

ABSTRACT

of dissertation for the degree of Doctor of Philosophy (PhD) in the specialty:
6D075500 – «Hydrogeology and engineering geology»

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Theme: «Causes of low reliability of hydrogeological forecasts in assessing of exploitable groundwater resources and ways to solve them»

The hydrogeological forecasts are scientifically proved prediction of the direction and intensity of the development of natural hydrogeological systems in course of their interaction with technogenic ones.

The relevance of the research. The reliability of hydrogeological forecasting has always been of great interest, both for the authors of forecasts themselves and for specialists using prediction data. The question of assessing the correspondence between forecasts and nature is relevant for about half a century. The criterion for the reliability of the economic value of reserves assessment is their actual utilization.

At the present time, there have been significant contradictions between the concepts of the hydrodynamic conditions for the groundwater extraction for the period of the commissioning of water intakes, the current analysis of exploration data results and observations during operation. The majority of water intakes were calculated according to the scheme of an unlimited reservoir and the development of cones of depression was forecasted from large water intakes for dozens of kilometers.

Due to the fact that in the overwhelming majority of cases, the exploitable reserves of groundwater considered to be a calculated value, since in assessing them it is necessary to forecast the changes in the rate, the level and quality of groundwater over time, the degree of reliability determination of the estimated groundwater reserves should be based on the analysis of hydrogeological calculations, conducted during reserves assessment.

As the result of comparing the calculated and actual depressions of the levels, it turned out that in most cases their calculated values significantly exceed the actual ones.

Despite the work had been done, this issue does not lose its relevance. Therefore, the need to raise the level of hydrogeological forecasts is obvious and there is no doubt.

Aims and objectives of the research.

The main goal of the thesis is to compare the results of exploration work and the results obtained in the process of operation of groundwater intakes in order to identify the reasons for the divergence of the forecast indicators, and the development of the rational methods of exploration, groundwater intake facilities design and their operation, based on modern methods of hydrodynamic calculations,.

The goal was achieved by solving the following tasks:

- analysis of a number of groundwater deposits in Kazakhstan for the reliability of hydrogeological forecasts based on monitoring data and reinterpretation of the results of pumping tests;
- study and identification of the main causes of discrepancy;
- testing and implementation of methodologies and recommendations for groundwater exploration activities;
- implementation of the proposed principles and methodologies for the study of groundwater by the example of some deposits;
- development for improving the regulatory and methodological base of groundwater study and use, the classification of exploitable reserves, the requirements for the deposits and reserves degree of study;

The main scientific and practical results of the dissertation work were obtained on the basis of a combination of analysis and generalization of theoretical and methodological achievements of hydrogeology, primarily hydrogeodynamics applying these thesis in practical activity

Scientific novelty:

- the need to improve the reliability of hydrogeological forecasts have been proved based on the results of the groundwater state monitoring during the operation of water intakes;
- the results of the pumping tests carried out in layered aquifer systems record the processes of overflow from adjacent aquifers, which allows us to determine the filtration and capacitance parameters of the water-bearing and separating rocks;
- the average, relatively stable values of the overflow parameters have been determined for the first time, and the dependence of the increase in the reservoir conductivity due to the overflow processes within the foothill plain of the northern slope of the Zailiysky Alatau has been established, which is also confirmed by monitoring data;
- the discrepancy of the filtration parameters determined for the boreholes drilled by various drilling methods is revealed and it is proved that the reliability of the determination of parameters under different hydrogeological conditions is significantly affected by the technology of drilling and well equipment;
- the influence radiuses of water intakes are logically justified and confirmed by analytical dependences in relation of their productivity and layer conductivity;
- the influence of the boundary of the firnge zone on the mode of the water intake operation was identified, based on the generalization of the groundwater extraction results within the Kumzhargan sand massif using the simulation;
- the actual use of groundwater, which is not exceeding 30% of the approved exploitable reserves is determined using the example of the Zailikskiy Alatau piedmont plume deposits based on the analysis of exploitation data.

Application area – - hydrogeology, geoecology, groundwater resources management.

Theoretical and practical significance of the work:

- it is established that in the layered strata of the Zailiysky Alatau foothill plain an important place is occupied by the hydrodynamic scheme of the reservoir with overflowing processes from adjacent horizons;

- the average, relatively stable values of overflow parameters, water conductivity, coefficients of piezoelectric conductivity and elastic water loss of aquiferous complex within the foothill plain of the Zailiysky Alatau northern slope were reliably identified;

- it is proved that the drilling technology and well equipment have an impact on the reliability of the definition of filtration and capacitive parameters;

- it is established that the radius of depressive cones around groundwater intakes can be determined using the hydrodynamic characteristics of the water-bearing strata and the total reservoir productivity;

- it is established that the observation wells should be located not more than half the radius of the depression cone (1-2 values of the overflow parameter value) from the water intake center to monitor technogenic changes in the groundwater level around the water intake;

- the principles for determining the balance participation are proposed, in particular, the increase in the role of balance reserves and the methodology for their accounting in assessing the mutual influence of the calculated water intake on water intake facilities with previously approved groundwater exploitable reserves.

Publications. On the topic of the thesis, 7 articles were published, including 1 in the international magazine, which is included in the Scopus database, 3 articles in the republican specialized publications recommended by the Committee for Control in Education and Science of the Ministry of Education and Science of the Republic of Kazakhstan, as well as materials and abstracts of 3 reports on international scientific and practical conferences, 2 of which were published abroad.