PREFACE

Geoenvironment is a short form for the more familiar titles such as Environmental Geoscience or Environmental Geology or Environmental Earth Science. Environment refers to the sum total of all conditions and influences that affect the existence, growth and development of an organism. In short environment for man is anything that surrounds him. Environment is not static and changes occur even if there is no human interference. Over geological ages, various geological processes have shaped the terrain as it is today. In its natural uninterfered conditions, the environment of any area is in the state of dynamic equilibrium. That is what called as ‘Balance of Nature’. This balance is disturbed only when man tries to over exploit and interferes with nature. Man has considerably affected the environment in accordance with his own needs without taking into consideration the capabilities of the land and availability of resources. Man is a part of environment and the subject of environmental science deals with the study of environment, its evolution, dynamics and its resources. Environmental geology comes into play where the application of geological principles and knowledge to problems created by man’s occupancy and exploitation are involved. Time has witnessed the domination of the nature by man. If on one hand, with the tremendous scientific and technological advancement, man has improved the quality of his life; but, on the other hand disturbed and altered the environment with extensive topographic changes and in some places even distorted. Environmental degradation due to industrialization, urbanization and population increase if not checked in time, will be potentially dangerous to the very survival of man. It is now only man has started realizing the grave danger he faces from his interference. There is a need to develop a better understanding of the relationship between man and environment. In particular, they need to be considered in order to meet sustainability requirements.

The study area, Dharamshala, is one of the famous hill towns situated in the foothills of the Himalayas in the District of Kangra and State of Himachal Pradesh, India. The present study has been carried out under the title “Impact Assessment of Geoenvironment of Dharamshala, H.P., India - Potential for Eco-Town”. The main aim of the study was to evaluate the resource base of the study area in order to access its feasibility of developing into an ecologically stable town for sustainable growth. The area has been selected for the study to know how much the area is vulnerable to
the natural processes and how the anthropogenic activities are adding to the geo-

hazards. An effort through this study has been made to highlight the problems in the
area. This work is an attempt towards establishing relationship and exploring
scientific means to protect geoenvironment of an area prone to many natural and man-
made disasters and also to suggest some measures to check further degradation of
ggeoenvironment.

The thesis comprises of seven chapters. After general description about
the study area and methodology in first two chapters, the results of field and
laboratory analysis were presented in next four chapters. The last chapter is dedicated
to the observations, suggestions and conclusion. The results and observations of the
study have been presented with the help of 102 tables and 189 figures.

Chapter - I gives a general introduction of the study area related to its location
and regional setting, physiography and drainage, climate, flora and fauna, soil,
mineral resources, natural and anthropogenic activities and present status of the area.
The previous work and scope of the study is also discussed in the chapter. Moreover,
this chapter includes that how the management of geoenvironment can make us to live
in harmony with nature and why the management of geoenvironment is must for
sustainable development.

Chapter - II deals with the methodology carried out in achieving the aim of the
study by analyzing water quality, soil quality and preparation of different thematic
maps by the application of remote sensing and GIS. The field and laboratory
investigations were carried out for the monitoring of water and soil samples.

Chapter - III deals with the hydrochemistry of surface water (Dal lake and
streams) to evaluate its suitability for human consumption and irrigational purpose. In
the study area lake water is mainly used for irrigation purpose whereas water from
streams is uplifted by the irrigation and public health (IPH) department and after
treating, it is used (supplied) for drinking purposes. Water from different streams is
also used for agricultural purposes. It is, therefore, necessary that the quality of
surface water should be checked at regular intervals. Various parameters such as pH,
EC (Electrical conductivity), TDS (Total dissolved solids), different cations like
calcium, magnesium, sodium, potassium and anions like carbonate, bicarbonate,
chloride, sulphate, phosphate, nitrate, and fluoride were evaluated. DO (Dissolved
oxygen), BOD (Biological oxygen demand) and COD (Chemical oxygen demand) of
water samples were also calculated. In order to assess the extent of bacterial
contamination, MPN (Most probable number) test was also performed. Some of the physico-chemical attributes of water samples mentioned above were used to evaluate the quality of water for irrigational purposes and parameters like percent sodium (% Na), sodium adsorption ratio (SAR), residual sodium carbonate (RSC), kelley’s ratio (KR), magnesium hazard (MH) and permeability index (PI) were calculated. The results were compared with standard limits recommended by the Bureau of Indian standards (BIS), Indian Council for Medical Research (ICMR) and World Health Organization (WHO) for drinking purpose. The results so obtained were also subjected to statistical analysis using Statistical Package for Social Sciences (SPSS, VS-16).

Chapter - IV discusses the hydrochemistry of groundwater and municipal water supply in order to evaluate its suitability for human use and irrigational purposes. Various parameters such as pH, EC (Electrical conductivity), TDS (Total dissolved solids), major cations (calcium, magnesium, sodium, potassium) and anions (carbonate, bicarbonate, chloride, sulphate, phosphate, nitrate, and fluoride) were calculated. Municipal water samples were also evaluated for the parameters like DO (Dissolved oxygen), BOD (Biological oxygen demand) and COD (Chemical oxygen demand). In order to assess the extent of bacterial contamination, MPN (Most probable number) test was also performed. Parameters like percent sodium (% Na), sodium adsorption ratio (SAR), residual sodium carbonate (RSC), kelley’s ratio (KR), magnesium hazard (MH) and permeability index (PI) were calculated to evaluate the quality of groundwater in order to check its suitability for irrigational purpose. The results were compared with standard limits recommended by the Bureau of Indian standards (BIS), Indian Council for Medical Research (ICMR) and World Health Organization (WHO) for drinking purpose. The results were also analyzed statistically using Statistical Package for Social Sciences (SPSS, VS-16).

Chapter - V includes the evaluation of soil samples by geochemical and sedimentological analysis. Soil samples were analyzed for pH, EC, TDS and for various oxides such as SiO₂, Al₂O₃, Fe₂O₃, MgO, CaO, Na₂O, K₂O, TiO₂, P₂O₅ and trace elements like cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), nickel (Ni) and zinc (Zn). Sedimentological analysis of soils was carried out to work out the grain size distribution and its relation to the mode of deposition and transportation of soil material.
Chapter – VI includes evaluation of various aspects of study area with the help of GIS and Remote Sensing technique. The thematic maps for geology, geomorphology, drainage, slope, land use land cover, mining area and hazard zonation were prepared and interpreted.

Chapter – VII comprises the observations and conclusions derived from the field and laboratory investigations carried out for the assessment of geoenvironment of Dharamshala area of District Kangra, Himachal Pradesh. An attempt has been made towards establishing relationship between the varying trends in geoenvironmental parameters and their distribution in space and time. The chapter includes the suggestions and recommendations to protect geoenvironment of the area prone to many natural and man-made disasters and necessary measures that has to be taken to check further degradation of geoenvironment. The significant findings of the research work are concluded at the end.