

**PROVINCE OF NEW BRUNSWICK
DEPARTMENT OF ENERGY AND
RESOURCE DEVELOPMENT**

Minerals and Petroleum Development Branch

**GUIDE TO THE DEVELOPMENT OF A
MINING AND RECLAMATION PLAN IN
NEW BRUNSWICK**



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INTRODUCTION

The user is directed to the Guide to the Mine Approval Process in New Brunswick for direction on the approval process and the submission of the Mining and Reclamation Plan.

The following is intended as a guide to the creation of a Mining and Reclamation Plan as per the legislative requirements of the Province of New Brunswick. The following format also assists in amalgamating the information requirements as set out in the Mining Plan, Reclamation Plan, and Environmental Impact Assessment (EIA) Registration document as required by the *Mining Act* and Regulations, and the *Clean Environment Act*, EIA Regulation 87-83.

This suggested general format will assist the proponent to develop a thorough and consistent plan that will be acceptable to the Standing Committee on Mining and the Environment (SCME) and streamline the mine approval process.

It is the responsibility of the project proponent to investigate and obtain all the data necessary to formulate the Mining and Reclamation Plan.

REQUIRED ELEMENTS

EXECUTIVE SUMMARY

A summary of the document is required and should highlight all major findings, issues and conclusions.

PART 1. BACKGROUND REVIEW

The purpose of Part 1 of the Mining and Reclamation Plan is to provide necessary background data to serve as both a benchmark for comparison purposes and also to assist in evaluating environmental risks associated with this project.

1. Company Information

Background information regarding full legal name of the company, location, and a brief synopsis of company experience is required.

1.1 Company Address

A full mailing address and also the physical address of the company or principals shall be provided.

1.2 Principal Contacts

A full list of all contacts is to be provided including the Owner(s) or President, Chief Executive Officer, and key project officers.

2. Site Location

Provide the geographic location and a description of the project location. As a minimum, a large-scale (preferably 1:12,500) map should be provided showing the site location and major geographical features.

2.1 Geographical Setting

Describe the topography, setting (whether lowland, upland, plateau, etc.), population density, vicinity of urbanization, etc.

2.2 Land Use

Describe the existing land use for the mine site as well as the adjacent land uses.

2.3 Access

Explain the existing methods of access to the site and the current state of transportation routes.

2.4 Ownership

State the NB Parcel Identifier (PID) number for the property in question and the name(s) of the registered owner(s). Provide a property map for the area identifying adjacent properties and landowners.

3. Geology

Describe the general geology of the project area and include site-scale maps.

3.1 Unconsolidated Geology

Provide a general description of the geology of surficial sediments. Include description of soil type and characteristics, thickness, and aerial extent. A topographic

profile should be provided showing the pre-development elevations and major landforms.

3.2 Bedrock

A general description of the bedrock geology is required for the immediate area including rock types, physical and chemical characteristics, and structure. A geological map of the project area should be provided outlining all major features including the surface expression of the ore body.

3.3 Ore Geology

Describe the ore to be mined and include details on its location, physical characteristics, mineralogy, and structure.

3.4 Seismicity

Provide general seismicity data for the project area location including the maximum likely event and expected seismic velocities.

4. Hydrology

A map should be provided showing surface water drainage patterns, watershed(s), and groundwater flow characteristics. Wherever possible, site-specific data obtained by actual measurement is preferred over extrapolation of regional data.

4.1 Climate

Indicate the climate for the project area including average temperatures, yearly rainfall, total snowfalls, average monthly rainfall, prominent wind directions, evaporation, etc.

4.2 Surface Water

Describe the characteristics of the watershed(s) affected by the project and include drainage patterns, runoff characteristics, volumes of discharge, water quality or chemistry, and flood characteristics. Include a sediment survey of metal levels within any watercourse or discharge area (springs) that might be affected by the development or operation of the mine.

4.3 Groundwater

Describe groundwater characteristics including flow

patterns, the groundwater table, aquifers and aquitards, chemistry, recharge zones, discharge zones, location of drinking water supplies if applicable, etc.

5. Biology

5.1 Vegetation

Provide survey results detailing the relative abundance of terrestrial plants including rare species that may be disturbed as a result of development.

5.2 Wildlife

Provide survey results detailing the presence and habitat of wildlife in the area including any rare or endangered species that may be disturbed as a result of development.

5.3 Aquatic Life

Provide survey results detailing the relative abundance of fish and benthos species in affected watercourses.

6. Site History

An assessment of the archaeological potential of the project site should be provided including a brief history of prior land use if applicable.

7. Environmental Sensitivities

Produce a list of sensitive environmental features that could potentially be impacted by mining development. This includes existence of rare plants, endangered species, sensitive habitats such as wetlands, water supplies, parks, and specially designated areas and protected zones.

8. Socioeconomic Sensitivities

Produce a list of economically and socially valuable resources that may be impacted as a result of the mine development. This includes such items as forestry operations, agricultural land, recreational land, tourism, native land issues, etc.

PART 2. MINING PLAN

1. Mine Site Description

1.1 Ore Reserves

Submit a description of the total resources and resources including grade of the ore and an indication of mineable and non-mineable reserves based on the

proposed mine plan.

1.2 Mining Methods

The principle mining method (s) to be employed to extract the resource should be detailed in this section, including the rationale for choosing this method over others. This shall include typical equipment and processes likely to be used. A flowsheet diagram is recommended to illustrate the concept.

1.3 Mine Site Layout

1.3.1 *Mine Workings*

The layout of the planned mined area and the surface expression of mining, either aboveground or underground, should be illustrated in appropriately scaled plans and sections.

1.3.2 *Surface Infrastructure*

The layout of surface infrastructure including buildings, roads, services and all surface structures shall be detailed along with an attached map or engineering drawing shown at an appropriate scale.

2. **Mining Operations**

2.1 Development Time Line

A schedule for the mining project should be summarized in this section and should include all major milestones from mine approval to estimated mine reclamation and closure. The use of a chart is recommended.

2.2 Mining Sequence

The amount of surface disturbance and the sequence of mining will be outlined showing expected progression in annual intervals. Expected underground and open pit development is included here. Vertical sections of key mining areas are also recommended to illustrate the progression of mining faces.

2.3 Ore Processing

2.3.1 *Plant Design and Flowsheet*

Information shall be provided describing the milling

facility. The method and procedure to process the ore should be explained in general terms and with a flowsheet diagram. Particulars such as milling rate, use of reagents, volume of wastes, water usage, ore handling and storage and any necessary pollution controls should be explained.

2.3.2 *Concentrate Handling*

Details should be provided for the proposed means of conveyance, storage and shipping of the concentrate including monitoring and protective measures.

2.3.3 *Thiosalt Management*

Thiosalt generation should be addressed if applicable. This will include prediction of concentrations in effluent using a standard industry model and development of a thiosalt management plan.

2.4 Water Management Plan

2.4.1 *Surface Water Runoff*

The seasonal surface drainage during operations should be detailed in this section. Key drainage routes shall be clearly shown across the site property and shall include all ditches, surface catchments, sewers, ponds, plant effluent locations, and streams.

2.4.2 *Potable Water*

Potable water sources shall be detailed in this section and include estimates of water quality and quantity required. A method for protection and quality control of the potable source should be included.

2.4.3 *Mine Water*

An acceptable method should be used to estimate the expected seasonal mine inflows and expected mine outflows or de-watering rate. The inflow and outflow rates shall be estimated for different stages of the expected mine development and life if expected to change.

2.4.4 *Water Balance and Loadings*

A description of how the proponent intends to manage all site water in an environmentally safe manner should be included. A general hydrologic water balance should be estimated for the mine site in order to estimate loadings and impacts to the environment.

2.5 Waste Management Plan

An overall plan for the management of waste shall be provided for the site. Infrastructure required for waste management shall be included in a detailed engineering drawing.

2.5.1 Air Emissions

Any air emissions from the plant site or other sources shall be detailed in this section and shall include a description of expected pollutants, estimated levels, and proposed mitigation and monitoring methods.

2.5.2 Tailings Management

A tailings management plan shall be provided if applicable. Tailings storage impoundments shall conform to the Canadian Dam Associations guidelines for Dam Safety. An estimate of the rate of tailings discharged, its expected physical and chemical properties, method of disposal, and expected accumulation pattern over the life of the mine shall be provided.

2.5.3 Waste Rock Storage

Similarly to tailings, the method and infrastructure required to provide waste rock storage shall be outlined. There shall be an estimate of the rate of waste rock produced, its expected physical and chemical properties, method of disposal, and expected accumulation pattern.

2.5.4 Water Treatment

A description of all water treatment efforts shall be provided. This includes treatment of acid rock drainage and treatment of suspended solids. The methods used for water treatment shall be fully described and engineering drawings provided. The proponent shall discuss the reagents used, expected volumes, estimated water volume, estimated water quality before and after treatment, and the management of any byproducts (such as hydroxide sludge).

2.5.5 Solid Waste Disposal and Sewage

An estimate of the volume and type of solid waste and sewage generated from the site should be

outlined including a method for handling and storage of all such wastes.

2.5.6 Hazardous Products

An outline of expected chemical, petroleum and other hazardous products to be used and stored on site shall be provided and include physical and chemical properties and plans for safe storage and handling.

2.6 Environmental Monitoring

The proponent must submit a proposed plan for monitoring the environmental effects at key locations around the site. This will include surface water, effluents, groundwater, air quality, noise, seismic, and biological monitoring. Background monitoring stations should also be considered.

For metallic mines, the project must adhere to federal Metallic Mining Effluent Regulations and perform aquatic environmental effects monitoring. The proposed monitoring plan should be outlined in this section.

2.7 Physical Stability

Methods shall be provided to monitor and maintain the physical stability of the mine site before and during operations including site erosion and runoff controls, dusting, ground subsidence, slope stability, and stability of earthen structures such as tailings impoundments and rock piles.

2.8 Progressive Reclamation

A plan shall be provided to include progressive reclamation into the mine development process. Details of the type of reclamation, the objectives and a time line should be explained.

2.9 Emergency Preparedness Plan

An emergency preparedness plan must be presented and shall include the procedures to be followed in case of an environmental emergency. A list of contacts shall be provided.

2.10 Site Security and Safety

The proponent must propose the security and safety measures to be performed on the mine site for each stage of the mining.

2.11 Temporary Shutdown Procedure

The proponent shall produce a definitive plan to complete reclamation obligations during the event of a temporary and/or longer term mine closure. This will include definitive time lines for reclamation and monitoring.

3. Impacts

Potential impacts specific to the proposed mining project shall be defined in the following section along with suggested mitigation measures if the impact is negative.

3.1 Environmental

Provide a summary of all predicted negative impacts and methods to prevent, minimize or mitigate them.

3.2 Economy and Employment

An estimate of the economic impact should be briefly mentioned here including gross revenues, expected local expenditures, employment, salaries and potential contribution to taxes.

3.3 Transportation

Provide information regarding the existing transportation network, which modes of transportation will be used to support the project, and what the external impacts will be from increased traffic or changes in traffic patterns.

PART 3. RECLAMATION PLAN

1. Infrastructure Removal

1.1 Buildings and Equipment

Describe how all buildings will be demolished and disposed of including all ancillary equipment, permanent and mobile. Note any permanent structures such as foundations expected to be left intact and give reasons why they will not be removed.

1.2 Utilities

Describe how all electrical, pipeline, drainage channels, septic beds, landfills, water supplies, etc. will be demolished and disposed of, and if left intact, an explanation for doing so.

1.3 Transportation Access

Describe how all roads, railways and other accesses will be removed to limit site access and the reasons for leaving any such infrastructure in place.

2. Site Stabilization

2.1 Contouring and Grading

Describe all the areas on site that will be recontoured to achieve physical stabilization, to remove physical hazards, to achieve water management goals and to allow a growth medium for revegetation. This includes any excavations, waste rock piles, and foundations left in place.

2.2 Re-vegetation

Describe efforts toward establishing an effective ground cover for revegetation and any active vegetation efforts. Indicate species of vegetation to be used, the target areas, and the objectives of the work.

2.3 Crown Pillars

If crown pillars are expected to be an issue from underground mining then a plan should be presented to explain how the proponent would ensure long-term stability from crown pillar subsidence and collapse. Indicate what reclamation efforts will be required to secure crown pillars and what monitoring will be required.

2.4 Mine Openings

Describe how all pits, tunnels (adits), shafts, and other openings will be secured from being a public and/or environmental hazard and the reasons for the particular method.

2.5 Tailings Pond Stabilization

A concept is required to address how any tailings ponds and associated water and waste management structures will be reclaimed upon mine closure. This should include estimates of final waste volumes and the expected environmental condition and the stability of such structures.

3. Site Description at Closure

Present a conceptual description of the mine site after closure and how it may differ from the original geographic and environmental setting. Indicate potential land uses post mine closure. Describe any new facilities which are expected to be constructed after mine closure such as

water management structures, water treatment facilities, monitoring stations, etc.

4. Site Safety and Security

If necessary, describe measures that will be required to maintain site security and safety after mine closure.

5. Post-Reclamation Monitoring

Estimate and give a concept of what type of post-closure monitoring will be required to validate the success of the mine reclamation efforts and site stabilization. Indicate if water quality, aquatic surveys, vegetation surveys, or erosion/subsidence monitoring will be required and what the schedule and time line for this monitoring is expected to be.

6. Schedule of Work

Present a conceptual schedule of the reclamation work in terms of milestones or projects and clearly indicate a reasonable time line to complete such work.

7. Reclamation Cost Estimate

The proponent is required to submit a reasonable cost estimate to complete the reclamation plan in order to provide a basis for the financial security the Province requires in case the proponent is unable to meet its reclamation obligations. The company must state the form and amount of security for the project.

7.1 Capital Construction Costs

Prepare a reasonable cost estimate to complete the work as described in the reclamation plan. This will include a breakdown of all phases of the plan and consider capital costs, labour costs, and administrative costs.

7.2 Long-Term Maintenance, Monitoring and Water Treatment

If applicable, prepare a reasonable estimate of the expected annual costs to perform maintenance on remaining site infrastructure, perform monitoring and to perform water treatment. Include an estimate of the duration of post-closure presence on site.