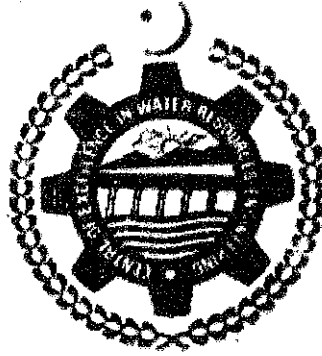


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THESIS

**RAINFALL – RUNOFF MODELING FOR KAHA HILL
TORRENT WATERSHED D.G. DISTRICT**



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ABSTRACT

Climatically major part of Pakistan falls in arid to semi arid zone, where the rains are seasonal and sporadic. Almost all hilly nullahs/hill torrents originating from these mountains receive flashy floods of short duration and high peaks and pass through large tracts of fairly leveled and fertile lands before to join the Indus Basin System. Due to steep slopes of hill torrents, flood-flows move with high velocity, which result in damages to crops, irrigation system, houses, roads etc, and some time to human lives also. These hill torrents have lot of potential for development of agriculture to meet the shortage of food and other raw materials for agro-based industries, if managed wisely.

Kaha Hill Torrent originates from the Suleiman Range in the Province of Balochistan, at an approximate altitude of 2,050 meters above mean seal level. It enters the Punjab Province near Muranj village and debouches through the Pachad area of D.G. Khan Division after leaving its Darrah near Harrand. It has a catchment area of about 5,720 sq. km and is one of the biggest hill torrents of Suleiman Range. The Darrah of Kaha Hill Torrent is about 28 miles in west of Dajal Branch.

In recent years, advancement in the Geographic Information Systems (GIS) has opened many opportunities, for enhancing hydrologic modeling of watershed systems. Geospatial Hydrologic Modeling Extension (HEC-GeoHMS) has been used for the digital elevation model (DEM). Soil types and land use information has been used as HMS input data/files to develop sub-basin boundaries and to prepare a number of hydrologic information. HEC-HMS model was used for estimating realistic volume of runoff based on rainfall data for optimum utilization of water resources and better watershed management.

Kaha Basin has been divided into four (4) sub-basins. Each sub-basin represents a complete watershed and possesses a separate value. HEC-HMS model was calibrated using historical rainfall data of Murange rain gauge station and discharge data at Darrah for the year 1963 under existing watershed conditions. After calibration, the model was tested for the year 1997-rainfall data of Ziarat rain gauge station and the computed hydrograph was found matching to the observed flood peak at Darrah within the above stated parameters. The simulated values (Calibrated & Tested) are matching with the observed peak within 10% variation of the flood peaks. Then HEC-HMS model, was used for the frequency storm method with different return periods (different probabilities) in Meteorologic model periods i.e. 25, 10, 5 and 2.33 years.

The model calibration was also used to compare the computed values with observed discharge values by using optimization procedure. The Univariate Gradient method and Percent Error in Peak Flow & Runoff Volume were used for iteration. These iterative results are close to the observed values i.e. in peak flow & runoff volume errors 0% & 2% respectively.

Model developed is considered useful for planning and management of the all hill torrents areas of Pakistan. Model can be used to estimate the peak flood discharges at Darrah for different return periods. This would help to design the more economical flood control structures for development of storage and utilization floodwater resources. Further more the model can be used to assess the changes in hydrologic conditions.