

# *Geologic Mapping for Environmental Purposes*

Edited by H.F. Ferguson



THE  
GEOLOGICAL SOCIETY  
OF AMERICA

ENGINEERING GEOLOGY DIVISION



# *Geologic Mapping for Environmental Purposes*

Edited by H.F. Ferguson

*with contributions by*

Robert G. Font

Robert F. Legget

Christopher C. Mathewson

Samuel J. Meltz

Charles R. Meyers, Jr.

Hugh B. Montgomery

*Prepared for the  
Engineering Geology Division of  
The Geological Society of America*



**THE  
GEOLOGICAL SOCIETY  
OF AMERICA**

**ENGINEERING GEOLOGY CASE HISTORIES NO. 10**

The printing of this volume has been made possible  
through the bequest of Richard Alexander Fullerton Penrose, Jr.,  
and the generous support of all contributors  
to the publication program.

Copyright 1974 by The Geological Society of America, Inc.  
Copyright is not claimed on any material  
prepared by U.S. Government employees  
within the scope of their employment.

Library of Congress Catalog Card Number 73-90839  
I.S.B.N. 0-8137-4010-X

Published by  
THE GEOLOGICAL SOCIETY OF AMERICA, INC.  
3300 Penrose Place  
Boulder, Colorado 80301

*Printed in the United States of America  
by Edwards Brothers, Inc., Ann Arbor, Michigan 48104.  
Type composed by The Geological Society  
of America, Boulder, Colorado 80301.*

# Contents

Preface . . . . .	<i>Harry F. Ferguson</i>	v
What kinds of geologic maps for what purposes? . . . . .	<i>Hugh B. Montgomery</i>	1
Abstract . . . . .		1
Multidisciplinary trends . . . . .		1
Professional aspirations of environmental geology . . . . .		3
Problems with data and their use relative to comprehensive environmental analysis and planning . . . . .		3
Some special problems presented by a comprehensive area-wide approach to environmental planning		
administration . . . . .		5
Interfaces . . . . .		5
Interdisciplinary reactions . . . . .		6
Total professional practice or secondary status . . . . .		7
References cited . . . . .		8
Regional land use analysis and simulation models: a step forward in the planning process . . . . .	<i>Charles R. Meyers, Jr.</i>	9
A land use model supposition . . . . .		10
Model attributes meeting the needs of planners . . . . .		10
Epistemological questions of land use models in the planning process . . . . .		11
The future . . . . .		11
Selected bibliography . . . . .		12
Geonatural resources planning . . . . .	<i>Samuel J. Meltz</i>	13
Abstract . . . . .		13
Introduction . . . . .		13
Geonatural resources elements, problems, and options . . . . .		14
Geonatural resources elements . . . . .		14
Geonatural resources problems . . . . .		14
Geonatural resources option alternatives . . . . .		14
Tools required . . . . .		15
Concept implementation . . . . .		15
Conclusions . . . . .		16
Selected bibliography . . . . .		16
Engineering geological maps for urban development . . . . .	<i>Robert F. Legget</i>	19
References cited . . . . .		21
Geologic environment: forgotten aspect in the land use planning process		
. . . . .	<i>Christopher C. Mathewson and Robert G. Font</i>	23
Abstract . . . . .		23
Introduction . . . . .		23

Planning process . . . . .	24
Constraints to geologic planning . . . . .	25
Responsibility of geologic profession . . . . .	26
Acknowledgments . . . . .	28
References cited . . . . .	28
Environmental analysis in local development planning . . . . .	<i>Hugh B. Montgomery</i> 29
Importance of early analysis and planning . . . . .	30
Aspects of environment important to planning . . . . .	31
Air . . . . .	32
Water . . . . .	32
Streams . . . . .	32
Underground flow . . . . .	33
Land . . . . .	34
Soil and topography . . . . .	34
Rock . . . . .	34
Minerals . . . . .	34
Historical, aesthetic, and archaeological sites . . . . .	35
Steps to incorporate environmental factors into local development planning . . . . .	35
Tools available to implement local plans . . . . .	38
Legislation . . . . .	39
Scheduling . . . . .	40
Budget and finance . . . . .	40
Organization of compacts . . . . .	40
Acknowledgments . . . . .	40
References cited . . . . .	40

# Preface

The rapid increase in the development of land, the exploitation of minerals, and the related accelerated environmental impacts have caused an explosion of demand for information that can be used as a guide to land use decision-making.

“Environmental Geology Mapping” was the topic of an engineering geology symposium at the 1972 annual meeting of The Geological Society of America; natural resources planning and the roles and interrelations of geology and geologists, planning and planners were considered and discussed. This book presents the coverage of those subjects because of their continuing timeliness and the need for a reminder that we must provide data that are relevant and usable for interdisciplinary considerations in natural resources planning. The authors express their ideas on how to translate professionally the traditional, basic earth-science data into forms that are adaptable to interdisciplinary solutions of environmental problems. They unanimously state that this conversion of data has to result in a viable input for decision-making, and it must also stand the scrutiny of the real world; that is, it must receive public endorsement and support.

We conclude that current planning practices are inadequate in predicting the effect of specific technological projects or specific social activities or policies on the natural environment. Presently, large sums of money are being spent on environmental assessment and resource planning. Whether this expenditure of time and money is justified depends upon how effective the natural science and selected engineering data are in the land use decision-making.

The development of the land and all the ramifications that contribute to the environmental impact will continue whether or not good geonatural resource decisions are reached. The existing social-political system demands that the final product not only be completed as growth requires but also that all impact, good or bad, be carefully assessed and considered to determine the least-effect approach from among the alternatives. With the increasingly constrictive requirements of an environmental impact statement on most public works and regulated private utilities, it is imperative that future highways, housing, and other land and resource developments be planned and built with the quality of the environment considered and evaluated in an operating framework that guarantees the best possible developmental and environmental results.

Despite all this concern over the effective uses of natural resources data input, we re-emphasize that at the policy-making level (state and federal land use policy and planning assistance acts) there is need for much more knowledge and skills than the natural and physical sciences can contribute. The ability of geologists to fit into environmental planning, not only in their professional capacity but also in a policy-making capacity, is questioned. Hopefully, an enlightened geological educator and professional practice leadership will emerge and grow and eventually prove that there is a tremendous potential in using geology input to aid in solving our developmental-environmental problems.

**HARRY F. FERGUSON**  
*Department of the Army*  
*Corps of Engineers*  
*Pittsburgh, Pennsylvania 15222*

