Groundwater Seepage Assessment at 4/6 km of Tehran Metro Line 7 Tunnel whit SEEP/W Software and Comparison with Analytical Methods and Observations

Document Type: Research Paper

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Abstract

Groundwater Seepage Assessment at 4/6 km of Tehran Metro Line 7 Tunnel whit SEEP/W Software and Comparison with Analytical Methods and Observations. One of the important problems in the construction metro tunnels under ground water table is the problem of water entrance into the tunnel, which can completely affect the tunnel construction activity. There are several ways to solve these problems. In order to lower the groundwater level in a section of the Tehran Metro line 7 tunnel (4.6 Kilometers), from two galleries with length 14 meters along the tunnel is used. Water drainage modeling and comparing its results with analytical results and observations are reviewed in this paper. In order to find out the performance of such software, in this paper, by considering the actual data of the tunnel line 7 of Tehran subway, 4.6 Kilometers, a model of the tunnel in the SEEP/W software, was simulated, to calculate the water input to the tunnel and drainage. The results show that the seepage rate calculated in the numerical method is 640 (cubic meters per day) and the analytical is 747.3 (cubic meters per day) which have a good agreement in calculating the rate of groundwater infiltration into the tunnel. The finite element method error is 11%, which indicates its ability to estimate the amount of water entering and exiting the tunnel thus, this software is reliable for modeling and achieving the desired goals. Also, effective factors such as changes in gallery distances from the tunnel and parameters such as permeability and water head were investigated, which had the greatest effect on the water entering the tunnel.

Keywords

- Water seepage
- Tunnel Line 7 Metro Tehran
- Drainage gallery
- SEEP/Wsoftware
- Analytical methods

Source determination and formation mechanisms of sulfur and thermal springs of Siah-Kuh anticline, south-west of Iran, using hydrogeochemistry and isotope characteristics

Document Type: Research Paper

Authors

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Abstract

Dehloran and Doiraj Sulfur and thermal springs having different physicochemical characteristics are both discharged from the Siahkouh anticline located north of Dehloran city, southwest of Ilam province. Geological, hydrogeological, hydrogeochemical and isotopic studies were performed to determine the properties of the springs. Monitoring of discharge, temperature, pH, amount of hydrogen sulfide and dissolved oxygen in situ, and analysis of major ion chemistry in the laboratory were arranged for one year in a monthly intervals. Deuterium, oxygen 18, and sulfur 34 stable isotopes were measured in two dry and wet periods to determine the source of water. Hydrochemical composite diagrams were used to identify the dominant hydrochemical processes. Hydrochemical-based geothermometry and relationships between stable isotopes and comparing with local and global meteoric water lines were performed to determine the source of springs water. Finally, by using the findings of geology, hydrogeology and hydrogeochemistry, a conceptual model is presented for springs formation. Geological and hydrogeological studies showed that the deep faults in Siahkouh anticline have caused hydraulic connection between Ilam and Sarvak karstic formations with old and deep suited evaporite formation. The high temperature of the springs is due to the deep circulation of meteoric waters along fractures and faults. The origin of hydrogen sulfide (H2S) in the springs' water is the activity of sulfate reducing bacteria. Despite the presence of brines in the oil and gas fields in the study area, the Na/Cl, SO4/Cl and TDS/Br ratios showed that the salinity of Doiraj and Dehloran sulfur springs is the dissolution of evaporite formations. Analysis of sulfur stable isotope (34S) also revealed the source of dissolved sulfate in spring water is evaporite formations. Analysis of Deuterium, oxygen 18 stable isotopes in the springs determined the origin of these springs is the local precipitation.

Keywords

- Dehloran
- Hydrogeochemistry
- Stable Isotopes
- Sulfur and Thermal Springs
- Sulfate Reduction

Assessment of groundwater resources management solutions by finite element in numerical simulation

Document Type: Research Paper

Authors

- Samira Rezaee
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Abstract

Todays based on limited Water Resources, growth of population and industrial development has caused to be taken on the optimal use of groundwater resources. On the other hand, construction of underground dam does not need to surface water storage, land use and ecosystems changing. By using groundwater model, the fluctuation of groundwater levels in aquifer is simulated and predicted against various conditions such as underground dam. This study is to investigation of the future status of the Eyvanki aquifer and its reaction against various management scenarios were used by FEFLOW software. Moreover, for aquifers with limited area, finite element method could be more effective because of considering small grid size. Actually, the grid size of network in finite element method shape on as small triangle, so groundwater flow would be simulated with more details in each cell. In this study, to investigation of the subsurface dams effects on the hydrodynamic behavior of the aquifer as a main scenario, define three management scenarios and their effects were studied along with the implementation of an underground dam. Auxiliary scenarios involves perform artificial feeding; reduced utilization was 10% and 20%. The results showed that the construction of an underground barrier along with 20 percent reduction utilization, on average about 2/53 meters to the aquifer water are added. In addition, the result of this study would proposed that in aquifers faced with decreasing groundwater level specially in arid or semiarid regions, construction of underground dam is more effective solution to avoid owing to an ongoing.

Keywords

- Artificial recharge
- Eivanaki aquifer
- exploitation management
- FEFlow
- finite element model

Investigation of Groundwater Monitoring System in Iran and Selected Countries and Pathology Based on it

Document Type: Research Paper

Author

- Saeideh Samani

Abstract

Monitoring is a Supervisory process with a scientific and dynamic design based on observation, inventory, measurement and data recording, to identify the quantitative and qualitative water resources for planning and managing water resources. Long-term monitoring without evaluation, pathology, and optimization processes leads to poor management of output data, the inefficiency of the system, and increased monitoring costs. One of the essential steps in the evaluation of the monitoring networks is to determine the state of their measurement parameters and their frequency according to the purpose of the monitoring network. Hence, based on the evaluation of information needs, especially in the basic groundwater studies and groundwater balance calculations, this paper evaluates the groundwater monitoring network in Iran. This assessment has been carried out by comparing the network of groundwater monitoring in our country with the monitoring network in some countries of the world with a different degree of development. Finally, after the evaluation of the present monitoring network, considering the global experiences and comparing them with the current situation in Iran, Suggestions in four areas: management of groundwater monitoring network information through full understanding of network information needs, design, deployment and implementation of integrated water information management system and upgrading of equipment and technologies in line with world standards; 2) Manage through Recruit capable human resources appropriate to equipment installation, data collection and transfer, data recording and processing along with motivating human resources and enhancing public participation approaches; 3) Managing organizational structure in the country; and 4) Managing finances through in order to implement the optimal monitoring network in the country, is presented.

Assessment of Groundwater Vulnerability of Golpayegan Plain Using DRASTIC Method Optimization

Document Type: Research Paper

Author

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Abstract

Assessment of Groundwater Vulnerability of Golpayegan Plain Using DRASTIC Method Optimization Qualitative and potential of contamination evaluation of groundwater resources is necessary for contamination protection and their effective management. The Golpayegan study area as one of the most important plains of Isfahan province and one of the most important agricultural areas, has been exposed to nitrate contamination. Therefore, investigation of vulnerable areas of the aquifer in this area with proper method has a more importance. In this study, at first, DRASTIC method was applided to determining the vulnerable areas of Golpayegan plain. Then, to optimizing the DRASTIC method using genetic algorithm, the objective function was defined to the genetic algorithm and by maximizing the objective function, the optimum weights of the DRASTIC parameters were obtained. Also Sugeno fuzzy logic method was used to improve the weights of the DRASTIC method. Nitrate concentration data and its correlation index with vulnerability were used to evaluate the validity of the proposed methods. Correlation indices showed that the optimized DRASTIC using the genetic algorithm has a higher correlations with nitrates and presented the better results than the genera DRASTIC for the region. Optimized map using Genetic Algorithm method showed respectively 6, 23, 34, 21 and 16% of the plains are located in areas with very low, low, moderate, high and very high vulnerability. Correlation indices showed that the optimized DRASTIC using the genetic algorithm has a higher correlations with nitrates and presented the better results than the genera DRASTIC for the region. Optimized map using Genetic Algorithm method showed respectively 6, 23, 34, 21 and 16% of the plains are located in areas with very low, low, moderate, high and very high vulnerability. Keywords: Aquifer, Contamination, DRASTIC, Fuzzy Logic. Golpayegan Plain.

Effect of Aquifer Management on Some Soil Properties (Case Study: Meymand Station, Kerman Province)

Document Type: Research Paper

Authors

- ali akbari jor
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Abstract

In addition of precipitation deficiency, the rainfall with high intensity and short duration are the characteristics of arid and semiarid regions. This situation caused huge floods. These floods carries a lot of fine sediments that were silted on land and could change the soil properties. In addition of precipitation deficiency, the rainfall with high intensity and short duration are the characteristics of arid and semiarid regions. This situation caused huge floods. These floods carries a lot of fine sediments that were silted on land and could change the soil properties. In this study, the effect of flood spreading on soil was investigated at Flood Spreading Station after 15 years of its construction. Meymand Floodwater spreading Station is located 210 km from Kerman and has 23 broadcast channels. According to the number of floodwater spreading channels, sampling for soil experiments was carried out from three parts of the flood spreading area (first, middle and end of the flood spreading area), one channel and each channel of three samples were randomly taken from 0 to 30 cm depth. Analysis and comparison of the meanings were done using Duncan test. Statistical analysis of the data showed a significant increase in the percentage of clay, sand, silt, electrical conductivity, saturation percent, total nitrogen, phosphorus and potassium, and a significant decrease in the percentage of sand and saturation percent. There was no significant difference in pH in floodwater spreading and control area. There was no significant difference in pH in floodwater spreading and control area. There was no significant difference in pH in floodwater spreading and control area.

Keywords

- Duncan test
- Floodwater spreading
- Meymand - Shahr-e Babak
- Control area
- Soil properties

Development of Hydrogeochem software for investigation of hydrogeochemical properties and water quality

Document Type: Research Paper

Author

- Mehdi Kord

Abstract

Graphic evaluation is an important part of hydro-geochemical evaluation of surface and groundwater resources, by which important water characteristics such as origin, use, main reactions, type, sample classification, and many other specific water issues are identified. So far, various softwares have been presented in this field, each of which has advantages and disadvantages. The purpose of designing Hydrogeochem is to provide a software with a simple environment, free of any complexity to check the quality of water, which, while providing the necessary facilities, has no installation restrictions. Hydrogeochem is a Windows software that is compatible with a variety of Windows and is designed to draw some of the most widely used hydrogeochemical diagrams such as Piper, expanded Durov, Stiff, Schoeller, Wilcox, and the USSL. It is very easy to work with and has a fast operation. Simultaneous evaluation of 999 water samples (in groups or case) is possible with this software. The major elements including calcium, magnesium, sodium and potassium, chloride, sulfate, carbonate and bicarbonate are the qualitative parameters necessary to study most qualitative diagrams. Moreover, the pH and total dissolved solids are also used in some diagrams. In the designed software, linear equations were used to draw the position of each sample. In the case of diagrams such as Piper and Durov diagrams, line equations for cations and anions are first formed, and then their intersection is calculated. Finally, the points obtained are plotted in a Cartesian system. For all the basic diagrams, on which the data are implemented, their mathematical equations are used so that the quality of the output images is not reduced. The figure below shows the main windows of the Hydrogeochem. In designing the Hydrogeochem software, we tried to consider the most important qualitative analysis diagrams, including the expanded Durov, which is one of its great advantages. Another advantage of this software is that it draws the Schoeller diagram based on the limits of drinking water quality and simultaneous display of pH. In this software, it is possible to draw diagrams after calculating the ionic balance. Although the presence of an error in chemical analysis does not lead to the failure of drawing the sample quality diagram, it notifies the user of the error. Data entry, necessary settings, and the output of the software are designed in the simplest possible way, and this software lacks any complexity. In the next version, we try to provide the necessary facilities for calculating statistical indicators and drawing contour maps using statistical and geostatistical tools.

Investigation of groundwater fluctuations influence of climate change and improved irrigation method (Case Study: Ahar plain)

Document Type: Research Paper

Authors

- Maryam Mohammadpour
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- Vahid Rezaverdinejad
- behzad hessari

Abstract

Ground water management is one of the most basic water management issues on basin level. In recent decades, natural and human factors have created critical conditions in aquifers of the country. In this research, the effects of development of pressurized irrigation systems on groundwater resources of Ahar plain have been investigated with WEAP software during 16 years. After calibration and validation of the model, the present situation of the region was simulated. The simulation results showed that development of pressurized irrigation systems has a significant change in the storage volume of aquifer and caused a drop in groundwater level of the Ahar plain. In order to analyze of conditions and to demonstrate of changes effect in different conditions and prediction for the future, the general circulation models of CGCM3 and HadCM3 were developed under A1B, A2 and B1 emission scenarios. The scenarios results showed that the average annual volume of aquifer increased 25% in the lack of pressurized irrigation development condition in the region. If pressure irrigation did not develop in the region, and instead of, surface irrigation was carried out, Surface runoff and agricultural return flow were more than the current situation in the basin. Also, the future climate scenario showed that with continuing the current situation in the future, the average annual volume of the aquifer will be reduced by 33%, that it will be caused to groundwater destroyed in the future. So pressurized irrigation systems not only do not save water but also lead to destruction of groundwater aquifers in the country. The results of this study emphasize the necessity of basin management studies to adopt proper management strategies, especially in critical areas.

Keywords

- Ahar plain
- Groundwater level
- Pressurized irrigation
- Atmospheric circulation models
- WEAP model

Potential of hydrogeochemical karstization of springs in Hashtgerd study area

Document Type: Research Paper

Authors

- Mahsa Jamdar
- Mahdi Sarai Tabrizi
- Hossein Yousefi

Abstract

Structural and lithological features in the study area of Hashtgerd have provided suitable conditions for the formation of karst phenomena in the region. The high approximate groundwater level in the area is a sign that karst is not expanding in depth. The karst geomorphological forms are not as visible as the cave, the sinkhole, and the poner. The only karst phenomena observed in the Carnegie region are karst springs and dissolving cavities. The aim of this study was to study the hydrogeochemical study of springs with emphasis on the sex of the formation. For this purpose, 5 water samples from the permanent springs of the region were collected and chemically analyzed during the water shortage period (October 2016). The results of hydrogeochemistry of karstic springs and XRF in the region showed that karstic waters flow in a highly developed system. The average ratio of calcium ion to magnesium in selected springs is 2.29. Therefore, the material of the groundwater aquifer in the watershed of the studied springs is mainly calcareous. The degree of dolomite saturation index in the valleys of Vali Darvish Cheshmeh (2), Vardeh (4), and Yamanjliq (5) is negative, which shows and reflects the saturated conditions, and the higher density of surface and subsurface fractures, as well as the flow type - It is a source of water flow in these springs. Groundwater chemistry in carbonate rocks was a function of the dissolution of calcite and dolomite. The high water temperature in the Alan salt spring has affected the dolomite saturation capability in Dalan Formation. The results of factor analysis showed that the most important factor depends on the dissolution of carbonate and then on the amount of magnesium and electrical conductivity, which has the greatest effect on the rate of dissolution.

Identifying the permeable zones in Dare-h-Zar copper mining area in Sirjan using time series analysis of the precipitation and groundwater level

Document Type: Research Paper

Authors

- Sepideh Mali
- Hadi Jafari
- Reza Jahanshahi

Abstract
The Dareh-zar copper mining area is located approximately 50 km northwest of Sirjan and 10 km south of Sarcheshmeh copper mine in Kerman province. The general direction of the groundwater flow is approximately from north to the south. Without groundwater pumping in the mining area, temporal variations of the groundwater levels were dependent only on the rainfall and the river's discharge fluctuations. In this research, the time series analysis of the precipitation and the water table has been performed to determine their relationship. In order to prepare the water table and precipitation data, the components of the trends were identified and then deleted for the calculation of time series in the frequency domain. Also, for preliminary study of the location of permeable zones in the hard rock layers, the three-dimensional graphical model of permeable zone has been drawn based on the geo-statistical method using ROCKWORK software. In the time series of the groundwater levels, a dominant decreasing linear trends were recognized during the period of 2014-2017. After de-trending the time series of rainfall and water table, using autocorrelation functions, a seasonal trend with a period of 12 months was recognized in the data, which was due to the annual changes in climatic conditions. According to the time series analysis, the time lags between the precipitation and the groundwater levels vary between 1 and 2 months. The time lags have been increased to one year in the southeastern of the mining pit. It is probbaly resulted from a zone with very low permeability. The lag time of impact response functions (IRF) for water table in the observation wells (in related to the spatial variations of hydraulic head) were plotted versus the direct distance between the wells. In general, the lag time is expected to be increased with increasing spatial spacing between wells, while in the study area there was no strong relationship between the lag time and the direct distance. In fact, the IRF of the water table to variations of the hydraulic head in the hard rock aquifer of study area (unlike to alluvial aquifers) was not dependent on the distance between the observation wells. So hydraulic connectivity was probably through high-permeability zones in the study area. The north and south area of the pit show the lowest lag time with the maximum number of lag times less than 1 month. Therefore, high-permeability zones were probably located in the north and south of the pit. It was confirmed by three-dimensional model (fence diagram) of lithology showing the locations of the seepage faces and permeable zones in the area. The northern and southern parts of the pit are suitable places for drilling wells for dewatering plan of the mining area. Finally, three-dimensional model and fence diagram of the lithology showed that a permeable zone has been extended in elevation 2500 to 2600 m above sea level. The locations exactly correspond to the seepage faces level in the mine pit.
Keywords

Potential location of renewable groundwater in Urmia Lake basin by AHP analysis and spatial fuzzy technique (case study: Urmia plain)

Document Type: Research Paper

Authors

- saied moghaddam
- hojjat ahmadi
- Kamran Zeynalzadeh
- behzad hessari

Abstract

Groundwater resources have long been used by humans as a reliable alternative due to their higher reliability and lower fluctuations, and have declined quantitatively and qualitatively in recent decades due to over-harvesting. In this study, the potential of groundwater resources in Urmia Lake basin was studied using Analytical Hierarchy Process (AHP) method and hybrid model of fuzzy logic- Analytical Hierarchy Process. It is necessary to reduce the negative interaction between the lake and the surrounding groundwater resources as much as possible by managing the abstraction of groundwater and identifying the sensitive areas of the aquifers of this basin and identifying the harvestable areas. First, the effective layers in groundwater potential (layers of height, slope model, land use, river distance, river density, geology, precipitation, evaporation and groundwater level) were prepared by ArcGIS. The results of study showed that in the AHP and the combined model of fuzzy logic, about 18.9% and 25.33% of the region's surface have high potential and are suitable for drilling wells, respectively. Finally, the ROC curve was used to determine the accuracy of the final maps. The accuracy of the final maps prepared by the AHP method and fuzzy logic-AHP was 0.775 and 0.812, respectively, and Fuzzy logic-AHP method had better performance in groundwater potential finding than Analytical Hierarchy Process.

Keywords

- AHP
- Aquifers
- Fuzzy logic
- Groundwater potential
- Lake of Urmia

Hydrogeological evaluation of heap leaching site of Sungun copper mine (East Azarbaijan) and analysis the potential environmental pollution

Document Type: Research Paper

Author

- Vahab Amiri

Abstract

Release of toxic heap leaching fluids into the environment can affect the health of both the surrounding ecosystem and human population. Understanding the hydrogeological conditions based on the hydrogeochemical behavior of water resources at the heap leaching site of the Songun copper mine as the most important action which should be taken to prevent potential environmental problems provides the conditions for sustainable development at the surrounding of this mine. In this study, field surveys, sampling of groundwater resources, geophysical studies, geotechnical studies, and reverse geochemical modeling were used to analyze the hydrogeological status of the area. The presence of fractures and cracks extending to depths suggests that some of the deeper preferential paths can be considered for water flow in the area. Flowing the water in the fractures network along with the hydraulic gradient as well as the topographic status of the area towards the southern areas has caused the seepage face in some places. Based on the analysis of the hydrogeological conditions of the area, it seems that the potential of the geological structures and structures of the area as well as the fracture network in this area are not capable of high water transfer and storage. On the other hand, it should be noted that the hydrological and climatic capability of the region does not provide a significant volume of water and this has prevented the formation of groundwater resources (i.e) aquifer). Therefore, there is no potential for environmental problems at this site due to leakage from the heap leaching site as well as contamination at an alarming extent. However, the establishment and development of drainage facilities located on and near the surface of the land can minimize the risk of environmental problems.

Keywords

- Songun copper mine
- Heap leaching
- Hydrogeology
- Reverse geochemical modeling