Executive Summary of Project

Title of the Project: **Groundwater Zonation by Using Landform Characteristics in Karha River Basin, Pune District, M.S.**".

Name of Principal Investigator: **Prof. Virendra R Nagarale**

UGC Reference No. & Date: **F. 42-89/2013(SR)** dated 30th March 2013

Tenure of the project: 3 years from 01-04-2013 to 31-03-2016 Extension Up to 31 March 2017

University Grants Commission (UGC) New Delhi under XII Plan facilitate various schemes to University teachers to undertake research projects in various subjects. Under this Major Research Project scheme, Prof. Virendra R. Nagarale sanctioned Major Research Project in the Geography subject under the Science faculty. This research project is interdisciplinary in nature and deals with Geomorphology and Geology. Landform analysis in a given drainage basin can give clues for groundwater potentiality and this was the main idea of this project. The main objective of the project was to assess the role of geomorphological approach for delineating the groundwater resources. Further research also highlights to study groundwater condition, quality of groundwater for the domestic and agricultural utilisation in Karha River Basin.

The project is divided into four chapters with various maps, tables and photographs. Chapter first **Introduction** deals with study area and geographical profile of the Karha rivers basin. It highlights the basic Geomorphological Characteristics, Geological Characteristics and Hydrological Characteristics of the study area. In this chapter aims and objectives of the present project with origin of research problem, interdisciplinary relevance, national and international status of the present study has been highlighted. Detail methodology with various phases has been also incorporated in this chapter. In the other part its relevance to society with interdisciplinary approach has been also discussed in detail. The research work encompasses various disciplines such as geography, hydrology, geology, geomorphology, watershed management, economics of water resources etc. The results obtained from such study will be definitely useful for hydrologist, geologist, civil engineers, government agencies, NGOs, planners and administrators for design and development of watershed.

Chapter second **Ground Water Quality and its Assessment** deals with various parameters associated with ground water for drinking, agricultural, domestic and industrial purposes. Various groundwater samples were collected and analysed its quality under the light of various physico-chemical parameters such as pH, EC, TDS, Cl, Ca, Mg, CO_3, HCO_3 Na, K, SO_4, NO_3, TA, TH. It is shown that the average concentration of all the physico-chemical parameters are within the permissible limit. The towering values of some physico-chemical parameters such as EC and TDS which increases as the amount of dissolved mineral (ions). The groundwater quality of the study area is also evaluated view point of agricultural and irrigation purpose also by taking into consideration of the Piper-Hill diagram (1953) and U.S. Salinity Diagram, only 10% samples are unsuitable for irrigation purpose it may be the cause of higher concentration of Electrical Conductance. It shows that the groundwater quality of study area is good for drinking and agricultural purposes.

Chapter three is the core chapter of the research project deals with **Ground Water Conditions/ Potential** associated with the various landforms in the Karha basin. The groundwater potentials calculated with the help of detailed morphometric analysis and classification of geomorphic landforms viz. structural, denudational and depositional landforms. Various soil samples were collected and analysed for obtaining ground water conditions in the basin. Pre-mansoon and post-monsoon ground water levels for various GSDA and open wells for consecutive three years data helps to show the groundwater potential in the Karha Basin. Various groundwater zones viz. runoff, recharge and saturated zones demarcated in the Karha river basin map.

Last chapter **Conclusions, Results and Discussions** deals with overall assessment of the research problem and its application in the various branches through geomorphic perspectives. The landforms give clues for groundwater potential and the quality of ground water and its usefulness in various sectors which is discussed in analytical manner. Various zones with the area under that region with geomorphic characteristics are useful for Geomorphologists, geologists, administrators, planners, farmers, researchers given is very useful application art of the research project.

The main objective of the proposed study is to assess the role of geomorphological approach for delineating the groundwater resources of the Karha River Basin area.

The supportive objectives are:

1. To study groundwater conditions in Karha River Basin with reference to geological, geomorphological and hydrogeological characteristics.
2. To study the quality of groundwater for the domestic and agricultural utilisation to identify pollution zones within the study area.
3. To demarcate various groundwater zones with reference to landforms and their characteristic.
4. To study the morphometric characteristics of each zone for identifying factors limiting ground water potentials. and
5. To quantify the ground water availability in different seasons

Methodology

To achieve above objectives following methodology has been carried out in the entire period of the project. In the first phase base map has been prepared from toposheets and satellite data. Ground truth verification of satellite data by conducting field surveys, and various field visit with GPS readings were considered in this phase. Collection and analysis of soil and groundwater samples, conduction groundwater inventory of wells, tube well, in the basin was part of methodology to achieve above objectives. Finally, after tabulation and analysis of the data groundwater zonation and Potential map representation objective has been achieved.

Summery of Findings:

Drainage basin morphometry explicitly reveals quantitative information on landform. One of the purposes of studying morphometry of watershed is to obtain information in quantitative form with relation to the geometry of the watershed that can be correlated with hydrologic information. Remote sensing studies allow the assessment of regional structures and their trends. In the Karha river basin bifurcation ratio ranges from 2.74.to 7.25 to The mean bifurcation ratio for Karha river basin is 4.23. This means that on an average, there are 4.23 times as many channel segments to any given order as of the next higher order. The average bifurcation ratio of the basin reveals that there appears to be strong geological control in the development of the drainage. Karha basins are not circular in shape. Drainage density is a significant factor affecting the flow, infiltration capacity etc. drainage density of Karha basin is 2.90. The studied Karha river basin has a dendritic drainage pattern with good drainage texture showing a 7th order stream network. In Karha drainage basin it is observed that the

texture of this basin is in good quality. The drainage basin is being frequently selected as an ideal geomorphological unit. Watershed as a basic unit of morphometric analysis has put on importance because of its topographic and hydrological unity. Drainage density and stream frequency are the most useful criterion for the morphometric classification of drainage basins which certainly control the runoff pattern, sediment yield and other hydrological parameters of the drainage basin.

In the present study 10 groundwater samples were collected and analysed its quality under the light of various physico-chemical parameters such as pH, EC, TDS, Cl, Ca, Mg, CO_3, HCO_3 Na, K, SO_4, NO_3, TA, TH. It is shown that the average concentration of all the physico-chemical parameters are within the permissible limit. The towering values of some physico-chemical parameters such as EC and TDS It increases as the amount of dissolved mineral (ions). The groundwater quality of the study area is also evaluated view point of agricultural and irrigation purpose also by taking into consideration of the Piper-Hill diagram (1953) and U.S. Salinity Diagram, only 10% samples are unsuitable for irrigation purpose it may be the cause of higher concentration of Electrical Conductance.

As above mentioned it must be said that the groundwater quality of study area is good for drinking and agricultural purposes. Landforms are playing major role in groundwater occurrence and potential of the groundwater. There is wide scope to study the landforms and other groundwater related parameter geographically. In the present study researcher found that the Basin area of Karha River facing the problem of water scarcity during summer season because of hard rock topography. Source region of Karha river basin having very limited Groundwater potential and most of the area comes under Moderate and Medium Groundwater potential areas. Some places have no groundwater zone areas along the study region.

Contribution to the Society:

The present research work encompasses various disciplines such as geography, hydrology, geology, geomorphology, watershed management, economics of water resources etc. The results obtained from such study will be definitely useful for hydrologist, geologist, civil engineers, government agencies, NGOs, planners and administrators for design and development of watershed. Such types of research can be helpful to quantify and explain the relation between geomorphic processes and hydrologic parameters of any river basin. Research of micro watershed/ river basin can be applicable to any other river basin having similar litho-climatic and geo-environmental conditions for design and development of watershed. Planning and development activities in a river basin area can be efficiently formulated by following the

criterions that will be evolved through this study. This study will provide a simple means to complete it with other basins to regionalize the experimental results.

With this approach, the present work, will attempt to delineate the catchment area with different landform units. Based on the nature of origin, these units can be grouped in to structural landforms, denudational landforms and depositional landforms. Such types of landforms can be classified as per groundwater potential characteristics with the help of preparing a groundwater potential zone maps.

By visualizing groundwater basin as a large natural underground reservoir, it is clear that over development of groundwater in one portion of a basin directly affects water supplies throughout the remainder of the basin. This has led to basin-wide planning and development of groundwater. In order to maintain sustainability, a hydrologic equilibrium must exist between all waters entering and leaving the basin. Porosity and water holding and releasing capacity of landforms and geological structures vary with the presence of lineaments, fractures and folds. Similarly, the surface soil properties like infiltration capacity, terrain slope, drainage density etc. determines the infiltration opportunity time and thereby recharge rate to the aquifer material. Remote sensing and GIS have emerged as useful techniques to decipher groundwater zones in any river basin. The interpretation of satellite data in conjunction with sufficient ground truth information makes it possible to identify and outline groundwater potential zones in various landforms of denudational, fluvial and structural origin, that may serve as direct or indirect indications of the presence of groundwater. Modern remote sensing techniques facilitate demarcation of different landforms suitable for groundwater replenishment by taking into account the diversity of factors that influences groundwater recharge.

Prof. Dr. Virendra R Nagarale

(Principal Investigator)