

ABSTRACT

of the dissertation work of **Tazhiev Sultan Rysniyazovich** on the topic: “Groundwater resources of the Kazakhstan part of the foothills of the Kyrgyz Alatau: formation, state and prospects for use”, submitted for the degree of Doctor of Philosophy PhD in specialty 6D075500 - “Hydrogeology and Engineering Geology”

The relevance of the research. An important component of the national security of the Republic of Kazakhstan is the problem of ensuring water security in conditions of limited and vulnerable water resources. In the Strategy “Kazakhstan 2050”: a new political course of an established state, it is noted: *“Water is an extremely limited resource and the struggle for the possession of sources is already becoming the most important factor in geopolitics, being one of the causes of tension and conflicts on the planet.”*

In the Message of the Head of State to the people of Kazakhstan “ECONOMIC COURSE OF A FAIR KAZAKHSTAN” dated September 01, 2023, K.K. Tokayev notes that *“A serious barrier to the sustainable economic development of the country is the lack of water resources. In current realities, this topic is becoming a national security issue.”*

The research area is confined to the southern part of the Zhambyl region, which is characterized by the development of industry and agriculture, which requires the attraction of significant volumes of water resources. The “Basic provisions of the General Scheme for the Organization of the Territory of the Republic of Kazakhstan”, approved by Decree of the Government of the Republic of Kazakhstan dated December 30, 2013 No. 1434, lays down the need to ensure conditions that contribute to the preservation of the life and health of the population of the state. The main directions of development of the regions of the country, for the Zhambyl region, as priorities of the agricultural complex until 2050, provide for the development of fruits and vegetables, sugar beets, livestock farming and meat and dairy production. The regional akimat is implementing a number of practical measures aimed at increasing the volume of irrigated land and the area of watered pastures.

In recent years, there has been an increasing deficit of river waters associated with climate change and increasing water withdrawal in the adjacent territory of the neighboring state - Kyrgyzstan. Under these conditions, with decreasing surface runoff, the main and reliable source of water for the developing agricultural sector of the territory is groundwater.

Thus, research into the problems of formation, condition and prospects for the rational use and protection of the resource potential of groundwater seems very relevant.

The object of research is the groundwater of the foothills of the Kyrgyz Alatau in the Zhambyl region of Southern Kazakhstan.

The subject of research includes regional features of formation and distribution, quantitative and qualitative indicators, natural reserves, renewable and forecast resources, proven operational reserves of groundwater in the foothills of the Kyrgyz Alatau in the Zhambyl region of Southern Kazakhstan.

The main goal of the work is the scientific substantiation of the effective development of groundwater resources in the Kazakh part of the foothills of the Kyrgyz

Alatau for the development of rational management decisions on the use of their resource potential for the sustainable development of urban and rural areas of the Zhambyl region.

To achieve this goal, the following tasks were solved:

1) the hydrogeological features of the study area were clarified based on the collection, analysis and systematization of the results of previously carried out work;

2) the current state of exploitation of explored groundwater deposits and self-flowing hydrogeological wells, as well as hydrogeochemical indicators of groundwater were assessed based on ground-based route surveys with sampling and laboratory analyses;

3) transboundary aquifers were characterized and the risk categories of transboundary problems affecting the groundwater resources of the Kazakh part of the foothills of the Kyrgyz Alatau were clarified;

4) natural (capacitive and elastic) reserves, natural (renewable) and forecast resources of groundwater in the foothills of the Kyrgyz Alatau of Zhambyl region were clarified;

5) a geoinformation database was formed and an information-analytical model of groundwater resources and reserves was developed in the foothills of the Kyrgyz Alatau of Zhambyl region;

6) the prospects for using the resource potential of groundwater in the foothills of the Kyrgyz Alatau to ensure the socio-economic development of the southern part of the Zhambyl region were assessed.

Research methods. The dissertation uses complex research methods, including modern methods and methodologies of geology, hydrogeology and hydrology, as well as software and geoinformation and analytical technologies for collecting and processing information.

Ground route, chemical and analytical laboratory studies were carried out to study the existing hydrogeological and water management situation of the territory and assess the condition of explored groundwater deposits and self-flowing hydrogeological wells.

The methodology for the automated formation of a geoinformation-analytical system of groundwater resources in the study area includes not only the collection and storage of primary hydrogeological data, but also the possibility of their generalization and analysis, as well as their use as an information basis for solving various management and practical hydrogeological problems.

The scientific novelty of the work is as follows:

- the current state of exploitation of explored groundwater deposits and self-flowing hydrogeological wells, as well as hydrogeochemical indicators of groundwater in the foothills of the Kyrgyz Alatau in the Zhambyl region were assessed;

- categorization of the risks of transboundary problems associated with groundwater resources during intensification of water extraction or the emergence of sources of pollution on the territory of Kyrgyzstan was carried out;

- the resource potential of groundwater in the foothills of the Kyrgyz Alatau of the Zhambyl region and the prospects for its use for water supply to cities and rural settlements and the needs of the agricultural sector in the southern part of the Zhambyl region were assessed;

- a system of integrated multi-scale information and analytical models of the Zhambyl region has been developed and created for assessing, forecasting and making management decisions on the rational use and protection of groundwater resources and reserves.

Basic provisions submitted for defense. The following basic provisions are substantiated and defended in the work:

1) Within the study area on the border of the Zhambyl region of Kazakhstan, the Talas and Shu regions of Kyrgyzstan, the Shu and North Talas transboundary aquifers are distinguished, for which five types of transboundary groundwater flows have been established, and which are classified as the 3rd category of risk of transboundary problems arising when economic development of groundwater deposits on the adjacent side or the advancement of a source of contaminated groundwater into the territory of the Zhambyl region from the Kyrgyz Republic.

2) The updated resource potential of fresh groundwater in the foothills of the Kyrgyz Alatau in the Zhambyl region is estimated according to predicted resources, calculated according to three options, at 21.7-31.4 m³/s, and according to operational reserves at 13.9 m³/s for industrial categories A+B and 19.7 m³/s in categories A+B+C1, with exploration of the study area at 44-64%. The operational reserves of groundwater in the deposits of the study area in categories A+B+C1 do not exceed the optimistic version of the forecast resources, which takes into account only 70% of the annually replenished groundwater resources, thereby draining productive aquifers and complexes is not expected.

3) Fountain exploitation of groundwater in the study area through the development of self-flowing hydrogeological wells on the foothill plain will increase the volume of available water resources to increase the area of irrigated land and will have a positive impact on attracting private investment, increasing employment of the rural population, and increasing the range of the food basket.

4) A system of integrated multi-scale information and analytical hydrogeological models has been created, including geoinformation models of the Zhambyl region, the foothill plain of the Kyrgyz Alatau, Shuya, North Talas and South Talas transboundary aquifers, areas of self-flowing hydrogeological wells of the Zhambyl region, as well as geoinformation models of large underground deposits waters of the Zhambyl region for making management decisions on scenarios for the rational use and protection of groundwater.

The practical significance of the research carried out is associated with the scientific justification for increasing the volume of available water resources, aimed at the sustainable socio-economic development of the Zhambyl region, including the agricultural sector in the conditions of climate change and anthropogenic loads. Sustainable development of rural areas contributes to employment of the region's population and an increase in the range of food baskets.

Further research should be aimed at developing a groundwater monitoring system to assess the state of its exploitation and prevent depletion and pollution, the emergence of transboundary threats, and the creation of hydrodynamic models for making management decisions.

The research results were introduced into the implementation act No. 1 dated August 7, 2023.

The work on the dissertation was carried out at the Institute of Hydrogeology and Geocology named after U.M. Ahmedsafin within the framework of grant and program-targeted financing of scientific research.

The author's personal contribution lies in setting the goals and objectives of the dissertation; processing and analysis of the results of previously performed studies; in carrying out expeditionary ground route work with inspection and testing of production

and self-flowing hydrogeological wells; generalization and analysis of the results of field and laboratory research; formulating conclusions and main provisions submitted for defense; preparation and publication of scientific articles on the topic of the dissertation.

The author of the dissertation participated as the main executor in the implementation of the grant project "Assessment of promising fountain (self-flowing) exploitation of groundwater for the sustainable development of territories in the Zhambyl region." Currently he is taking part in research on the target programs: "Assessment of fresh groundwater resources as the main source and long-term reserve of sustainable drinking water supply for the population of the Republic of Kazakhstan" and "Heat-energy, mineral raw materials and therapeutic and health potential of thermo-mineral and industrial groundwater Kazakhstan. Assessment of the state and trends in changes in hydrogeochemical parameters of groundwater under the influence of natural and climatic changes and anthropogenic loads."

Publications. 9 articles have been published on the topic of the dissertation, including: 2 articles in an international journal included in the Scopus database (NEWS of the National Academy of Sciences of the Republic of Kazakhstan, Series of Geology and Technical Sciences); 5 reports were published in proceedings of international conferences; 2 reports published in the proceedings of regional conferences

Structure and scope of the dissertation. The dissertation consists of an introduction, 5 chapters, a conclusion, and a list of sources used. The volume of work is 133 pages of text, 32 figures, 21 tables, a list of used sources of 101 titles.

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