Summarized Assessment of the Role Oil and Gas Complex Mangystau Region in Pollution Ground Water

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Abstract: - The authors have developed a way to solve the inverse problem of integrated environmental assessment with the help of geographic information systems, and the objective function models based on available in the Atlas of Mangystau region map with pre-integrated environmental assessment, take into account effect all exposure sources. Results of these calculations showed that oil and gas producing complex provides an additional contribution to the degradation of soil cover in excess of the average for all anthropogenic sources in the 19.31%, in relief degradation - 18.3%, vegetation - 16.7%. In this article considered impact assessment in the oil and gas complex ground water.

Key-Words: - Mangistau region, oil and gas complex, the degree of anthropogenic disturbance underground water natural protection of groundwater geographic information system, objective function.

1 Introduction

Region located in the South-West Republic of Kazakhstan in the desert zone and includes Mangyshlak, Ustyurt floor island Buzachi sors Dead Kuluk and Kaidak. Region characterized dry continental desert climate, severe pain and winds. In most of the Mangistau region in winter prevail eastern and south-eastern winds summer - west and north-west. The average annual speed of wind 3-7 m / s, maximum reaches 10-26 m / s winds hurricane nature at a rate of more than 15 m / s are observed on the coast in winter.

Most of the area is occupied wormwood saline wilderness with areas bush vegetation on brown soils: face partially covered with salt marshes, salt licks takyr-like and sand extremely rare vegetation. In this way, climatic conditions Mangistau region determine the development sor and deflationary processes, the formation of a meager land cover small capacity mitigate the effects of anthropogenic influences. In area registered 559 industrial enterprise, including large and medium - 70. Raw-material orientation of the economy of the region predetermined priority the mining industry, the state of development which are directly dependent on all other sectors of the economy. The area on the total volume produced industrial products it takes third place in the country. At the heart of the region's economy - oil and gas sector, volume of production which takes 90 percent the total volume produced in the region industrial products, which explains related to the oil and gas complex as the main source of anthropogenic disturbance components of the environment, since oil and gas industry has traditionally been considered one of the most ecologically dangerous branches of economy [1, 2].
Specificity climatic conditions with considering the total absence of a permanent river flow determines the sharpness of the problem of water scarcity, and primarily deficit drinking water.According to experts, the shortage of drinking water in the Mangistau region of 40,000 m3 per day and will reach 70,000 m3 / day by 2020 [3-5].

According to the akimat of Mangystau region there are 60 rural settlements, of which the centralized water supply provided 17 settlements, decentralized - 35. In connection with small number population and economic inexpedient system construction water supply, 9 rural residential points used imported drinking water. Aktau and Zhanaozen with surrounding towns, as well as oil producing companies consume 93% of the total volume of water in the proportion of settlements accounted for 7% [3, 6].

Mangistau region is provided with water from three sources: a limited liability company "Mangistau Atomic Power Plant-Kazatomprom" by desalinated seawater covers 47-50% of the demand in the region; Volga water supplied water pipeline "Astrakhan-Mangyshlak" provides about 40%; from groundwater deposits is possible to provide,

according to various sources, from 11 to 13% of the total needs of the region [3, 5].

Total deposits groundwater Mangistau region is 65 units, total reserves - 522 thousand cubic meters per day. The largest deposits of underground waters are: Tuyesu, Sauyskan, Kuyulus, Tonirekshyn, Janajol and Ketikskoe [3-5]. These fields allow provide household the needs of 17.5% of the population province [3, 6-7]. Thus, the problem of deficit water resources drinking quality solved mainly due to water desalinated Caspian and the Volga water coming from the Russian Federation. All this water consume Aktau and Zhanaozen with surrounding towns, as well as oil production company. Rural settlements over the entire region supplied local fields groundwater, so assessment of their ecological condition of very relevant. . This assessment is an information base for building as private (for one component of the natural environment), and the total or integrated integrated environmental assessments (built taking into account the impact on all components of the environment) and environmental planning. However, the financing of these activities less important is a targeted binding to pollution sources to implement the principle of "the polluter pays". This principle implemented RK on the basis of receipt of the enterprises permits for emissions the environment, issued by the competent government authorities after their studies in standards projects where they are calculated according to the industrial environmental control, taking into account all the planned changes in the activities of the enterprise. On the other hand, any kind of environmental monitoring records the combined effect of the various sources of pollution on the natural environment components. Thus, the great theoretical and practical significance is the "inverse problem" integrated environmental assessment - determining the role of certain pollutants in the formation of the ecological situation in the region. Relevance this problem increases also for the reason that the current mechanism of payments for emission formally approved in compliance with all emission regulations. The solution to this problem is the aim of the authors performed the project grant funding of the Ministry of Education and Science of the Republic of Kazakhstan №0589 / GF-4 "Development of a method of expert estimations objectification contribution of individual sources of pollution in the territory of the general environmental situation." As part of the project carried out a number of works, some of which has already been published [8-11]. In published and on the stage review papers reviewed examples of solving inverse problem for estimating the contribution of the activities of oil and gas complex Mangistau region in anthropogenic modification of the most important components of the natural environment and the actual materials for their confirmation. Results of calculations developed by technique showed that oil and gas producing complex creates additional contribution degradation in soil, exceeding average of all anthropogenic sources at 19.31% in relief degradation - 18.3% vegetation - 16.7%. In that work the estimation of the impact of oil and gas complex in the groundwater. Specificity of this evaluation is the need to detail the existing scale of the expert assessment of the level of anthropogenic disturbance of groundwater.

The aim of this work is a statement of acceptance of detail and expert assessments of the scale of the inverse problem solution integrated environmental assessment to quantify the contribution of oil and gas complex in the anthropogenic transformation of groundwater Mangistau region using the method developed on the basis of the final expert private environmental assessment given to the traditional five levels of exposure.

2 Problem Formulation

The authors have developed a way to solve the inverse problem of integrated environmental assessment with the help of GIS technologies and models of the objective function on the basis of the available in the Atlas of Mangystau region maps with ready-made, integrated environmental assessment, take into account the effect of all sources of exposure.

The published previously and are in the process of reviewing the works of the technique of realization of the method and examples of its decision to assess the contribution of oil and gas field in Mangistau complex activities in the most important anthropogenic modification components natural environment - relief, soils and vegetation. Technique composed of two parts. The first part - the procedure for obtaining the specific evidence in a form adapted for use in the objective function, implementing simplified process solutions inverse and study enough objectivity of the objective functions. The second part of the methodology is based on a comparison of areas of different levels of human exposure to a specific component of the natural environment (in this case, groundwater) in the whole of Mangistau region of the Republic of Kazakhstan and the same levels for areas with oil and gas complex in the objective function.

General form objective function, taking into account not only the intensity exposure each environmental factor, but also its role (importance) in the formation of favorable or adverse conditions for the existence of biological systems (1) as proposed by R. Pentla looks like a linear multiple regression equation [12]:

$$OF_{IEA} = a_1 \cdot f_1 + a_2 \cdot f_2 + \ldots + a_n \cdot f_n , \quad (1)$$

where OF_{IEA} - calculated value of the objective function for integrated environmental assessment;
f_i – value specific environmental factors (i = 1,2, ..., n) at the observation point;
a_i – weight coefficient, taking into account the orientation (Plus or minus with respect to the target) and significance (weight) of this factor in the formation of the total exposure level.
Objectification of objective functions includes a rationale for the selection of the most significant factors on the basis of taking into account specific geographical, environmental and economic conditions and the estimated area completeness rating scales range.
To solve the latter problem of environmental engineering methods proposed formula (2):

$$\Delta = \frac{1}{l^n}, \quad (2)$$

where l - level quantization of grading scales used in the assessment of environmental factors (the number of divisions rating scale).
From the formula (2) implies that even at the rough grading scale with the level of quantization of 2 (ie for peer review on a "yes" or "no") reasonable accuracy (Error not greater than 4%) can be achieved when five parameters taken into account (□ = 1/25 = 0.03125, or 3.1%). Thus, a greater impact on the accuracy (that is actually the objectivity) has a number of expert assessments of the analyzed parameters of the n (the exponent in the denominator of the formula), and not the level of quantization of grading scales l (the number of divisions on our measuring "line"). For getting data source in previous works we used published map of human impact on the relief, map of soil degradation, map of anthropogenic transformation of vegetation, are a private environmental assessment (integrated environmental assessment for one of the components of the natural environment) of anthropogenic impact on the rellief, soil and vegetation cover all possible sources of relief degradation, soil and vegetation of Mangistau region. Each these cards done based expert generalizations a large number of variety of information and zoned five levelsanthropogenic impacts, and higher levels of exposure corresponds to a more complex set environmental measures for their rehabilitation and correspondingly higher levels of financial costs.

Published in the same atlas anthropogenic map disturbance groundwater knocked out of this number, since it is only three levels of impact. A legend to the map shows that the level (degree) of anthropogenic disturbance of groundwater reflect the state of underground water to the extent of security area probable reserves and proven reserves, as well as man-made impact on the underground hydrosphere. The map shows the impact of individual factors or combination of factors to change hydrogeodynamic and hydrogeochemical groundwater status and isolated areas with low (green), moderate (yellow) and strong (red) the degree of anthropogenic disturbance of groundwater. The horizontal shading on the map are reflected in the zone of influence hydrogeodynamic and hydrogeochemical groundwater regime of the Caspian Sea level changes and man-made factors, and inclined - man-made factors, pollution and water intake.

The most important anthropogenic factor taken into account when assessing the level of anthropogenic disturbance of groundwater is groundwater contamination house keeping-drinking destination. The level and extent of groundwater contamination allocated based analysis of results observations regime for the network State groundwater monitoring and occasional observations. In the region as a result of regime observations revealed 7 of groundwater pollution sources and 12 according to episodic observations. The main pollutants: oil products - up to 10-15 MPC (maximum permissible concentration of pollutants) fluorine- 3-5 MAC, ammonia - 2-4 MAC. The extent of ground water contamination in the zones of influence of the revealed centers characterized as moderately dangerous.

So, analysis by map anthropogenic disturbance groundwater and legends shows that the allocation level disturbance states ground water taken into account the impact of oil and gas, mining, energy, chemical industries industry and livestock changes to the level and mode of chemical parameters normalized to 7 (sulfates, chlorides, synthetic surfactants, fluorine, oils, phenols, radionuclides and uranium), that is completely set factors considered meets objectivity and accuracy. However

for comparison with others executed estimates anthropogenic component changes the natural environment must have five-level evaluation anthropogenic disturbance groundwater status. The basis for drill evaluation may serve map natural protection of ground water (Fig. 1).

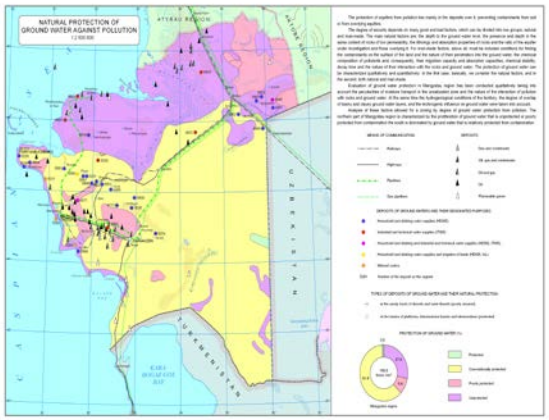

Fig.1: Map of natural protection of ground water

The legend for this map provides a brief description of the term and given parameters, for the security: "Under protected aquifer from pollution understood overlap deposits prevents the penetration of contaminants from the surface of the earth or of the overlying aquifer horizon.

Protection depends from many factors, which can be divided into two groups: natural and man-made. The main natural factors are: the depth to ground water levels, the presence and power in the context of low permeable rocks, lithology and sorption properties of rocks, level ratio investigated and overlying aquiferous horizons. For man-made factors first of all, should include conditions spent pollutants matter on the ground and respectively their nature penetration into groundwater, chemical composition pollutants, and consequently, their migration ability, sorption, chemical resistance, time disintegration the nature of the interaction with the rocks and groundwater. Ground water protection can be described qualitatively and quantitatively. In the first case, generally considered natural factors, in the second - natural and man-made. Assessment of groundwater protection Mangistau region conducted qualitatively based on features of moisture in the area aeration and the nature of the interaction of pollution with rocks and groundwater. At the same time take into account the hydrogeological conditions of the territory, the degree of overlap ground water loamy and clay layers, and the impact of technogenic on ground water. "Analysis of the map of natural protection of groundwater in the same way as in the case with the analysis of maps of anthropogenic disturbance of groundwater shows that the allocation of the degrees of protection taken into account the impact of more than five factors, and this map fully complies with the requirements of objectivity and accuracy. Consequently, the resulting map, built in Arc GIS by combining vector layers map options presented in Figure 1, the more will fulfill the requirements of precision and objectivity. It outlines four levels of natural protection of groundwater (the contours of each level of natural protection are marked with a separate color) and three levels of anthropogenic disturbance of groundwater (the contours of each level disturbance allocated a separate species hatch). In order to calculate the possibility of the integrated objective function, taking into account the impact of all environmental components must be of the two scales to build a five-level. The map legend to assess the degree of natural protection of groundwater noted that this estimate was based, taking into account not only the natural factors (hydro-geological conditions of the territory, the degree of over lap groundwater

Loamy and clay layers) but man-made (especially moisture in the aeration zone and character pollution interaction with rocks and groundwater) the logical choice as a basis for building a level of protection taking into account the specifics of allocation of anthropogenic disturbance of groundwater, as described in the legend to Fig. 1 (tab. 1).

Table 1. Compliance with degree of protection rating scales and disturbance of groundwater with the conventional five-level scale of anthropogenic disturbance environmental components of Mangistau region

The three-level scale anthropogenic disturbance of groundwater (designated by two types of shading)	**Four-scale level of protection of groundwater (Indicated by 4-color)**	**Five-level scale levels of anthropogenic disturbance of environmental components (legend for building a new map)**	**The combination of colors degree protection (four colors) and Species hatch 3 types (in the box, horizontal line, oblique line)**
Little or no (Shading in the box)	Protected	Undisturbed (little / no)	Hatching in the box
	conditionally protected		Hatching in the box
	Weakly protected	weakly disturbed (weakly)	Hatching in the box
	Unprotected		**Hatching in the box**
Moderate (Shading horizontal lines)	Protected		there is no such zone on the map
	Conditionally protected	Average disturbed (moderate)	Hatching horizontal lines

	Weakly protected		Hatching horizontal lines
	Unprotected		**Hatching horizontal lines**
strong (Shading horizontal lines)	Protected	greatly disturbed (Significant)	there is no such zone on the map
	Conditionally protected		Hatching inclined lines
	Weakly protected	**Very much disturbed (Strong)**	Hatching inclined lines
	Unprotected		**Hatching inclined lines**

Thus, the Table. 1 is actually a description (algorithm) detail a three-level scale of the degree of disturbance of groundwater ("finished" integrated environmental assessment of human impact on groundwater) to the standard five-level scale anthropogenic disturbance of the natural environment components using additional by map zoning of groundwater in terms of their security. The essence of this method consists in that the outline of each five levels for traditional integrated environmental assessment will be determined as the appropriate combination color contour and circuit with shading (combination algorithm represented by the second column of Table. 1. The procedure for such a crossing (polygon) implemented in Arc GIS to produce a vector shape files, automatically storing certain areas of polygons with an indication of their belonging to the color and shading. You can now be considered solved to build the first part of the method of inverse problem solution integrated environmental assessment with the help of GIS technologies and models of the objective function on the basis of the available in the Atlas of Mangystau region maps with ready-made, integrated environmental assessment, take into account the effect of all sources of exposure: the algorithm of obtaining the specific evidence in the traditional manner using a five-level scale. This algorithm is applicable for the areas of polygons like on the territory of the region as a whole as well as for areas with oil and gas complex.

The second part of the methodology - mapping areas at different levels of human exposure to a specific component of the natural environment (in this case, groundwater) in the whole of Mangistau region of the Republic of Kazakhstan and the same levels for areas with oil and gas complex in the objective function does not change and is described in previous papers . The essence of this part of the procedure reduces to the construction and substantiation type of objective functions.

Since we are using as a raw material of the actual detailed ready evaluation map, objectivity and accuracy of expert assessments on which there is no doubt, challenge study evaluation parameter becomes the unit - an algorithm detailing rating scale describes the method of obtaining 5 levels of anthropogenic transformation of groundwater. Thus, the number of settings in the objective function, which is to describe human-induced transformation at all levels is assumed to be 5, the number of transform levels allocated to the detailed of estimated map. It now remains to prove the characteristics of ai weighting factor takes into account the direction (positive or negative) and the importance (weight) of the corresponding factor in the formation of the total level of exposure. Since the purpose of the assessment is the role of the oil and gas complex in the anthropogenic transformation of vegetation, a positive sign will mark exactly the direction of the transformation (negative changes).

Weight load each options define the objective function subject to compliance with the five levels of vegetation transformation of the traditional to expert estimates ten-point scale. In the case of linear scale for each of the 5 levels will fall by 2 points, and the increase will correspond to the level of transformation increase point evaluation. This statement, as in previous works, is justified from the standpoint of the complexity and the cost of environmental protection measures, in particular measures to prevent pollution of groundwater, which is often much more expensive measures for the rehabilitation of the vegetation cover.

As for any component of the environment the cost of activities is growing in proportion to the degree of anthropogenic disturbance, will conduct private environmental assessment of the contribution of each zone in accordance with a weighting factor proportional to the level of transformation in point grading scale. In this case, the lower and upper limits are 5 levels (the parameters of the objective function) are points:

For level low transformation or its absence - undisturbed areas - (green + cell of hatching) - 0 ÷ 2;

- for level weak transformation - slightly disturbed areas - (yellow + cell of hatching) - 2 ÷ 4;
- for level moderate transformation - moderately disturbed areas - (yellow on the map + horizontal shading) - 4 ÷ 6;
- for level significant transformation - strong disturbed areas - (pink on the map + inclined hatching) - 6 ÷ 8,
- for the level of transformation of strong – very greatly disturbed areas - purple color on the map + inclined hatching) - 8 ÷ 10 points.

Assuming for calculation weighted average contribution oil and gas complex in anthropogenic transformation of groundwater average between the boundaries class values, we obtain the following form private objective function to the overall transformation of the groundwater area (POF_{GWA}):

$$POF_{GWA} = f_1 + 3 \cdot f_2 + 5 \cdot f_3 + 7 \cdot f_4 + 9 \cdot f_5, \quad (3)$$

where fi - value of the total area of the polygons a certain level of anthropogenic transformation of the status of groundwater in the whole region.

At this point you should pay special attention. Since as fi not used variables and has specific values - the sum of all the circuits of the same color (5 samples from the table shapefiles attributes), as a result of the decision (3) will be obtained only one result - the number that describes the average anthropogenic transformation of underground water throughout the area. To solve the inverse problem of integrated environmental assessment by comparing areas of different levels of anthropogenic impacts on the status of groundwater in the whole of Mangistau region of the Republic of Kazakhstan and the areas with the oil and gas complex remains to construct a similar way the evaluation function for areas with oil and gas complex. Because these area determined by the same estimated map unlike private objective function for the overall evaluation of the area of the objective function for the location of the fields of vegetation zones of transformation will be only in the oil and gas complex values. Now it square color combinations and types of hatching zones only within the oil and gas producing complex circuits), and the weight load will remain the same as in equation (3):

$$POF_{GWOGC} = f_{OGC1} + 3 \cdot f_{OGC2} + 5 \cdot f_{OGC3} + 7 \cdot f_{OGC4} + 9 \cdot f_{OGC5}, \quad (4)$$

Where POF_{GWOGC} -function of a certain level of the anthropogenic disturbance of the status of groundwater in the areas of field location, which is calculated by dividing the value of the level of the total area of the polygons in the zones with the oil and gas complex on the total area of all zones with oil and gas complex

And in this case is a POF_{GWOGC} share space with the amount of a certain level of the anthropogenic disturbance of the status of groundwater in areas of oil and gas complex to the sum of the areas of all these areas in fact the function of a certain level of the anthropogenic disturbance of the status of groundwater in areas of oil and gas complex and POF_{GWOGC} reflects the average (weighted average) assessment of human impact on groundwater in the whole areas to oil and gas on the territory of the Mangistau region.

Attention is drawn to the fact that in the equations (3) and (4) will be involved not variables, and have specific values - the sum of all the circuits of the same color (5 samples from the table attributes shapefiles for circuits with oil and gas complex (in the numeral) and the area of the region, and the total area of all the zones of oil and gas complex (in the denominators) The solution of equation (3) or (4) is received only 1 result - the number that describes the average anthropogenic transformation of the status of ground water throughout the area, or only in one of its the part where there is oil and gas complex

The role of the oil and gas complex is in the transformation of the status of groundwater Mangistau region as a whole is determined by subtracting the value of POF_{GWOGC}

Resulting in a ten-point scale score is the result of the value of the inverse problem solution and represents an additional contribution of oil and gas complex in anthropogenically disturbed state of groundwater in the Mangistau region on all levels of human transformation. This value can be, for clarity, to translate into percentages. An additional contribution of oil and gas complex in the anthropogenic transformation of the status of groundwater is because POF_{GWOGC} reflected the net effect of the main factors in accordance with the legends to the scorecard) contribution.

3 Problem Solution

As the purpose of this work is incorporated to obtain the result of methodical (Admission detail assessment of anthropogenic transformation of groundwater status scale) and quantitative results - determine the contribution of the oil and gas complex in the anthropogenic transformation of the status of groundwater Mangistau region through the use of ready-made expert private environmental assessment.

Methodical result follows from the previous section, we give it more concentrated formulation.
The basis for assessment is the detailed map of the natural protection of groundwater. Algorithm, implements reception detail a three-level scale of the degree of disturbance of groundwater ("finished" integrated environmental assessment of human impact on groundwater) to the standard five-level scale is that the contours of each of the five levels for traditional integrated environmental

assessment will be determined as the appropriate combination of color contour and contour with shading (combination of algorithm represented by the second column of Table. 1) The procedure for such a crossing (polygon) is implemented in the Arc GIS to produce a vector shape files, automatically storing certain areas of polygons with an indication of their belonging to the color and shading.

The results of the inverse problem solution integrated environmental assessment on the basis of detail ready map expert private environmental assessment of anthropogenic transformation of the status of groundwater Mangistau region. Computational process consists of two parts - Obtain concrete evidence in the form, adapted for use in the objective function, implementing simple way to solve the inverse problem and comparing areas of different levels of anthropogenic impacts on the status of groundwater in the whole of Mangistau region of the Republic of Kazakhstan and the same levels for areas with oil and gas complex in the objective function represented in the equations (3) and (4). In determining the areas on starting estimated map anthropogenic transformation groundwater status under the base were selected separate data map Atlas of Mangystau region which were subsequently digitized in ArcMap by applying component.

Table 2. Assessment of the proportion of the contours of areas with oil and gas complex of the areas on the field zones in general, with a different degree of anthropogenic transformation of vegetation

The degree of anthropogenic disturbance of groundwater status	**Slightly / Absence**	**weak**	**moderate**	**Significant**	**Strong**
The total area of the zones on the levels of disturbance in the whole area, km2	483,37	24790,57	34800,37	5892,34	40275,69
The total area of the contour with the oil and gas complex in the areas and levels of disturbance, km2	0	269,32	3131,38	1031,16	2676,23
Share contour area with oil and gas complex in the areas and levels of transformation%	0,0	1,1	9,0	17,5	6,6

In areas with oil and gas complex also received the sum of the areas part of the contour of each of the five colors, which reflect levels of anthropogenic transformation of the status of groundwater within the contours of oil and gas complex (second row in Table 2). In the third row of Table 1 shows the percentage of the area of oil and gas complex contours in the areas and levels of transformation, expressed as a percentage, which shows the change in the proportion of area circuits with oil and gas complex with the growth of the degree of anthropogenic transformation of the status of groundwater:

for low-level transformation or its absence - the state of undisturbed groundwater - (green + cell of hatching) - 0.0%;

For low-level transformation - slightly disturbed state of groundwater - (yellow + cell of hatching) - 1.1%;

- for a moderate level of transformation - medium disturbed state of groundwater - (yellow on the map + horizontal shading) -9.0%;
- for the level of significant transformation – strong impaired groundwater status - (Pink on the map + inclined hatching) - 17.5%
- for the level of transformation of strong – very strong disturbed state of groundwater - purple color on the map + inclined hatching) - 6.6%.

In absolute terms (km2) the maximum areas with oil and gas complex belongs to the temperate zone of transformation, and in the relative (%) - to be significant. Thus, a simple comparison of the resulting zones for each color on the whole territory of Mangistau region contributes only oil and gas complex in the specific area of human transformation of the status of groundwater. Let us to calculations private objective functions row values given in Table 2. In this case equations (3) and (4) converted to (5) and (6), respectively:

$$POF_{GW} = 483{,}37 + 3\times 24790{,}57 + 5\times 34800{,}37 + 7\times 5892{,}34 + 9\times 40275{,}69 \quad (5)$$

$$POF_{GW\ OGC} = 0 + 3\times 269{,}32 + 5\cdot 3131{,}38 + 7\cdot 1031{,}16 + 9\cdot 2676{,}23 \quad (6)$$

Calculation objective functions (5) and (6) can provide receipt generalized evaluation (Table 3).

Table 3. Calculation of the average contribution in the oil and gas complex of anthropogenic transformation of vegetation on the territory of Mangistau region

Power anthropogenic transformation states groundwater	**insignificantly or absence**	**Weak**	**moderate**	**Significant**	**strong**	**Estimated value of the objective function private groundwater**
The total area of the zone score (score × km2)	483,37	74371,7	174001,9	41246,4	362481,2	**652584,551**
The total score area contours of the oil and gas complex (score × km2)	0,0	808,0	15656,9	7218,1	24086,1	**47769,0787**
The weighted average rating of anthropogenic disturbance of groundwater Mangistau region, points						**6,14**
The weighted average rating of anthropogenic disturbance of groundwater Mangistau region,%						**61,42**
The weighted average rating of anthropogenic disturbance of groundwater Mangistau region with oil and gas complex, points						**6,72**
The average contribution of the oil and gas complex in the anthropogenic disturbance of groundwater Mangistau region,%						**67,20**
An additional contribution of oil and gas complex in the anthropogenic disturbance of groundwater Mangistau region,%						**5,78**

So, the main purpose of this work - quantification of the contribution of the oil and gas complex in the anthropogenic transformation of the status of groundwater Mangistau region - has been achieved as a result of specific decisions of the new theoretical problems in the field of integrated environmental assessments. As a result, new types of assessments inverse problem solution integrated environmental assessment obtained an opportunity to Allows you to solve practical questions of economic support for environmental activities on a particular component of the natural environment (in this case - of groundwater) the implementation of the principle of "polluter pays" by quantifying the additional contribution of the oil and gas complex in anthropogenic the transformation of the status of groundwater in the Mangistau region, which is 5.78% higher than the weighted average value for all the impact factors.

The weighted average rating of anthropogenic transformation of the status of groundwater in the Mangistau region with oil and gas complex was 6.72 points on a scale with an average assessment of anthropogenic transformation of the status of groundwater in Mangystau region as a whole 6.14 points. Based on the results in Table 3, showing an increase in the share of oil and gas area contours of the complex with the growth of the degree of anthropogenic transformation of the status of groundwater, it can be concluded about the possibility of further growth of anthropogenic transformation of the status of groundwater.

The resulting value shows that the impact of oil and gas complex in the state of underground water has gone beyond its specific areas, as well as all other components of the natural environment. This situation highlights the need for control methods of the organization of industrial environmental monitoring, the results of which are not usually show no exceedances of standards issues.

4 Conclusion

The main purpose of this work - quantification of the contribution of oil and gas complex in the anthropogenic transformation of the status of groundwater Mangistau region - has been achieved as result of specific decisions of the new theoretical problems in the field of integrated environmental assessments. Quantification of the additional contribution of oil and gas complex in the anthropogenic transformation of the status of groundwater in the Mangistau region, which is 5.78% higher than the weighted average evaluation of the impact on all factors allows us to solve practical issues of economic support for environmental measures implementing the principle of "the polluter pays".

A detailed evaluation of the reception of anthropogenic transformation of groundwater status scale). The basis for assessment is the detailed map of the natural protection of groundwater. The algorithm that implements the reception of detail a three-level scale of the degree of disturbance of groundwater ("finished" integrated environmental assessment of human impact on groundwater) to the standard five-level scale is that the contours of each of the five levels for traditional integrated environmental assessment will be determined as the appropriate combination of color contour and contour with shading (combination of algorithm represented by the second column of Table.1) The procedure for such a crossing (polygon) is implemented in the Arc-GIS to produce a vector shape files, automatically storing certain areas of polygons with an indication of their belonging to the color and shading. The advantage of the method is simplicity and speed of receipt result in the presence of vector formats scorecards in Arc GIS. However, it should be borne in mind that when using expert review map you need to check them on the level of objectivity (set of parameters) and accuracy

(quantization scale levels for each assessment parameter) and lead to a uniform evaluation system. However must be keep in mind, that when using peer evaluation map you need to check them on the level of objectivity (set of parameters) and accuracy (quantization scale levels for each assessment parameter) and lead to a uniform evaluation system.

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