Regional Flood Management using GIS

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Abstract: Today, a new approach to regional flood management is site-specific management. Pinpoint flood zoning as one of the critical steps in the management of flood studies and flood insurance premium is about. However, most existing methods for determining flood zoning are very difficult and time consuming. Therefore, the study area flood zoning is done using GIS. All relevant information was prepared in a six month period. Then in a database using Arc GIS 9.3 software system has been implemented. Studies were selected in Sabzevar city.Then, using the information obtained from the efficiency of the field model, catchment and sub-catchment identified and their characteristics such as area, slope, main channel length, and ... done. This study combines hydraulic model HEC-RAS GIS software Arc GIS 9.3 software through the amendment of zoning HEC_GeoHMS the flood was estimated. The total area damaged by the results of the HEC-RAS   return per period was calculated. Land which overlapping maps, maps of flood zoning and infrastructure plans from the HEC-RAS model of the damaged area of the premises and property and infrastructure, agricultural lands, was predicted. Using simulation with a return period of flood zones to prevent flood hazards and regulate and improve the action.

1-Introduction:

The first work on the use of GIS to study phenomena flood back in the early 1980s. The first work in this field analyzed (regular square grids of elevation data) for hydrological applications began. Mr. Ocallaghin and Mark in 1984 and Jenson and Domingue in 1988, ways to fill down Rftgyha and Pstyhay DEM to determine flow direction and accumulation suggested that it would result in the automatic watershed and grid drain it. Unfortunately, the use of digital elevation model, or DEM for hydraulic analysis of river is not very good. Because the model does a poor job of describing the complicated side. Thus a)triangular irregular network) model was proposed to model hydraulic river channels. TIN models with a triangular lattice structure that coordinates the triangles each vertex (x, y, z) is the way to show topography. It details all the problems in places with dense side effects, and complications in low-density areas such as plains, gentle slopes, good show. In 1991, Mr. Djokic and Maidement TIN models were used to model the drainage runoff in an urban environment. He further research in this area expressed using TIN models to determine the estimated parameters are very useful and effective. With the development of remote sensing techniques and GIS software allows the model to be more accurate flood phenomenon is provided. 1382 Khosrowshahi catchment basins to determine the role of the highly fertile basin flood usual Hec-HMS hydrologic model is used. Using the model, the risk areas prone to flooding within the basin can be determined. Flood of words in each of the priority subbasins or hydrologic unit. The flood disaster is reversible. Pyamdh important environmental, social, economic, lack of proper management of water resources and human societies, Floods are threats to lives and property. This is due to the fact that about 91 million hectares of flood-prone areas have been estimated. It is worth noting that the main factor causing increased flood flood plain land use or land adjacent to the river bank are. Given the breadth of issues discussed with management of the flood that has a lot of scientific research and findings. (knapp and Olson, 1995; McKinney et al., 1999;Postel et al., 1996;Allen, 1998), Studies, Johnson and colleagues (1999) Oliver and David Mead grace Krstvfrtyk Warrick (1999) pointed out. this study curiously look at new techniques in water resources management is a step. and its new approach, site-specific management [2]. All relevant information was prepared in a six month period. Then in a database using Arc GIS 9.3 software system has been implemented. Studies were selected in Sabzevar city.Then, using the information obtained from the efficiency of the field model, catchment and sub-catchment identified and their characteristics such as area, slope, main channel length, and ... done. This

study combines hydraulic model HEC-RAS GIS software Arc GIS 9.3 software through the amendment of zoning HEC_GeoHMS the flood was estimated. The total area damaged by the results of the HEC-RAS return per period was calculated. Land which overlapping maps, maps of flood zoning and infrastructure plans from the HEC-RAS model of the damaged area of the premises and property and infrastructure, agricultural lands, was predicted. Using simulation with a return period of flood zones to prevent flood hazards and regulate and improve the action. This study developed a flood management program using simulated flood zoning district is intended to run. Gained from this study to estimate the amount of compensation received from insurance is insurance agencies. And engineers to assist in flood control methods. And to reduce damage to farms and construction sites around the city or the river was an important deal.

2-Purpose:

This study is based on the monitoring mechanism, accurate, timely, and appropriate location for a regional flood management is. The modeling of the flood waters in the study area was conducted. Able to use the findings in the field of flood management replied to the following questions?

1 -Use Zoning Comp flood waters in the study area, specify the area or areas threatened? What routes will follow?

2 -Locations that require structural measures are identified in the Flood. To the direction of surface water runoff and to minimize operating losses?

3 -The use of flood insurance premium rates for flood zoning can be calculated.

4- Calculation of damages from floods with different return periods, which is very important.

3- Theoretical framework and the implementation of research:

This research mainly on three stages, respectively, are: 1 - Data collection and classification of data, and data analysis in Arc GIS 9.3 software. 2 - HEC-RAS hydraulic model combined with Arc GIS 9.3 software and the efficiency of this process, 3 - Use the results of the regional flood management, then briefly describes each of the steps is the creation and application of research. Integrated design of a conceptual model is presented in this study (Figure 1).

3-1- classed collect and analyze data in Arc GIS 9.3 software:

The goal of this stage, the complete structure of spatial data for use in Arc GIS is a Geographic Information System software. To this end, a careful review of existing data, the required information is provided. This data includes the list of basic data and

technical information is available on the map. In preparing the basic data and technical data and technical information on how to implement basic data is checked.
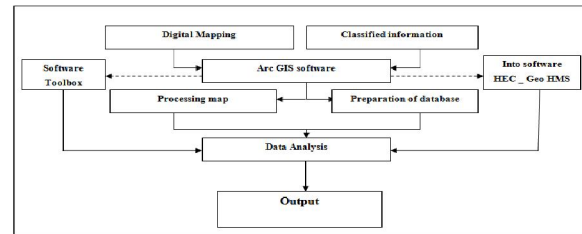

Figure 1 - Schematic conceptual model

4-1- data required

Topographic information of longitudinal and transverse profiles and the lands bordering the river, and also includes information on the flood inflow hydrograph flood hydrograph subsidiaries and its input and output streams, hydraulic information, including the status of any bridge river waterfall, and other structures intersect, the ration of rough.

4-2 - Preparation of the data base

Login Map based environment for GIS, should be on one side of a point, line or surface preparation and be saved. Due to the nature of 1:2000 cartography maps, some problems need to change into the appropriate type were defined in preparation. Also in connection with the preparation of four layers, this process is done in two ways: automatic and manual. Some of the rules for building topology and fix errors in the data preparation process. The rules for the different combinations of layers, are separately defined and implemented. Which is composed of the following.

Must Not Overlap -Not Have Gaps -Must Not Overlap With -Boundary Must Be Covered By - Must Not Intersect -Must Not Have Dangles -Must Not Have Pseudo -Must Not Self-Overlap -Must Not Self-Intersect

3-3-Relative humidity:

Relative humidity is a percentage of water vapor saturated atmosphere, as well as temperatures. The importance of relative humidity associated with the occurrence of thin films of ice on the road surface will be higher. Increase in ambient relative humidity, evaporation is reduced, So when the rain falls slightly due to the high humidity, evaporation is reduced. And some water remains on the surface of asphalt road surface will be the potential for Slippery scales.

4-2-1 - extract specific data, and the technical project plans and implement them on the base map

In order to extract specific data, and the technical project plans and implement them on the base map preparation, technical drawings done. All

technical information contained maps of surface water flows in the format of Dwg. Three different scales of 1:7500, 1:10000 and 1:50000 were prepared. The basic data plan just to get the points were shared control with the maps of 1:2000. The only specific information extracted from the relevant technical drawings based on the (1:2000) have been implemented. This information consists of: Site plan of the city center conductor detailed design, detailed design of the law, a member of the plan conductor, semiconductor design, implementation, major drainage basins final grading, slope.

4-2-2- Using the data

First stage of geo-referenced maps with selected control points in common between them took to their accurate coordinates map to be transferred. Total basic and technical data collected and prepared in the form of digital files have been modified and used. In order to provide better information to users with a simple structure and descriptive information plus maps with format conversion and also allows analysis of the GIS on by some software possible, data formats Shape - File [7] been saved . This file format is also less than 3 Extension of shx, shp and dbf is made. To provide descriptive information about the files in the widely used English users of the operating system Windows, the Microsoft standard used. also integrated in the information provided.

4-3-Preparation and processing of database management and map

According to the functional requirements of the model, the logical model could be designed and produced. logical modeling the conceptual modeling phase of translating the information into understandable language for software [5]. Spatial database model used in this study, the model is Geo database 7 Arc GIS software it supports. This model is able to hold all the information in a database and the structure of the Feature Dataset Geo database used to organize related data together. The Representation of the ability to store the information in Arc GIS graphical effects, along with other information, is used.

4-4- Analysis of data

The management and efficiency of the data flow analysis pass.It is composed of two parts, each of these two results, the results of this research. Flood zoning initiatives in order to be used. It is worth noting that each of these two parts are:

5- Analysis using Arc GIS software toolbox

Analysis using Arc GIS software toolbox that includes a general feature of the system is defined. Is briefly described in the following

1- analysis using Arc GIS software toolkit that includes a general feature of the system is defined
2 - Analysis using the software program that has been implemented in Arc GIS software.

The analysis of the efficiency and flood zoning and flood management measures in the study. Each of the two parts of the application in the field of flood management area is described.

5-1- To create a TIN surface

TIN terrain data combined land surveying and topographic maps were created. TIN is a part of the study area. TIN has been found in the river (Figure 2).
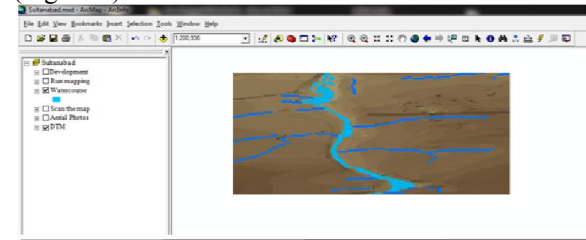

Figure 2 - TIN for ground

5-2- Prepared to provide the center line of the river

Central line route map for the path of the river, and then I want to clear the river Bank (Figure 3).
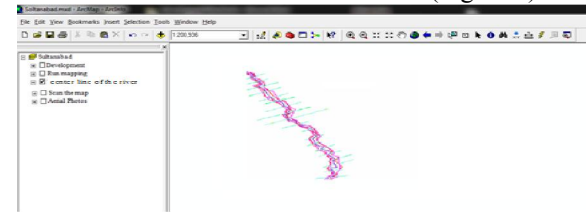

Figure 3 - Part of the Central Bank to achieve the river flow

6- HEC-RAS hydraulic model combined with Arc GIS 9.3 software

Hydraulic model HEC-RAS, an integrated package of hydraulic analysis programs Secret. Through its graphical user interface to communicate with the system. (Hydrology Engineering Center Army United States of America (a user can have one or more different types of analyzes that are included in the HEC-RAS software package that is used by the project. This study combines hydraulic model HEC-RAS using Arc GIS 9.3 software through flood zoning amendment has EC_GeoHMS estimate. HEC_GeoHMS side application software within the GIS by Environmental Systems Research Institute (ESRI) for spatial data analysis in combination with Arc GIS software has been created [8,9]. With GIS, users can use a corresponding supplementary DEM data, and analyzed the data and analysis needed to obtain the output side. In this study, the geometric characteristics using digital elevation model DEM watershed basin in the program HEC_GeoHMS side

calculated in Arc GIS 9.3. In order to obtain the cross sections perpendicular to the cut surface of the river, cross the river on a digital elevation model (DEM) of the region, cross sections, and the rider HEC_GeoHMS created in Arc GIS 9.3 was used. Manning coefficient of the main branch and the flood of data in each section was defined (Figure 4).
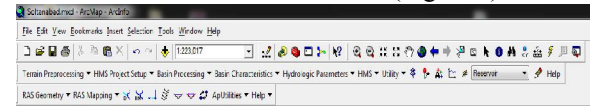

Figure 4 - HEC-RAS hydraulic model combined with Arc GIS 9.3 software

7- Zoning of flood

Geometric characteristics of the river Arc GIS 9.3 software was developed in software environment. And other specifications such as the Manning coefficient and discharge floodwaters were calculated. During the course back then the simulation of the HEC-RAS model was introduced. The HEC-RAS model zoning of flood water level was calculated digitally. And cross sections shown on the model. With the water level in each field and transverse sections of the processor macros HEC_GeoHMS, exchange TIN file that flooded the show was produced. And then combining TIN flood zoning in Arc GIS 9.3, respectively. Generally bed and privacy river floods with a return period of 20 years and 50 years were designed (Fig. 5 and 6). Map of flood zoning classification is widely used in studies of flood management. Today's map is one of the basic and important part of the development projects in the world. And before you make any investments or development projects, of which the organization is on the agenda. Abbreviated application under the Flood Management Area Map Flood scheme is presented.
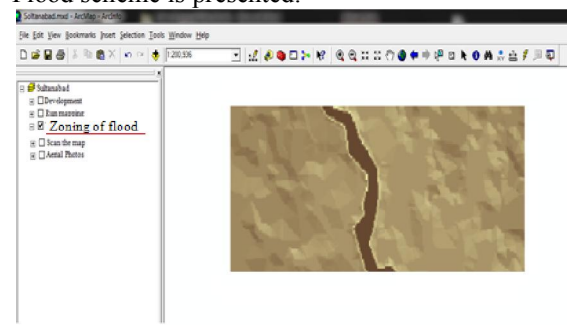

Figure 5 - 20 year flood zoning district on the TIN

8- Zoning Application Management in flood zone

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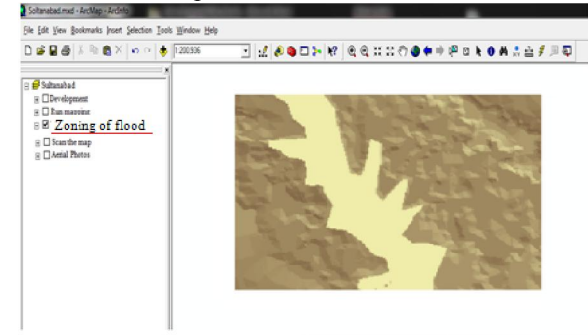

Figure 6 - 50-year flood zoning district on the TIN

8-1- Total area damaged Divided Land

Zoning of flood zone layer by layer, the flow of information without flooding the overlap region. Areas that do not overlap between the two layers, the surface area is damaged. This can be easily modeled using HEC-GeoRAS Land Area truly has to calculate the flood (Figure 7).
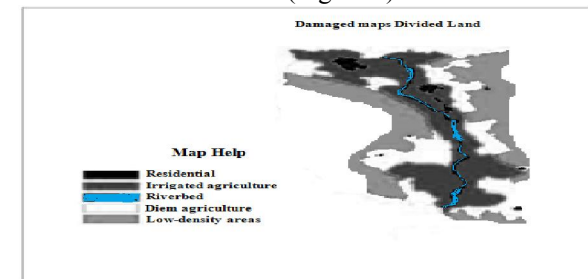

Figure 7 - Map of areas damaged Divided Land

8-2- Privacy and the river bed

With flood zoning maps, flood and land bank margins were around the passage. With this layer, available water resources are the land. Layer could be at risk for flooding and inundation revealed houses, and the area used for flood management.

8-3- Economic feasibility studies and development projects

The first step in the management of economic studies flood control project is flood zoning maps. Following the return period of the flood zone and the estimated damage to avoid damage to the optimal level of investment will be calculated. The scope of this study was to determine the return period of the flood. Land and facilities located in flood-prone area is carefully examined and their value determined. This figure is the interest rate (the amount of damages in the event of flooding) is identified. In this case the value of the investment can be justified accordingly to reduce the amount of damages in the know clear.

8-4- Flood Insurance

Insurance company to determine the amount of risk in different areas, rivers and receives premiums commensurate with risk in any area of the map need. Now as to what is in flood insurance. All lands adjacent to the river, regardless of their level of risk, based solely on the extent of the land or the value of investments will determine the premium. While the flood zoning maps, the majority of financial institutions before the investor can control the map with the location. And gradually reduced investment in the Flood Zone One of the main objectives of flood management are provided.

8-5- Forecasting and warning and rescue operations

Flood zoning map, road map and route communications with the bank almost overwhelming. By using these overlaps are not flooding the communication path that is closer to where it was prone to flooding. There was relief in the flood potential of this route is used (Figure 8).
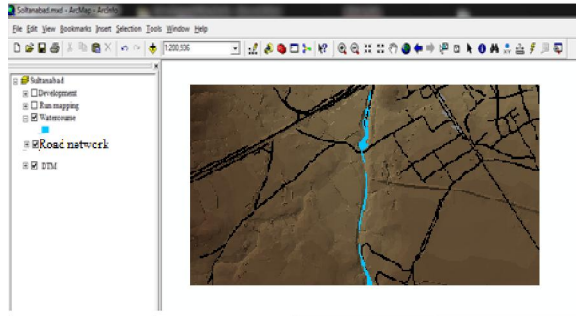

Figure 8 - Map network communication paths near the river

9- Conclusions

Flood zoning and other layers using the information obtained from the Arc GIS software. Able to apply management practices in the following areas.

1 - To receive reports of the extent of damage to the insured.

2 - Risk provisions for damaged areas (infrastructure, electricity, gas, water)

3 - Planning for the prevention of risks to lives and property flooding areas where threats are available.

4 - plan to reduce flood damage from flooding by building dams and trenches..

5 - To prevent discharge of debris in the watercourse, the watercourse dredging and direct current flowing waters.

6 - The protection, maintenance, avoid allowing direct manipulation and organization of floodwater.

7 - The economic feasibility studies and development projects.

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8 - Forecasting and Warning and rescue operations.

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