University of Zabol
Graduate School
University Campus
Department of Civil Engineering

The Thesis Submitted For the Degree of M.Sc.
(in the field of Civil Engineering - Water Engineering)

Title:
modeling of surface reservoirs behavior in case of sudden injection of biological pollutants with passive defense approach (Case Study: Sistan Chah–Nimeh reservoirs)

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Abstract

Water security is one of the major issues that can be compromised by the sudden injection of a pollutant into the drinking water of a city, for example, following a terrorist attack. Hence, passive defense studies, and the establishment of a pollution control system, rapid detection of the level and manner of pollution spreading and warning are of great importance. In this study, using the two-dimensional CE-QUAL-W2 model, a quantitative-qualitative model for Chahnime reservoirs is presented. After verifying the accuracy of the model, Coliform index is used to predict the behavior of reservoirs against random biological pollution load. Afterwards, spreading manner, displacement and decay of the pollutant according to the arrival time in the reservoir, wind speed and direction, air temperature, location and the time of entering the pollutant, and the discharge into the reservoir, are studied for one year (1392). The water-body response to the random input of pollutants as a programmed hazard warning can be used by the managers of the exploitation of the connected Chahnime reservoirs. The pollution scenario illustrated that the highest and lowest pollution rates for the output of the Chahnime 1 occurs in the months of Khordad and Mordad, and for the output of 3, this was in Ordibehesht and Dey, and for the output of Chahnime 4, it occurs in Tir and Bahman. Therefore, in order to determine the response of water reservoirs to other pollution scenarios, the rate and trend of pollution spreading in Khordad and Mordad months is obtained for Chahnime reservoirs 1, 2 and 3, and Tir and Bahman months for Chahnime reservoir 4. The results show that the decay rate of coliform is more effective on the amount of pollution in the outlet points than sedimentation rate. Increasing the wind speed increases the amount of pollution (a) at the output of Chahnime 1 in both months of Khordad and Mordad, (b) at the outlet of Chahnime 4 in both months of Tir and Bahman, and (c) at the outlet of Chahnime 3 in Khordad. On the contrary, in Mordad, the amount of pollution in the outlet of Chahnime 3 decreases. Considering the direction of 5.89 radians, due to the coincidence with the prevailing Winds of the region, the concentration of pollutant at the outlet points is less than wind in the 2.75 radians. As the air temperature decreases, the pollution rate increases in the outlet of Chahnime 1 in Khordad and decreases in Mordad, and increases in both months of Khordad and Mordad at the outlet of Chahnime 3, and in the outlet of Chahnime 4t, decreases in Tir and increases in Bahman. 2 times increase or 50% reduction in the input pollutant concentration increases the concentration of pollution at the outlet points by 2 times or decreases it by 0.5 times, respectively. In the study of the location and manner of pollution entry, it was also found that when pollution occurs near the outlets of the reservoirs, it is faster and more concentrated at the outlet point. But farther away from the outlet, the amount of pollution peak decreases and it leaves the reservoir with more delay. By increasing the amount of discharge into the reservoir, the pollution concentration in both outlets of Chahnime 1 and 3 decreases in Khordad and increases in Mordad. In the outlrt

of Chahnime 4, with increasing and decreasing inlet flow in both months of Tir and Bahman, pollution concentration increases and decreases respectively.