CONTENTS

PREFACE vi
ACKNOWLEDGEMENTS vii
LIST OF FIGURES viii
LIST OF TABLES x
LIST OF PLATES xi

I INTRODUCTION 1-13

1.1 Himalayas
1.2 Location of the study area
1.3 General information of the study area
  1.3.1 Location & extent of the study area
  1.3.2 Physiography
  1.3.3 Climate
  1.3.4 Flora
  1.3.5 Fauna
  1.3.6 Landuse / Land cover
  1.3.7 General Geology
1.4 Scope & Objectives
1.5 Previous work
1.6 Methodology
  1.6.1 Pre-field interpretation
  1.6.2 Field work
  1.6.3 Post-field /Lab work
  1.6.4 Data used

II GEOLOGY AND STRUCTURES 14-39

A REGIONAL GEOLOGY
2.1 Introduction

B GEOLOGICAL SETTING
2.2 Geological Setting
2.3 Lithological distribution
  2.3.1 Mandhali Formation
  2.3.2 Blaini Formation
  2.3.3 Infra-Krol Formation
  2.3.4 Krol Formation
2.3.5 Subathu Formation
2.3.6 Dharmshala Formation
2.3.7 Siwalik Group
  2.3.7.1 Nahan Formation
  2.3.7.2 Pinjor Formation
  2.3.7.3 Boulder Conglomerate Formation
2.3.8 Gravels/Alluvium Deposits

B STRUCTURES
2.4 Introduction
2.5 Methodology
2.6 MINOR STRUCTURES:
  2.6.1 Planar Structures
    (a) Current beddings
    (b) Bedding cleavages
    (c) Crenulation cleavages
    (d) Microcrenulations
    (e) Axial cleavages or slaty cleavages
    (f) Fracture cleavages
    (g) Joints

2.7 MAJOR STRUCTURES
  2.7.1 Major structures:
    (a) Lineaments
    (b) Thrusts:
      (i) Upper Krol Thrust
      (ii) Krol Thrust
      (iii) Renuka Thrust
      (iv) Main Boundary Fault
      (v) Markanda Thrust
      (vi) Bata Thrust
      (vii) Paonta Thrust
      (viii) Yamuna Tear Fault
      (ix) Himalayan Frontal Thrust

2.7.2 Lineament Analysis

III GEOMORPHOLOGY
3.1 Introduction
3.2 Methodology
3.3 Geomorphological Classes
  3.3.1 Structural Hills
  3.3.2 Ridge type Structural Hills
  3.3.3 Cuesta type Structural Hills
  3.3.4 Residual Hill
  3.3.5 Piedmont Zones
  3.3.6 Alluvial fans
3.3.7 River Terraces
  3.3.7.1 Giri river terraces
  3.3.7.2 Yamuna river terraces
  3.3.7.3 Bata river terraces
  3.3.7.4 Markanda river terraces

3.3.8 Flood Plains

IV SLOPE AND DRAINAGE ANALYSIS

4.1 SLOPE
4.2 Slope Analysis
  4.2.1 Methodology
    (a) Digital Elevation Model (DEM)
    (b) Slope from topographical maps
    (c) Determining hill slope using topographical maps
  4.2.2 Slope categories
    4.2.2.1 Nearly level slope
    4.2.2.2 Very gently sloping
    4.2.2.3 Gently sloping
    4.2.2.4 Moderately sloping
    4.2.2.5 Strongly sloping

4.3 ASPECT
4.4 Drainage Analysis
  4.4.1 Drainage Patterns
    4.4.1.1 Dendritic to sub-dendritic drainage pattern
    4.4.1.2 Rectangular drainage pattern
    4.4.1.3 Parallel to Sub-parallel drainage pattern
    4.4.1.4 Trellis drainage Pattern
    4.4.1.5 Deranged drainage pattern
    4.4.1.6 Braided drainage pattern

4.5 MORPHOMETRIC ANALYSIS
  4.5.1 Drainage density
  4.5.2 Circulatory ratio
  4.5.3 Elongation ratio
  4.5.4 Basin form factor
  4.5.5 Basin shape index
  4.5.6 Conclusion
V MORPHOTECTONICS  
5.1 Introduction

5.2 Landform related to uplift
   5.2.1 Morpho-structural signature in Structural Hills
   5.2.2 Active tectonics in Cuesta type Structural Hills
   5.2.3 Landslides along the active fault system
   5.2.4 Tectonically induced Piedmont zones
   5.2.5 Structural Valleys along major thrusts
      5.2.5.1 Structural valleys along Giri river
      5.2.5.2 Structural valleys along Jalal river
   5.2.6 Evolution of Alluvial plains
      5.2.6.1 The Bata river alluvial plain
      5.2.6.2 The Markanda river alluvial plain
   5.2.7 Development of Flood Plains

VI HYDROGEOLOGY AND GROUNDWATER POTENTIAL  
6.1 Introduction

6.3 Hydrogeomorphic units
   Alluvial zone:
   6.3.1 Alluvial Plain
      6.3.1.1 Flood Plain
      6.3.1.2 River Terrace
         i) Markanda river terraces
         ii) Bata river terraces
         iii) Giri river terraces
      6.3.1.3 Channel Bars/Point Bars
   6.3.2 Palaeochannel
   6.3.3 Piedmont Zone
      6.3.3.1 Western Piedmont zone
         i) Piedmont zone in Markanda valley
      6.3.3.2 Central Piedmont Zone
         ii) Piedmont zone in Bata valley
      6.3.3.3 The Eastern Piedmont Zone
         iii) Piedmont zone in Giri valley

6.4 Structural Valleys
   6.4.1 Structural valleys along Giri river
   6.4.2 Structural valleys along Jalal river
6.5 Structural Hills
   6.5.1 Ridge type structural hills
   6.5.2 Cuesta type structural hills

6.6 Well Inventory

6.7 Observation wells

VII GROUND WATER MODELING

7.1 Introduction
7.2 Data Requirement and source
7.3 Methodology
7.4 GIS analysis for Plains
   7.4.1 Weightages for Relative relief
   7.4.2 Weightages for Reduced Water Level
   7.4.3 Weightages for average bore well yield/discharge
   7.4.4 Weightages for Geomorphic units
   7.4.5 Weightages for Slope classes
   7.4.6 Integration of themes by Proportional addition

7.5 GIS analysis for Hills
   7.5.1 Lithological unit weightages
   7.5.2 Weightages for Geomorphic units
   7.5.3 Weightages for Slope classes
   7.5.4 Weightages for Drainage density
   7.5.5 Weightages for Lineament/Fracture density
   7.5.6 Weightages for land use/ Land cover
   7.5.7 Integration of Themes
      (A) Cumulative Addition
      (B) Proportional Addition
   7.5.8 Results
   7.5.9 Conclusions

VIII SUMMARY AND CONCLUSIONS

REFERENCES

Appendix  (Geological map FIG 2.1 and Geological section Fig 2.2 )