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Risk or Sensitivity Assessment of Surface Water Pollution in the Catchment Area of Ahmad Beyglu Dam Using a WRASTIC Model

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1-Introduction

One of the most important water-related problems is surface and groundwater pollution, mostly due to human activities, which is currently threatening many of the world's water resources (Surface water quality monitoring guidelines, 2009: 14). Occurrence of natural disasters such as floods and earthquakes, accidental and deliberate release of pollutants into water sources, and other accidents, including accidents at facilities, transportation and movement of hazardous materials that have destructive effects on the environment, are among the most important issues which have already affected many communities (Simeono et al., 2003: 16). Regarding the limited water resources of the country and the intensification of the needs of different sectors, providing suitable water for different uses is one of the main challenges for the government to achieve sustainable development. In line with policies to prevent water pollution and control pollutants, optimal use of water resources and proper implementation of laws and regulations for the protection of water resources should be refined. The reuse of urban, industrial, and agricultural effluents should be considered as one of the important orientations of the next decade (Mahmoudi, 2003: 6).

2-Materials and methods

In the current study, the WRASTIC method has been used to evaluate the pollution risk of the Ahmad Beyglu dam catchment, and the Iran water quality index for surface water resources-conventional parameters (IRWQISC) has been used to evaluate the efficiency of this method. Arc Hydro add-on in Arc Gis software environment has been used to determine the scope of study and its sub-basins. Research steps include collecting information and reviewing study records, identifying the factors affecting the river based on available information, visiting the area (including identifying industries, sand

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extraction workshops (river materials), fish farms, agricultural lands, water facilities, Sewage and runoff, and other activities affecting the river in the current situation), preparing the distribution of effective activities in the GIS environment and finally analyzing the data and information using the WRASTIC index.

The WRASTIC method is a systematic method for measuring the pollution potential of the catchment and, ultimately, the ability of rivers to accept new pollution. This method has been introduced by the American Water Works Association (AWW) in accordance with the relevant instructions and guidelines. In this method, basin settings, which are a combination of the basin's main characteristics and user parameters (which affect the potential for pollution), are the main basis of the work. These characteristics include the presence of Wastewater discharges (W); Recreational land use impacts (R); agricultural land use impacts (A); the size of the watershed (S); transportations avenues (T); industrial land use impacts (I); and amount of vegetative ground cover (C). Using such a method and combining the above parameters, the overall sensitivity of the basin to potential contamination can be assessed. These features can also be plotted graphically (Diamantino et al., 2005: 39).

After determining the above parameters, using Equation (1) to determine the WRASTIC index for the desired basin was used (6):

(1) $\text{WRASTIC Index} = W_R W_W + R_R R_W + A_R A_W + S_R S_W + T_R T_W + I_R I_W + C_R C_W$

3-Results and Discussion

The concluding results of the pollution assessment of the whole basin revealed that the total water risk index of Ahmad Beyglu Dam is equal to 30.52. Since each sub-basin area is different, to determine the absolute risk of the whole basin, the product of the area of the sub-basins is multiplied by the risk value of each sub-basin was used. The final results of the water pollution risk assessment of Ahmad Beyglu Dam under the basins are presented in Table 1.

Table (1): Results of basin risk assessment and hydrological units of Ahmad Beyglu Dam

Name of study section (z)	Area (Sz)	Risk Value (RZ)	$R_{zi} * S_{zi} / SB$
A1	10	35	1.57
A2	28	35	4.41
A3	46	44	9.11
A4	33	28	4.2
A5	58	29	7.57
A6	19	16	1.36
A7	28	18	2.3
Total Basin	222	205	30.52

Based on the risk classification results using the WRASTIC model in the catchment area of Ahmad Beyglu Dam and based on the scoring range in this model, it can be acknowledged that the risk of sub-basins A1 to A5 is moderate, and the risk of sub-basins A5 and A6 is low.

Regarding the obtained data, according to the IRWQI index, sub-basin A2 has a 70% compliance with the quality index at quality monitoring station No. 2 and 81% compliance with the risk index at the location of the quality monitoring station No. 3. Also, sub-basin A3 in quality monitoring station No. 4 has 88% compliance with the obtained risk index.

4-Conclusion

This study aims to evaluate the risk of Ahmad Beyglu dam catchment and evaluate the compliance of this index with the results of quality monitoring data in the basin to increase the accuracy of the model. Accordingly, the risk level of the main parameters of the WRASTIC index in the basin was calculated. The results reveal that the level of risk increases from sparsely populated, new, and less developed industrial and recreational areas to densely populated areas with access, close to Meshginshahr, tourists, and industries.

Keywords: Risk Assessment, Pollution Accidents, WRASTIC Model, IRWQISC Index, Ahmad Beyglu Dam, Ardabil.

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