. Forecast of socio- economic development of the Republic of Kazakhstan for 2019-2023. Phase one. Approved at the RBC meeting of may 15, 2018, minutes No. 9. – 51 p.
7. Forecast of socio-economic development of the Karaganda region of the Republic of Kazakhstan for 2020-2023, Approved by the decree of the Akimat of the Karaganda region dated October 09, 2018 No. 54/01, Karaganda, 2018 – 145 p.
8. Forecast of socio-economic development of the Akmola region of the Republic of Kazakhstan for 2020-2024 stage 2, Kokshetau, 2019 – 47 p.
9. Forecast of socio-economic development of the North Kazakhstan region of the Republic of Kazakhstan for 2020-2024 stage 2, Annex to the resolution of the Akimat of the North Kazakhstan region of October 9, 2019 No. 284, Petropavlovsk, September 2019 – 27 p.
10. Saspugayeva G.E., Zhaken A.M.. Territorial redistribution of water resources of the Irtysh river as a method of increasing water supply in the Central and Northern regions of Kazakhstan // Materials of the international scientific and practical conference «Modern achievements in ecology, soil science and agriculture». Kokshetau: 2019. – pp. 224-231.
11. Novikova N. M., Kuzmina Zh. V., Podolsky S. A., Balyuk T. V.. (2005). Criteria limiting the regulation of river flow by environmental indicators // Arid ecosystems: volume 11, no. 28. Moscow: Institute of water problems of the Russian Academy of Sciences.
12. Ministry of agriculture of the Republic of Kazakhstan, Committee on water resources Production cooperative «Kazgiprovodkhoz Institute». Reference on the issue of justification for the construction of the «Astana complex». Almaty, 2012
13. Ministry of agriculture of the Republic of Kazakhstan, Committee on water resources Production cooperative «Kazgiprovodkhoz Institute». Scientific and project studies on the transfer of runoff to Kazakhstan and Central Asia. Vol. I. Almaty, 2011