

Abandoned Mine Openings Hazards and Remediation Handbook



Minerals and Energy Branch
Information Series 23

ABANDONED MINE OPENINGS

HAZARDS AND REMEDIATION HANDBOOK

NOVA SCOTIA DEPARTMENT OF NATURAL RESOURCES

ACKNOWLEDGEMENTS

The development and production of this handbook has been made possible through funding provided by the Canada-Nova Scotia Cooperation Agreement on Mineral Development.

The Nova Scotia Department of Natural Resources would like to thank: the National Park Service, Denver, Colorado; the US Bureau of Mines, Spokane, Washington; the Department of Natural Resources, Denver, Colorado; Utah Natural Resources, Salt Lake City, Utah; and the Bureau of Land Management, Lakewood, Colorado for permission to use information and references from various publications and documents they have been associated with. Thanks are also expressed to Jacques Whitford and Associates Limited for their work in assembling and compiling the Handbook.

TABLE OF CONTENTS

Page No.

■	INTRODUCTION	vii
	INTRODUCTION	vii
	Handbook Organization	vii
■	CHAPTER ONE	1
	MINING INDUSTRY OVERVIEW	1
	Surface Mining	1
	Underground Mining	1
■	CHAPTER TWO	5
	HAZARDS	5
	Unsecured Mine Openings	5
	Open Pit Mines and Quarries	5
	Subsidence and Caving Features	8
	Other Hazards	8
■	CHAPTER THREE	13
	LANDOWNER RESPONSIBILITIES	13
	Legal Code	13
■	CHAPTER FOUR	15
	SAFETY PROCEDURES AND INSTALLATION GUIDELINES	15
	Shafts, Inclined Shafts and Raises	15
	Adits, Declines and Slopes	15
	Subsidence or Caving Features	16
■	CHAPTER FIVE	17
	REMEDICATION AND CLOSURE OPTIONS	17
	Securing Mine Openings	17
	Monuments	18

■	CHAPTER SIX	19
	REMEDICATION AND CLOSURE METHODS	19
	SIGN POSTING	20
	Application	20
	Effective Placement of Warning Signs	20
	Life Expectancy	20
	Advantages	22
	Disadvantages	22
	FENCING	23
	Application	23
	Types	23
	Effective Placement of Fencing	23
	Life Expectancy	23
	Advantages	24
	Disadvantages	24
	STEEL WIRE SCREEN	26
	Types	26
	Application	26
	Installation	26
	Life Expectancy	26
	Advantages	27
	Disadvantages	27
	STEEL GRATE CLOSURES	28
	Types	28
	Application	28
	Installation	28
	Life Expectancy	29
	Advantages	29
	Disadvantages	29
	BULKHEAD CLOSURES	30
	Types	30
	Application	30
	Installation	30
	Life Expectancy	30
	Advantages	30
	Disadvantages	31

CONCRETE CAP CLOSURES	32
Types	32
Application	32
Installation	32
Life Expectancy	33
Advantages	34
Disadvantages	34
 BLAST CLOSURES	 35
Application	35
Method	35
Life Expectancy	35
Advantages	36
Disadvantages	36
 BACKFILL CLOSURES	 37
Application	37
Materials	37
Preparation	37
Procedure	37
Life Expectancy	38
Advantages	38
Disadvantages	39
 ■ CHAPTER SEVEN	 41
ENVIRONMENTAL CONSIDERATIONS	41
Wildlife Habitat	41
Construction Activities	41
Domestic Refuse and Debris	41
 ■ CHAPTER EIGHT	 43
ADDITIONAL INFORMATION AND REPORTING	43
Obtaining Information	43
Reporting	44
 ■ CHAPTER NINE	 45
REFERENCES	45

LIST OF FIGURES

Page No.

Figure 1	Map of Nova Scotia Showing Locations of Abandoned Mine Openings	ix
Figure 2	Typical Surface Mining Operation	2
Figure 3	Typical Underground Mining Operation	4
Figure 4	Adit Into Hillside Showing Weakened and Fractured Rock Around Entrance	6
Figure 5	Mine Stope Extending Through to Surface	6
Figure 6	Water Filled Stope Which Has Caved Through to Surface	7
Figure 7	Vertical Open Shaft With Deteriorating Timber	7
Figure 8	Water Filled Subsidence Features	9
Figure 9	Measuring the Depth of a Caving Feature	9
Figure 10	Dynamite Explosives and Packaging	11
Figure 11	Typical Examples of Blasting Caps	11
Figure 12	Abandoned Mill Foundations and Structure	12
Figure 13	Deteriorating Abandoned Mine Structure	12
Figure 14	Recommended Placement of Warning Signs	21
Figure 15	General Fencing Arrangements	25

LIST OF TABLES

Page No.

Table 1	
Mine Openings Remediation Options	19

LIST OF APPENDICES

Page No.

Appendix A	
Glossary of Common Mining Terms	A-1
Appendix B	
Technical Specifications for Closure Methods	B-1
Appendix C	
Costs for Closure Methods	C-1

• Notes •

INTRODUCTION

Nova Scotia has a long history of mineral exploration and mining activity which dates back to 1720 when coal was first mined on the Island of Cape Breton. Prior to the current requirement to reclaim and revegetate abandoned mine sites, this mining legacy has left a large number of abandoned mine sites and unsecured mine openings throughout the province. These abandoned sites and the associated openings present a hazard to land users and a potential legal liability to private landowners.

This handbook is intended to provide private landowners with information regarding the potential hazards and legal liabilities of abandoned mine openings located on their property, and to describe remedial methods to reduce or eliminate the hazard. It is designed for use by land owners who are subject to regulations governing public safety hazards that exist on their land, but who may be unfamiliar with the hazards associated with abandoned mine openings.

Publication of the handbook is part of a program by the Nova Scotia Department of Natural Resources, to increase public awareness of the potential hazards of abandoned mine openings. To this end, the Department has compiled an inventory of over 5,000 known abandoned mine openings in the province, many of which are unsecured. This inventory has been completed with the assistance of Department field staff, prospectors, landowners, recreational land users and woodlot/forestry operators. The general locations of these abandoned and inactive mine openings are shown on Figure 1.

The Department continues to document and record the location of these sites, and to make that information available to private landowners and the general public. The handbook describes the most commonly documented methods in use today to seal and secure abandoned mine openings, which are appropriate to the Nova Scotia situation.

Handbook Organization

If you are unfamiliar with mining activities and the hazards associated with abandoned mine openings, it is recommended that you read Chapters 1 and 2. These chapters provide background on typical mining activities in Nova Scotia and the nature and types of hazards which can result.

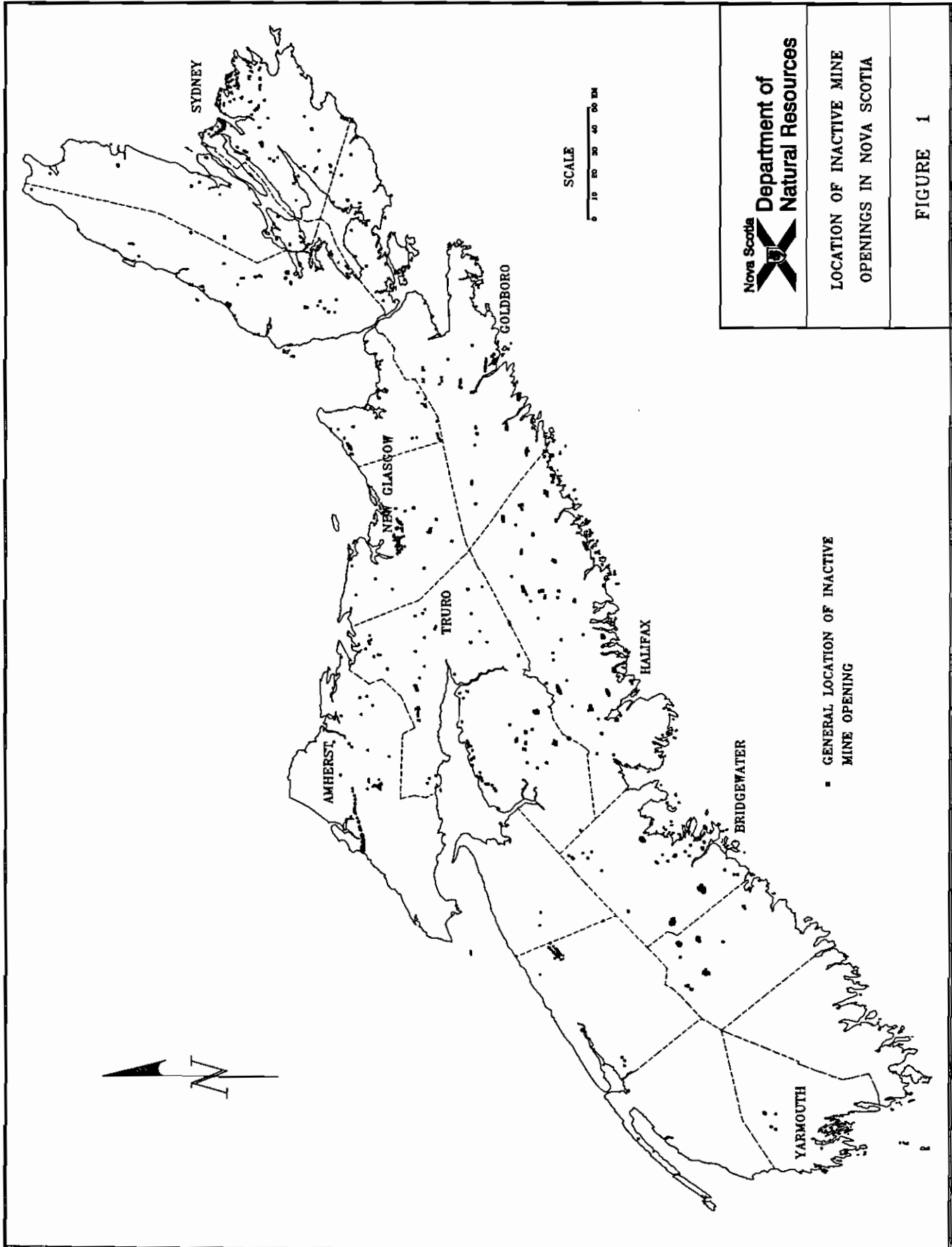
Chapter 3 outlines legal responsibilities private landowners have if mine openings are located on their property. Working around abandoned mine openings can expose the worker to potential accidents and injury. Chapter 4 details these concerns.

Chapter 5 and 6 provide information on the various remediation and closure methods and options available to secure or seal mine openings. Environmental considerations associated with sealing or closure of abandoned mine openings are provided in Chapter 7.

Chapter 8 and 9 identifies who to contact should you encounter an unsecured mine opening, how to report the finding and where to obtain additional information.

A glossary of common technical terms is provided in Appendix A. Appendix B contains technical details on the fabrication and installation of the remediation and closure methods outlined in the Handbook. Cost information for the various abandoned mine openings closure methods is provided in Appendix C.

• Notes •



Nova Scotia
**Department of
 Natural Resources**

LOCATION OF INACTIVE MINE
 OPENINGS IN NOVA SCOTIA

FIGURE 1

