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Flood Control and Flood Management of Sarbaz and Kajo Rivers in Makoran

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Abstract

Floods are among the most devastating natural hazards in the world. Iran and specially Makoran has big rivers and flood planning and management is mainly concentrated on riverine floods occurring during seasonal rains. This research investigate on the Lower Sarbaz and Kajo rivers and used discharge analysis of river channel-gauging time series to assess the regional water supplies and agricultural purposes. This analysis reveals that for all flood conditions especially on the lower Sarbaz river, have systematically risen for monthly maximum discharge volumes over the period of record. The Sarbaz and Kajo rivers have served as important routes for transportation and commerce since the formation. These two rivers need to be re-assessed especially in light of the predicted large increase in rainfall and water in the rivers over the next 25 years or so as predicted by the global climate change models. Iran has big rivers and flood planning and management is mainly concentrated on riverine floods occurring during monsoon. However, flash floods in hilly and mountainous areas are also common with demonstrated damage potential. Flood events in arid areas can be extremely damaging with increasing development, particularly in Garmbeet and Bahowkalat area (Down-stream of Pishin Dam). Flood protection and drainage design are considerable importance. Existing flood risk models are inadequate, and predicted changes in the climate show that there may be much more water in the system in the near future. New models are being built to test how the river-floodplain systems will respond to large increases in the discharge in the future.

Keywords: Agriculture; Catchment; Discharge; Flood; Hydrology; Kajo; Makoran; Pishin dam; Rainfall; Rate of flow; Sarbaz

Introduction

Stream and rivers provide water for drinking, watering animals, irrigation and for human habitation for over thousands of years. They are dynamic environments and their banks are prone to erosion, and periodically flood over their banks. This is part of a rivers normal cycle that relied upon the generations of farmers for replenishing and fertilizing their fields. However, the use of river floodplains has changed dramatically in the past few decades. Thousands of miles of earthen levees, flood walls, and river control structures have been built along both rivers. Dikes and levees have been built around the two rivers in attempts to keep the flood waters out of towns. However, these tend to make the flooding problem worse because it confines the river to a narrow channel, and the water rise more quickly and cannot seep in the ground of the floodplain. In the light of flood control modifications to dam or reservoir as outlined in alternatives are intended to support limited flood control operation at reservoir in both rivers in Makoran. Furthermore, it could be anticipated that this flood control capacity would remain until a flood event occurs in that particular corresponding area. During a flood event, out flows from the dam could be reduced in order to prevent flow of water at reservoirs, the flood water was un-controllable because the Pishin dam does not have any levees or by pass canals or dykes to protect the dam from cracking or even from complete destruction . There could be several flood control strategies being analysed but commonly to modify operations reservoirs in Makoran which may require new outlets, increased storage and new discharge guidelines [1]. The objective of this study is to provide engineers, sponsors and other interested for water management some discussion of the potential environmental impacts associated with these proposed modifications and to provide some related recommendations and participations. The need to develop a re-operation plan based on the dam modification alternatives presented would be an integral part to the overall success towards flood control [2,3]. Water discharge during flood 1997 and 2005 Water resources authority released excess flood water without any consideration to downstream agricultural farms and villages which damaged many lives and farms land, in fact it was a deliberate mismanagement by the authority and also there is lack of any flood by pass or diversion canal to that particular area on the other hand there were also occurs drought because entire water released from Pishin dam. Then in this case minimum water should be release from the reservoir and maximum water can be stored. As the reservoir rises and reaches each intake, the corresponding outflows adjust on a continuum with one outlet submerged then it could be possibility in the case of flooding all outlet perhaps would submerged , where after the reservoir fills, so discharge is passed both through the sluiceways and over the spillway (Figure 1). Increasingly speaking it varies each year, monthly outflow averages common range but also depending on the rainy month. In this regard the maximum storage pool elevation would be require the use of a five meters high rubber weir added to the spillway crest. So five meters high spillway structure would be inflated or dropped into place only during events that could require use of the additional flood control storage [4,5].

Materials and Methods

The study was conducted at Pishin and Zirdan Dams in Makoran. The area is located near the borders of Iran and Pakistan. Thus location up on which this study concentrates is bounded by the coastline of southern Iran and Western of Pakistan, approximately, by the line of latitude 25 degree to the South and the line of longitude 60 degree to the

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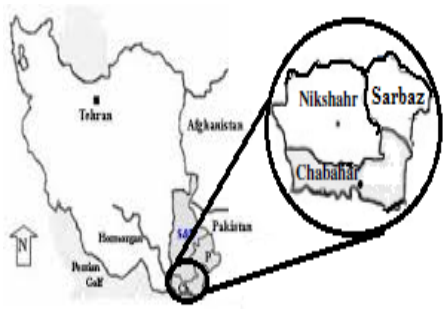

Figure 1: The area of study of Makoran.

west. The area consists of an inland chain of steeply sloping bare rock (mountains) which drain onto a coastal alluvial plain. The analysis is based on a multi-sites analysis approach, since the two rivers locations are not considered sufficiently similar to be pooled together. The flow data was obtained from 12 months from January to December has been tested by computer excel program the peak discharge was ranging from 3012 m^3/sec the same river on the month of April suddenly rate of flow dropped to 6 m^3/sec even though for other months during summer rate of flow for Sarbaz and Kajo rivers are completely drought or nil discharge according to the dry months when there is no rainfall at all in Makoran region.

Reservoir Maintenance, Operations and Flood Control in Makoran

The reservoir operations would be tied up primarily to flood control, a requirement could be necessary in place to ensure the reservoir elevation near the living communities in the areas is at or below to corresponding prior to the onset of the flood control therefore mostly in rainy season of year public property and lives could be protected. Thus, during the summer to fall drawdown period, flows from the river or reservoir would be passed through the outlet structures such that the reservoir lowers to the desired elevation of dam. Furthermore, whenever draw-down is complete, inflow will be passed through the outlet works to maintain reservoir elevation therefore it flows nearly to the Sarbaz, Rask and Chabahar carriage way [6].

The reservoir would remain relatively constant throughout the entire period of year and improvement of flood control and reduction of peak flow could be manageable. Where flow operations for reservoirs during non-flood events will be similar to the operation that is in place of major period non-rainy season. But, except for flood events, out flows should continue to follow historic outflows. Increasingly, wide flow variations would occur through the years. In general, daily discharge trends show flow increasing in all reservoirs in the province from a low flow in the summer but to a mean or average monthly flow in January and February and also sometimes it could be exceeding. Thus, this pattern would vary widely by year although maximum flows can be much higher than the average mean, so during flood season in Makoran, could be high water releases, which are common. These events tend to be relatively short in duration lasting around 3 to 5 days. However, these relationships are much more complex for a multi-purpose reservoir since they involve the seasonal distribution of stream flow and the reconciliation between it and seasonal and other varying demands for the several purposes perhaps for which the Pishin reservoir accordingly. The bank-full flows in the upper reaches below the dam occur at high discharges rate as in Figure 2.

Natural and Physical Environment of Makoran

In Makoran, the flood study could be said with location of Sarbaz and Kajo rivers the upstream parts of the rivers flow through heavily mountainous and hilly regions while the remainder of rivers flows through broad, flat valleys. The upland, villages landscapes are dominated by a mix of forests, which forests comprised of Nannorrhops (Mazari palm trees) and tamarixes etc. Also the upstream half of the rivers below Pishin and Zirdan flood control dams are dominated by coarse gravels, with areas of fines and larger sands also present to a lesser degrees. The downstream half of both rivers below the dams are predominately small to medium sized sand or cobbles. Therefore, interspersed with areas of fine sediment and larger sands and boulders, the coarse gravels are also present in those particular areas. Furthermore, the historic water quality problems stemmed from drainage and rainfall runoff, which also caused low dissolved oxygen, elevated water temperatures and high turbidity. Low summer flows have also caused some problems in the river but these are primarily a natural function arising from the small drainage size. Although, there are many reaches existed, so the majority of reaches are located of the side of the rivers. However urban development along these rivers in Makoran is important feature, providing crucial life history for flood control and also for such as rearing and holding habitat for fish, and over wintering habitat for migrating waterfowl. The existing fill and spill for flood control dams operations result in seasonal fluctuations surface elevations [7].

Impacts of Natural Environment From Flood Water in Makoran

The flood control could be appropriate to have and build high weir and dam may be useful during floods for approaching the 100 years event. Therefore, the control structure would engage for flood protection only and cause the reservoir to rise above the historic full pool elevation. Although in the light of flood it causes the flood waters to inundate a variety of upland and wetland habitats including, steep brush and timber slopes, shallow slopes and vegetated lowlands as well. It would be depending on the magnitude of the flood, it could also increase additional reaches and pools. However, floodwater may increase sediment deposition in the newly in-undated vegetation may affect growth rates [8]. Thus, it is anticipated that the timber and underbrush between different elevations will remain intact although and increase in woody debris recruitment would occur as a result of the higher pool of floodwater. The increased size of the reservoir during large flood events would be most noticeable at the head of the flood control reservoir. The extent of lost habitat from this additional

Figure 2: Spillway of the Pishin Dam with bankfull flow during flash flood in the stem of Sarbaz River.

main stem inundation is not likely to be significant given the timing of the events, so the existing steelhead may be infrequent nature of the flooding event. However, flood control operations under the proposed project would produce more frequent fluctuations of the winter reservoir. This proposed methods calls for the flood reservoir to be evacuated through the new outlet gates after each flood event to reclaim flood storage. Therefore, it could be appropriate and would strive to keep the winter pool at management desire elevation, and reduce the availability of shoreline vegetation to riparian animals and aquatic resources. In the light of flood control it could be good enough keeping the reservoir away from the shoreline during the lean winter months will make prey contributions of the tributaries and main-stem much more important. Also modifications to the dams under the flood control event include a small structural changes as well as the addition of a weir structure and additional low level outlet gates so impact from structural modifications would be limited to concrete work in and around the dam. Then after the weir would be employed only during the largest events to provide the extra reservoir storage space when is needed.

Flood Control and Reservoirs for Storage Purposes in Makoran

Floodwater storage reservoir could be stored such an excess water from periods of high flow for use during periods of drought. In addition to conserving water for later use, so the storage of floodwater would also reduce flood damage below the reservoir. Furthermore, regards of floodwater control so storage reservoirs are used to control floods, to conserve water, and to regulate stream flow. Reservoirs could be of two types: Single-purpose or multi-purpose. It would be dependent on the location and structural problems, the problems for a single-purpose reservoir leads to simple relationships among the available water supply, the water demand and the volume of reservoir storage to be provided. However, these relationships are much more complex for a multi-purpose reservoir since they involve the seasonal distribution of stream flow and the reconciliation between it and seasonal and other varying demands for the several purposes are intended (Figures 3 and 4) [8]. These streams water, which would carry little or no water during periods of the year in Makoran often, becomes a raging torrent after heavy rains and a hazard to all activities along its bank. By testing river flow to get better and actual rainfall runoff characteristics by obtaining appropriate monthly maximum flow to view and improve monthly peak discharge of Sarbaz and Kajo rivers in four different sites gauged by hydrometric recorded and tested by excel for wet and dry periods for flood purposes, though it shown the result of Makoran water flow in rivers analysed. Thus Sarbaz and Kajo rivers during storm water with monthly maximum discharge as indicated in (Figures 5 and 6).

Figure 3: River Kajoo Overtopped levee at District Ghasrghand during flash flood 2013.

Figure 4: River Sarbaz Peak Discharge Overtopped levee At Jakigovar, During Storm 2013 Up Stream OfPishin Dam.

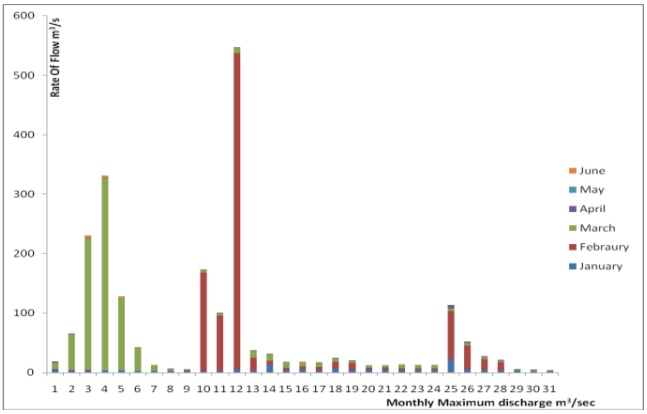

Figure 5: Duration 6 months from January to June (test 1).

In the light of discharge of water there could be drawn hydrograph, so an inflow hydrograph is simple a graphical plot of the river flow with time on the horizontal scale and discharge on the vertical scale. Although a typical hydrograph resulting from an isolated storm, which could be consisted of a rising limb, a crest and a recession curve. Also some ground water may enter the stream as base flow.

Flood Control and Reservoir Development in Makoran

The Reservoirs reduces people's dependence on the natural availability of water in rivers and streams flow. In recent years, it has become a common perception that reservoirs must serve for the protection of the environment during the life time of this generation as well as the future generations. Thus, how do we construct and manage flood reservoirs to meet these requirements? This is the crucial question of sustainable flood control reservoir development and management. The International commission on water resources systems also set up international guidelines to cope flood problem to reduce hazard for people life. However, management of annual peak flows to restore development of dam reservoirs in the Makoran regions. The contributions provide decision makers and flood control management with a collection of scientific contributions to be taken into account before setting up any project for flood control so dealing with water resources uses and management [8]. Strategy and different methodology for flood water shed management, also it is important for area under consideration soil erosion control and land water or underground water management use, water shed and river processes and their modelling. Furthermore, in the light of flood occurring

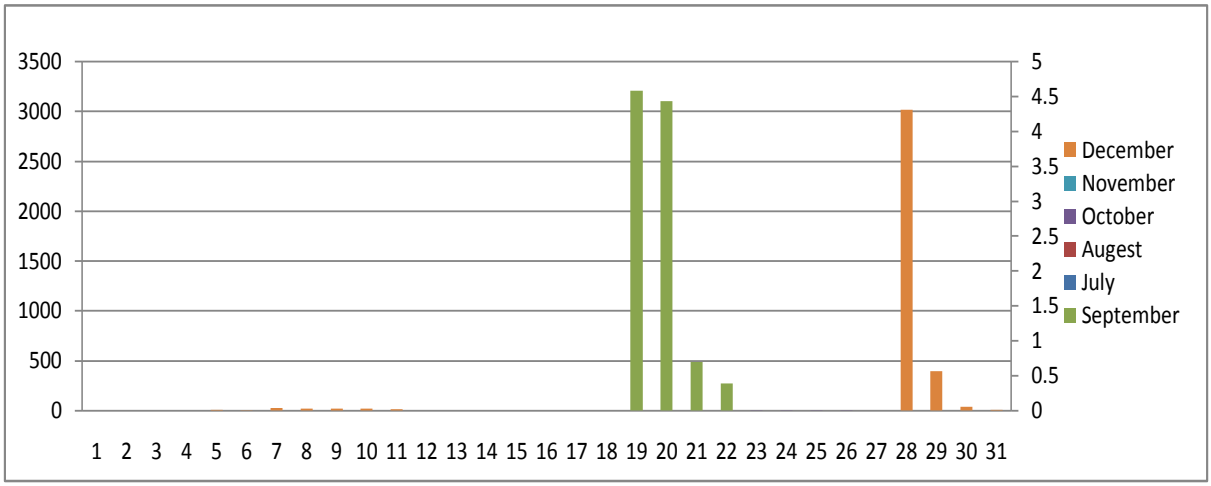

Figure 6: Monthly Maximum Discharge m^3/s (test 1) From July to December.

and environmental problems associated with land water use and monitoring, planning and rivers with flood water occur could be organized and properly managed. The activities towards flood control area, which under study is extensive with priority on functional techniques and management methods for the sustainable development of rural areas. It could be greatly benefits and concerning towards for the Baloch people life and also for their agricultural purposes of region towards agricultural production for food. The income of farmers in demonstration sites, which are using for agricultural and horticultural purposes, could also be increased sharply for aim of food production [9].

Flood and Drought Management for Makoran Regional Steering

The floods and droughts have been common events throughout the world. Many countries experience such catastrophic events each year. Beyond all doubt these natural hazards affect human living conditions and sustainable socio-economic development. Therefore, the flood and drought both are very important matter to be concern and could be under significant consideration for better solution towards safe place for human being and environment in the region. These issues of steering for water resources and flood management became very important aspects towards handling safe water resources management and organization of the corresponding areas. Hydro- meteorological hazards, towards monthly or daily rainfall data, as far as including drought event, are also main research activities for Makoran regions. To reduce the catastrophic destruction brought about water resources management, floods and droughts concentrated global action was necessary. Thus, floods and droughts for the region are two extreme events in the domain of hydrology and water resources. However, people live along rivers, large river such as Sarbaz and Kajo usually attract high-density populations and economic growth. This study show incorrect use of water resources and flood water plains because there would be due to wrong and un-sufficient water management towards flood plains by diverting water ways so there is no bypass canal, and land erosion activities lead to changes in river configuration and reduction in water storage facilities and flood ways [10]. Rainfall is very scarce in the Makoran regions, shortage of available water resources leads to insufficient water supply. There would be many factors contribute to water shortage, such as inadequate water distribution systems, insufficient water supply facilities in the regions. Drought intensifies water shortage and for some reason drought prediction is less accurate than flood forecasting. Therefore, Makoran regions have experienced serious flood or drought over the past few decades and periods of drought may last for several years and may re-appear after several years of more normal rainfall. However, right now the attention of the International Scientific Community has been drawn to the problem of severe drought or flood conditions with the related water resources management problems. It is also necessary for Makoran to reduce drought and flood disaster. Furthermore, water resources management and development is a key step to achieving this goal. In some part of Makoran areas where drought is frequent and it is essential to establish long and short term water resources management planning and to improve long term hydro-meteorological forecasting and so mitigate flood and drought disaster.

Classification and to Asses Planning of Rainfall – Runoff Processes

The hydrological processes in the above sections could be represented in rainfall runoff reviews in order to account for the transformation of rainfall into stream flow and other water balance components. This could be in a form of a monthly based rate of flow from Rivers in all Balochistan such as Sarbaz and Kajo rivers [11]. To a great extent the purpose of solving runoff problem and the level of complexity that may be required. There are mainly two purposes; (1) to test maximum discharge which represented rate of flow of water or flood that is held about a process or system and (2) to predict the character of a system under a given set of conditions. Most of the river Sarbaz rate of flow of water level tends to concentrate on the latter purpose. The least that can be expected is a rainfall runoff analysing procedure that relates the storm flow at the gauging station to the amount of rainfall that produced it [9].

By testing river flow to get better and actual rainfall runoff characteristics by obtaining appropriate monthly maximum flow to view and improve monthly peak discharge of river Sarbaz and Kajo in four different sites gauged by hydrometric recorded and tested by excel for wet and dry periods and so for flood purposes, though it shown the result of Makoran water flow in rivers analysed. Focusing the river Sarbaz for the purposes of water flow and gauged at two gauging station called Shirgwaz and Homeiri gauging stations though the catchment for

Pishin station is 6850 km^2 and the catchment area for the Bahawkalat hydrometric station is 3910 km^2 however, the river network is a complex inter relationship of a historically. A conceptual approach that allowed some degree of perception of the hydrological processes to be expressed in mathematical form. The establishment and development of distributed monthly maximum flow analysis that account for the spatial variability of hydrological processes is appropriate to achieve river discharge in Makoran, thus the different monthly maximum discharge m^3/sec are illustrated in Figures 7-11 which indicated various rate of flow for Sarbaz River during wet months [12].

Thus, the significant of the figures illustrated for different wet months shown the rate of flow for the region under study and a good translation lagging behind river Sarbaz during entire periods of the year 2013. In the light of the storms and flood monthly maximum the calibration of river Sarbaz basically illustrated during month of December 2013 has been tested by computer the peak discharge was 3012 m^3/sec, for the February 2013 was tested 532 m^3/sec, for the

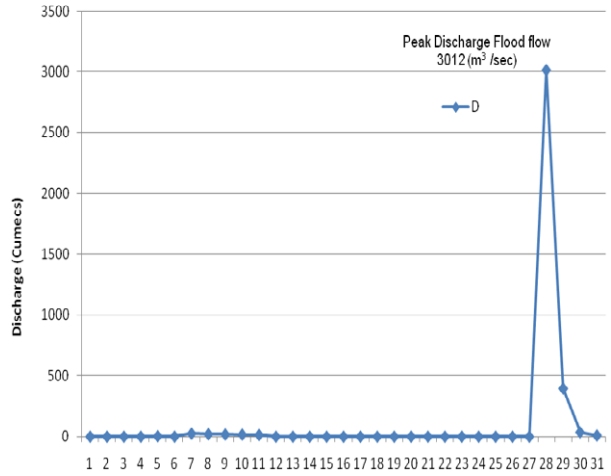

Figure 7: Monthly Maximum discharge m^3/s(test 1) from 01 to 31 of December 2012.

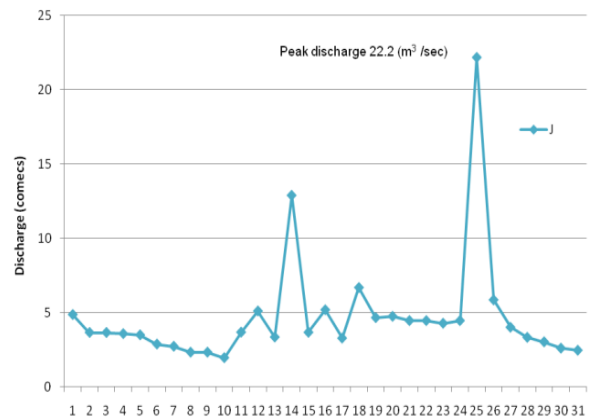

Figure 8: Monthly Maximum discharge m^3/s(test 2) from 01 to 31 of January 2013.

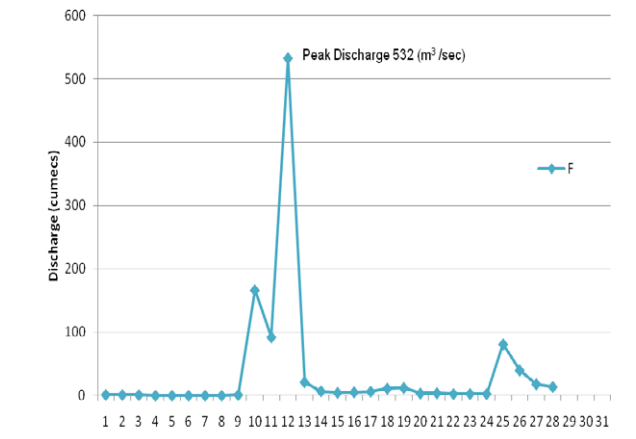

Figure 9: Monthly Maximum discharge m^3/s(test 3) from 01 to 31 of February 2013.

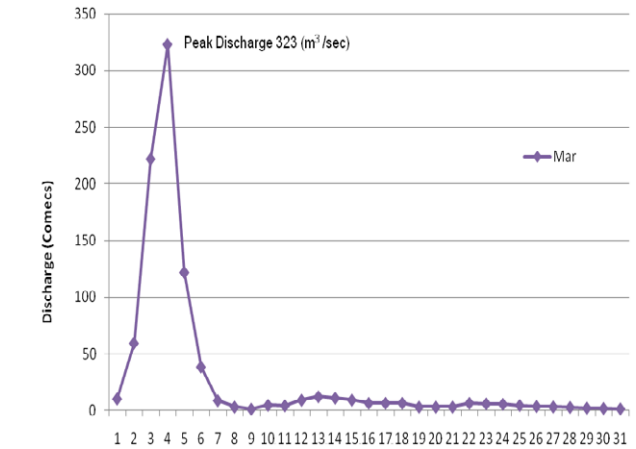

Figure 10: Monthly Maximum discharge m^3/s(test 3) from 01 to 31 of March 2013.

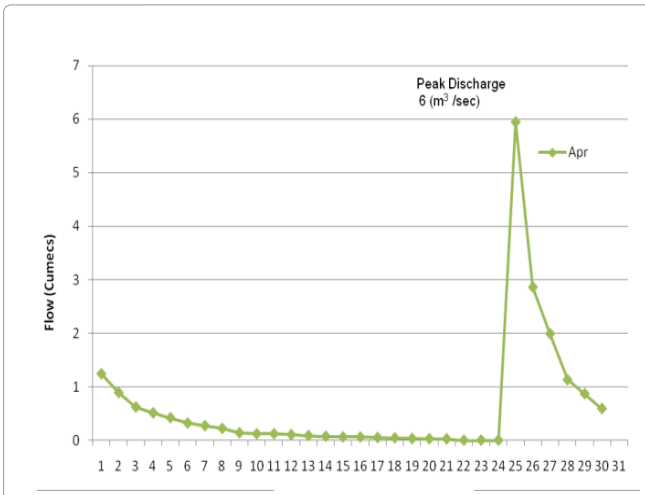

Figure 11: Monthly Maximum discharge m^3/s(test 3) from 01 to 31 of April 2013.

March peak discharge has been tested by excel was 323 m^3/sec where as for the same river on the month of April suddenly rate of flow dropped to 6 m^3/sec even though for other months during summer rate of flow for Sarbaz river is completely drought or nil discharge accordingly to the dry months when there is no rainfall in Makoran region, this is the link between rainfall and storm characteristics and its effect on monthly maximum discharge have been dealt with in the past also the storms characteristics mainly considered were the storm pattern, might be speed and direction of rainstorm moving in the downstream direction produces a higher peak flow than storms moving upstream which can be concluded that storms moving at the same speed as the stream velocity have more impact on peak discharge than rapidly moving storms.

Conclusion

However, measures to avoid flooding or to alleviate the damage it causes within a river catchments are best to taken into context of the interrelationship between the water courses, land use and developments within that catchments. Whenever the options could be involve both river and coastal defences, for example estuarine barrages, should be important to bring together both coastal and sites inland catchments, as well then process to observe the outcome towards the result of flood. Although where such works have significant effects on the environment these should be taken into account. Therefore, it is often beneficial to operating authorities and relevant interest groups to undertake a voluntary, environmental assessment, In this research the corresponding area shows climate change or global warming may be affecting flooding and flood frequency could be change. So measures to avoid flooding or to alleviate the damage it causes with in a river catchments are best taken in the context as well by the recent analysis towards flooding may be occurring sooner [1]. Unfortunately local authority costs are not based largely towards flood control and coastal defence activity due to less management of central government of Iran. Thus financial support for flood and flood defence works involves significant sums of expenditure it is therefore, essential that to put good maintenance towards flood protection. The research and analysing data shows the requirement that the range of options must be considered for new or improved defence measures encourages and more rigorous approach to cost effectiveness [13]. Thus it could be concluded that if progress is to be made with flood work periodically towards benefits of environment and to save people life. In response to heightened public concern for the environment and the effect of global climate change then the water authorities could be the best place to make information available to the general public on a range of local issues affecting flood and flood defence [14].

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