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The Studies of Implementation Phase and Integrating Flood Control of Ghaleh-Shah in Watershed, Kermanshah Province, Iran

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ABSTRACT

Physiographic parameters have a significant effect on the hydrological characteristics and water regime of the catchment area and are therefore important that there is a relationship between them and the flowing waters of the area and recognizing these physiographic properties in one area and having information about weather conditions in the area, can provide a fairly accurate picture of the quantitative and qualitative functioning of the hydrologic system.

The major physiological characteristics include: area, main channel length, slope, shape, height, posture and height, equivalent rectangle, focus time and center of gravity and all these factors have been calculated by computer and in the system of geographical data.

The basic information of Ghaleh-Shah in catchment area was taken from topographic maps and then finalized using field control and it was imported into GIS system and was produced with 1: 2000 scales. In the last step, supplementary information was added to the produced maps using aerial photos of 1: 20000.

Keywords: *Implementation Phase, Integration, Flood Control, Watershed.*

INTRODUCTION

Ghaleh-Shah in watershed has stretched between 45 57’11” western longitudes to 46 5’25” eastern longitude and 34 16’32” southern latitudes and 34 22’15” northern latitudes.

This area is limited to Braz Mountain in north, the village of Olia and Sofla Emamiyein the south, Nova Mountain in the east and dries Dane Mountain in the west.

The distance of the watershed from its outlet to Kermanshah is 150 km and it covers an area of 5101 hectares, equivalent to 51.01 Km2.

Several channels flow from the northern and northwestern highlands toward the west of the basin, and at 840 meters above the sea level, it flows out of Qaleh-Shahin watershed and pours into Ghale-Shahin basin.

The important mountains of this area include: Nova Mountain with 2018 m and Bars Mountain with 1930 m heights.

HYDROGRAPHIC NETWORK

The hydrographic network refers to a series of canals that discharge water in the basin. All the basin canals lead to the main canal. Hydrographic network arrangement in Ghale-Shahin catchment area in each sub-area is in the form of a tree branch and the main canals of the sub-basins are parallel to each other.

The drainage channel of the northern and southern flows has an eastern-western direction, and the flow of its drainage leads to Ghale-Shahin basin.

Canal Density

The length ratio of all canals in a watershed basin to its area is called canal density. The amount of canal density in the basin indicates the resistance intensity and weakness of the surface and substrates of the soil against erosion, as well as the focus time and drainage of the area. Therefore, if the underlying layers of the soil have a good penetrating feature or be resistant to erosion and the vegetation is massive and the surface area of the basin has low wrinkles, then the amount of canal density is low.

Conversely, in areas where the underlying layers of the soil do not have a good penetration feature and the surface condition is such that it has less erosion, the high canal density is indicating the higher flood discharge and the weakness of the bed age against erosion.

The following formula has been used to determine the density.

$$D=\frac{\sum_{i=1}^{n} L_i}{A}$$

That is:

D=surface canal density (km/km^2)

L_1= the length of the canals in each basin, both in permanent and dry rivers (km)

A=the area of the basin (Km^2)

Determination of Branching Coefficient (Branching Ratio)

In order to determine the canals' branching condition in a basin or comparing two basins for their networks, the channel coefficient is used. This coefficient includes the ratio of canal number in a certain degree to its number at a later larger degree.

This ratio affects flood water. The ratio of the branching in ordinary basins is between 3 and 5, and its low amount shows a higher peak in flood water of a basin and vice versa. In order to calculate this ratio, the following relationship is used.

$$B_r=\left(\frac{n1}{n2}+\frac{n2}{n3}+\frac{n3}{n4}+\cdots+\frac{n_i-1}{n_i}\right)\left(\frac{1}{i-L}\right)$$

That is:

B_r= branching ratio

N=number of branches in each order

I=the whole number of orders

Investigating The Main Canal of the Basin and its Sub-Basins and the Slope of the Main Canal

Patrimonialism

Later, according to the slope calculation methods, including the net slope, gross slope and the average weights, the calculation of these slopes was carried out, and the way of calculation has been presented briefly in the following.

Gross Slope

It is the difference between the two primary points (the outlet) and its most extreme point (the highest point) of the horizontal distance between the two points.

$$S=\frac{\Delta H}{L}$$

Net Slope

It is the tangent of a triangular angle whose surface is equal to the surface under the curve of the longitudinal profile of the main basin and its base is equal to the total length of the basin and is calculated as the following:

$$t_g\ a=\frac{a}{b}\quad ,a=\frac{2S}{b}\quad =>\tan a=\frac{2S}{b^2}$$

S=the equivalent surface under the longitudinal profile of the basin (Km^2)

B= Horizontal longitudinal profile of the river between the highest and lowest points of the main basin (Km)

A=the height of a right triangle that its surface equals S.

The Average Weight Slope

In this method, the parts of the river with the same slope are determined and by adding these slopes and dividing by the length of the basin, the average slope of the main basin is obtained.

$$D=\frac{\sum_{i=1}^{n} S_i L_i}{L}$$

D=the average weight slope of the main basin

L_i=the total length of the basin between 2 points of the river with L_1 distance (Km)

L=the horizontal length of the main basin (Km)

Studying Basin's Shape

The shape of a basin on a horizontal plane is called a basin's shape, which is obtained using topographic maps. Generally, the fields are divided into three groups of stretched, wide and flabellate.

The shape of the basin is also a factor affecting its reaction to rainfall. With its eastern-western canal, Ghale-Shahin basin seems to be wide. On the other hand, in order to have a better shape image of a basin, some coefficients called basin-shape are used, which are calculated by various methods such as Horton, Gravelius, Miller, and Xium.

Horton Method

It is calculated using the following equation and, in this method, the closer the result of the fraction to 1, the basin is closer to the square, and the smaller than 1, the basin will be longer.

$$R=\frac{A}{L^2}$$

R=Horton Coefficient

A=Basin area (Km^2)

L=Basin Length (Km)

Gravelius Method

The basin shape will be evaluated using the following formula.

$$C_c = \frac{0.28P}{\gamma\, A}$$

Cc=circulation coefficient (compression)

P=basin circumference (km)

A= basin area (Km^2)

In this relation, the higher the coefficient the closer the shape to the circle will be.

Drawing Method

Using the following formula, the basin will be studied.

$$R_e = \frac{D_c}{L}$$

R_e=longitudinal ratio

D_c=the diameter of the circle level with basin (km)

L=Basin length (km)

Miller Method

In this method, the following relation has been used to study the basin shape.

$$R_C = 12.56\frac{A}{P^2}$$

Rc=circulation ratio

P=basin circumference (km)

A=basin area (km^2)

The more Rc closer to 1, the basin shape will be closer to the circle.

The Hypsometric and Altitude Surveys in a Basin

In this study, after plotting the alignment lines extracted from topographic map, the altitudinal condition in sub-basins and the main basin is carefully considered.

In this study, the following factors have been analyzed and calculated.

The Average Weight Heigh

In this height, it has been calculated using the following formula.

$$E_m = \frac{\sum_{t=1}^{n} a_t L_t}{A}$$

E_m=the average height of the basin based on meter

a_1= partial surface with average height L_1

L_1=the average height between 2 altitudinal limits based on meter:

$$L_1 = \left(\frac{L_1 + L_2}{2}\right)$$

A=basin area (km^2)

Average Height Using Direct Method

It is calculated as the following.

Average direct height=lowest altitudinal point + highest altitudinal point /2

Mean Height (50%)

This height is obtained using the surface-height cumulative curve, and it is an altitude that is 50% of the surface area is above it, and 50% of the surface area is below it.

Altitudinal Mode:

The altitudinal level has the highest frequency that is calculated using the histogram of frequency distribution with height.

Studying Basin Slope:

The slope is the tangent of an angle that the surface of the earth makes with a horizontal plane. This slope has a great influence on the hydrological response of the basins. For example, in two basins having resistance slope of the floods resulting from basins with more slope show a higher peak than the lower slope basins.

The Focus Time of the Main Basin and Sub-Basins

The focus time includes the minimum time that lasts for a flow of water from the entire basin or sub-basin to participate in the outflow of water or sub-basin. This factor has a key and determining role in estimating the maximum amount of flood.

Geology and Geomorphology

In geology, the structure of the earth and its components and their origin are examined and the primary shapes of wrinkles, which are related to the substance of materials and the earth's structure has been considered. It is possible to determine the various factors that have caused changes in the earth considering the structure of the earth. The factors and forces that have caused these wrinkles, as well as the development and expansion of fractures, the process of earthquakes, the condition of the rocks and their resistance against various erosion and different weathers are studied in litho-logy science.

Geomorphology examines the earth's wrinkles and evaluates the factors affecting them. Currently, geomorphic studies are more used to systematically compare the shapes of wrinkles and their deposits. Respecting some sciences such as litho-logy, sediment-logy, agrology, hydrology, meteorology and geomorphology, it is possible to determine the age and primary shapes of the created wrinkles. Furthermore, these sciences are used for the projects of watersheds and natural resources, determining erosions type and the methods of fighting. Geomorphology is responsible in early identification of the environment and the methods for fighting water and wind erosion, correcting river basins, as well as engineering, the establishment of communication lines, mountainous and forest roads, and regional development projects.

Purpose

It is not possible to identify and assess the environmental potential of a basin and how to properly and continuously exploit the natural resources of a region, regardless of fundamental issues such as geology and geomorphology which are used as an information system.

Methodology

The general methods used to examine different sections of this study are as follows:

- Identifying and collecting the existing and available information and resources in the subject area such as maps and information provided by various institutions
- Receiving topographic and hypsometric maps and the slope of the canals network with 1:50000 and 1:20000 and geological maps with 1:250000 scales
- Changing the existing maps to separate rocky and geomorphologic units
- Visiting fields to evaluate and control the results and also to resolve ambiguities
- Preparing the final geological, geomorphologic and the sensitivity to erosion map
- Describing geological features of the region in the form of strati graphic, land-construction titles
- Common erosion processes in the area based on relevant works and evidence
- Receiving the required information from other parts
- Evaluating and assessing erosion and permeability of each rocky and sedimentary faces

Alluvial Regions of the Plain

Plain alluvial deposits are of the oldest alluvial deposits in the area that have deposited throughout the geologic period, in the area between valleys and the cavities from progeny. The arrival and departure of new alluvium to this point requires a long time, and most of the alluvial deposits in these areas are converted to soil and larger particles are also seen.

These parts in Qale-Shahin area have mostly used for agriculture.

Sediments of Mountains' Erosion

These types of sediments have only developed on the surface and hillside of the mountains and they have made from clay particles to rocky pieces that are composed of debris. The expansion of this sedimentary unit is high due to the mountainous nature of the area, especially in the northern parts. The especial characteristics of these sediments are as the following:

- Due to mechanical erosion, large particles are found among them.
- As the resulting areas are higher than plains, their surface coverage is not constant and moves towards plains during long periods of time.

Alluvial Cones

Alluvial cones are very important areas for watersheds. In the area of the GhaleShahin, these alluvial can be seen in 3 regions where the mountain is connected to the plain, and in other areas they are seen as partial and local.

River Alluvial

River alluviums the youngest sediments in the region extending around and at the bottom of the main basin. Their material is mostly sandy particles to large rocky parts, which has been deposited according to the velocity of the stream and the discharge of the river.

- These sediments are less extensive than other Quaternary sediments.

Finally, the quaternary alluvial deposits in the area cover about 1583 hectares, which are severely eroded due to the lack of continuity between the particles and are placed in class V with very high sensitivity.

Investigating the Slip Potential and Falling the Existing Rock Units in the Area

Due to the fact that only slippery motions are observed, their condition is described at the basin level.

In Ghale-Shahin basin, a considerable part of rocky and sedimentary units, especially in hillsides and high and steep parts and sometimes in low-altitude hills have been covered by relatively small deposits of mechanical shattering and chemical alteration of the rocks.

Finding the characteristics of this debris is a function of rock material, the quality of developing fracture systems and gaps, and the types of common physical and chemical erosion events on them, from medium to coarse textures.

Among the above factors, the role of rock resistance and the density quality of fracture systems on them is more important.

In the studied areas, various forms of debris, in accordance with the geological and geomorphologic characteristics of each region, have generally been developed and expanded along the steep slopes bounding Mahuri hill mountains and canals and also road sections. The thickness of the debris coating is varied in different areas of the basin, which is influenced by all the above-mentioned points and varies from several centimeters to several meters.

Hydrology

Regarding sustainable development policies and applying comprehensive management in the catchment areas, water is considered as the most important factor in planning the proper management of land use efficiency in energy production and infrastructure affairs. In this case, the quantity of water, the flow of rivers and canals, determining drought and wet periods, the way of supplying the required water, the scope of the project, as well as the chemical quality of the water resources in the region are studied.

The purpose of studying water resources and hydrology in the area is to identify the available facilities and the potential of the surface and underground water, their time and location distribution, their current use or water quality to use in vegetation development and drinking and implementing the information obtained from this section in planning the management of watershed basin.

The Study of Hydrometric Stations of the Region during the Statistical Period

After collecting all the daily, monthly and annual reports of the stations adjacent to the study area, a total of 16 hydrographic stations located on Alvand, Ghoreh, Tu, Tangab and other rivers, the 27-year index period was selected for the calculations and after calculating the regression for the statistics, Qasr-Shirin hydrological Station, which has a good statistical basis and Ghale-Shahin area is part of it was selected for the study of watering.

Estimating the Potential of Ghale Shahin Basin and Its Hydrological Units Through the Qasr Shirin Station

Considering that Ghal-Shahin is part of Alvand catchment area at Qasr-Shirin station and the statistics of this station in the region have more confidence coefficient to use in calculations than other stations and considering the relation between the surface and the dam, the potential of the catchment area of Ghale-Shahin and its sub-basins have been estimated.

Snow Hydrology of the Area

To estimate the snowfall in the area, Chandra's 1984 relation has been used, which is as follows:

$$S_n = p_t(1 - P_r)$$

S_n=Water from melting snow

P_t=Average monthly rainfall

P_r=The ratio of rainfall to sum of the falls

$$p_r = {(T_{max} - B_s)}\big/{(T_{max} - T_{min})}$$

That:

T_{max}=Maximum absolute monthly temperature (C)

T_{min}= Minimum absolute monthly temperature (C)

Based on temperature-based studies in the area, the first zero-recorded temperature is the basis of computations. The maximum volume of water equivalent to snow is from January to June, and the minimum is in June, July, August and September, which is zero.

Studying Dry and Rainy Periods in Qasr-Shirin Station

According to the calculations in the moving average section and the using the reports of the Qasr-Shirin Station, the frequencies of several years of dryness and wetness would be observed. But these frequencies have become more balanced during the wet years and their average fluctuations were very small, indicating a steadier flow and its changes.

Flooding

Each area is controlled by multiple agents. The most important of them are:

- General shape and number of gravity centers
- The amount of slope and physiographic characteristics
- Type of rock facies in terms of hydrodynamic performance and permeability
- The quality of the area's rainfall
- The quality of destructive and vegetation coverage of the area
- The presence or absence of snow covering in the area

Obviously, the study and evaluation of flooding in the area should be performed considering the role of all of the above factors and their integration in the form of the report of flooding of the area.

As a general rule and a result from a geological point of view, the potential of flooding in rocky and sedimentary faces has a converse relation, That is, the greater the permeability of rocky and sedimentary faces, the less flooding and flowing water will be and is more limited in proportion to the development of the waterway canals and conversely, in less-permeable units, rainfalls ultimately flow on the surface of the ground, join together and exit the area as a tide.

Erosion and Sediment

The study of the erosion and sediment of Ghale-Shahin watershed has been performed in line with the general objectives of the project, which identifies the potential and talents of the region and, in general, the status quo and prioritization of areas and planning based on a set of factors and factors.

The severity and weakness of erosion is effective in finding the region's talent and the generative potential of water and soil resources. Often, in areas with high erosion, production per unit area is minimal and the occurrence of devastating floods reaches the maximum.

Different Forms of Erosion in Ghale-Shahin Watershed Area

These forms are located in two sections of geomorphologic erosion (natural), which are then subdivided into the following sections.

Lands without erosion E_0

The hydraulic arable lands which are mostly placed in fourth period formations with a slope of 0-2.

Lands with E_1 erosion

They are formed due to the inequality of resistance of the rocks against erosion and cover an area of about 158 hectares.

Lands with negligible erosion R_c

Include rocky lands, rock mass and rocky outcrop

Results & Discussion

The investigation was managed on controlled floods can better sediment samples and change essential ecological qualities of the river ecosystem and know more about river procedures, both biotic and abiotic, during a flood incident. the hydrological features and water regime of the catchment zone to be affected considerably by Physiographic parameters and the relation between them is significant and the precise view of the quantitative and qualitative operational of the hydrologic process have a logical correlation with the current waters of the zone and recognizing these physiographic characteristics in one zone and having details about weather situations in the zone. Flood risk management must depend on a proper and enclose flood risk evaluation, which maybe sends back the separate features of all components at risk of being flooded. moreover, common expert knowledge, such a method must also depend on local science.

Conclusion

The main physiological features contain: zone, basic channel length, slope, shape, height, posture and height, equipollent rectangle, focus time and focus of gravity and all these parts have been computed by the computer and in the process of geographical information. The fundamental details of Qaleh Shah in catchment zone was taken from topographic plans and then concluded applying field control and it was imported into the GIS technique and was made with 1: 2000 scales. In the late stage, complementary details were added to the made plans applying airy pictures of 1: 20000. In this condition, stakeholder priorities for risk evaluation signals and evaluation deliverables hold great significance but are often neglected. This article offers to put this body of data into action in the shape of a science foundation, thereby making it accessible and recyclable in multi-criteria risk evaluation. choose applications occurrences to debate the benefits of such a semantically raised evaluation method.

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