INTRODUCTION

A sound knowledge of the hydrologic behaviour is the key in watershed planning and management. It is necessary to know how a watershed functions, what factors affect its behaviour, how they affect it, and the magnitudes of their effects. Furthermore, it is necessary to know which of these factors can be controlled or modified by man and to what extent ? It is therefore important to obtain inter-relationships between various factors so as to enable prediction of the influence of man-made works in the watershed management.

Hydrologic balance of a region is not static but keeps on changing through changes in a host of factors. However, a number of these factors are eleminated if the area under study is small. The effects of channel flow and basin storage are less pronounced in a small watershed. Moreover, a small watershed is found to be highly sensitive to high rainfall intensities of short durations. It also provides an opportunity for the quantitative examination of hydrologic performance under a degree of climatic, geographic and geologic homogeneity which is not possible on large watersheds. Studies from these small watersheds can then be extended to large ones with appropriate modifications.

Watershed management implies a project type operation developed and applied to all land and water in a specific watershed, taking into consideration the physical conditions, needs and problems, its relation-ship to larger watershed and the facilities available to accomplish the project. Each watershed must be studied in the light of its problems and individual characteristics before the most desirable corrective programme can be developed and a determination made as to how the specific watershed will operate. Perhaps the first organisation in India to tackle soil conservation measures in an integrated manner is the Damodar Valley Corporation. The entire upper Damodar Valley catchment which is about 6 lakh hectares has been divided into 39 catchments which are further

subdivided into a number of sub-catchments. An integrated and phased watershed protection work plan has been drawn up which envisages the selective approach of treating the critical areas which contribute heavy sediment flows into the streams. The plan calls for various types of soil conservation treatment measures in agricultural upland, waste-land and wooded forests. A complete knowledge of the efficacy of these treatments and the performance of these watersheds through a comprehensive study of the geomorphological features and analysis of hydrological data collected is the ultimate aim of this project.

The physical features of a watershed directly influence its hydrologic response or conversely, it is also true that the hydrologic character of a watershed, to a considerable extent, shapes its physical characters. Based on this inter-relationship, it is therefore possible to derive useful quantitative tools for predicting hydrologic response from measurable physical features. To date some useful relations have been evolved but they are more qualitative than quantitative.

Hydrological characteristics of an area are determined largely by climatic conditions and geologic structure. In general, climatic factors like magnitude and distribution of rainfall, wind, temperature, humidity and evapotranspiration are more important because they constitute a major part in establishing the hydrologic features of a particular area. It is therefore necessary to know how watersheds of different sizes, shapes and topographic features react in an area of similar geologic and climatic conditions. Keeping this in view, investigations on the effects of watershed characteristics on the shape of stream flow hydrograph, time lag, ground water flow and sediment delivery rate are most essential in watershed planning. Thus, the basic objectives of this study are:
i) to study the various watershed characteristics, their inter-

relationships and their effects on hydrologic behaviour of a watershed,

ii) to develop hydrological tools like co-axial correlations, unit graphs, S - curves, base flow and surface runoff recession constants and coefficients for synthetic unit graph construction, and relate the results obtained to watershed characteristics,

iii) to relate geomorphological characteristics of a watershed and run-off volume to sediment yield.

It is hoped that the methods adopted and the results obtained from the analyses can be of great help to predict the hydrologic performance of other similar ungauged watersheds in the region.