



Mineral Prospecting and Exploration Guideline 2018

Department of Geology and Mines
Ministry of Economic Affairs
Royal Government of Bhutan

Acronyms

CoG	- Committee of Geologists
DGM	- Department of Geology and Mines
EC	- Environment Clearance
GIS	- Geographical Information System
GPS	- Global Positioning System
MEP	- Mineral Exploration Permit
MMMA	- Mines and Mineral Management Act 1995
MMMR	- Mines and Mineral Management Regulations 2002
MoEA	- Ministry of Economic Affairs
MoHCA	-Ministry of Home and Cultural Affairs
MoIC	- Ministry of Information and Communications
MPP	- Mineral Prospecting Permit
NLC	- National Land Commission
RGoB	- Royal Government of Bhutan
RS	- Remote Sensing
SRF	-State Reserve Forest
ToR	- Terms of Reference
WGS	- World Geodetic System

Definitions

1. **“Construction Materials”** shall mean sand, stone, gravel and low-grade minerals used for building and construction purposes.
2. **“Drilling”** means digging a hole using both handheld drilling tools and machines.
3. **“Core”** shall refer to drill core of rocks and minerals obtained using drilling tools and machine.
4. **“Environment”** means the physical factors of the surroundings of human beings including the earth, soil, water, atmosphere, climate, sound, odors, tastes and the biological factors of animals and plants of every description including the complex web of interrelationships between the abiotic and biotic components which sustain life on earth.
5. **“Geochemical”** shall refer to the chemical composition of the rocks, minerals, and soil.
6. **“Geological Mapping”** is a mapping process to produce a special-purpose map showing the distribution of geological features such as rock types, mineralization, faults, folds, foliations, lineation, joints, etc.
7. **“Geophysical”** shall refer to recording or mapping of physical properties of rocks and minerals through an application of physics.
8. **“Grid System”** is a simplified grid used for systematic planning of prospecting and exploration works.
9. **“Industrial Mineral”** means minerals that are used as raw materials in the mineral processing industries, which shall include minerals other than metallic minerals, gemstone, and fossil fuels.
10. **“Inspector”** means a person employed by the DGM to monitor all activities pertaining to mineral prospecting and exploration.

11. **“KML”** is an XML notation for expressing geographic annotation and visualization within Internet-based, two-dimensional maps and three-dimensional Earth browsers.
12. **“KMZ”** a file extension for a place-mark file used by Google Earth. It is a compressed version of a KML file.
13. **“Mineral”** means any substance occurring naturally in or on the earth and having definite chemical formula or rocks with economic importance formed by or subject to a geological process and which can be obtained from the earth by digging, drilling, dredging, quarrying, hydraulic king, sluicing or other mining methods.
14. **“Mineral Deposit”** is any occurrence of a valuable commodity or mineral that is of sufficient size and grade (concentration) that has potential for economic development under past, present, or future favorable conditions.
15. **“Mineral Exploration or Exploration”** refers to an exploration of geological resources such as minerals, rocks, fuels, gemstones, alluvial, glacial, colluvial and residual deposits for various uses in construction, industry, metal extraction, tourism, decoration, and energy. It is a process of determining the grade and reserve of identified potential geological resources for economic extraction.
16. **“Mineral Exploration Permit”** is a permit that provides right to explore or study the permitted mineral(s) within the permitted area to determine the grade and reserve of the permitted mineral(s) for economic extraction.
17. **“Mineral Occurrence”** is an indication of mineralization, that is worthy of further investigation.
18. **“Mineral Prospecting or Prospecting”** means the geological study of searching and locating prospective minerals, fossils, precious metals or mineral specimens with use of handheld tools only.

19. **“Mineral Prospecting Permit”** is a permit that provides right to search for the permitted mineral(s) within the permitted area using handheld tools to locate and determine the grade and reserve of the permitted mineral(s) for economic extraction.
20. **“Mineral Resources”** means a concentration or occurrence of mineral in or on the earth’s crust in such form, quality, and quantity that are reasonable prospects for eventual economic extraction.
21. **“Mineralogical Study”** is a scientific study of chemistry, crystal structure, and physical (including optical) properties of minerals and mineralized artifacts for identification purpose.
22. **“Non-Strategic minerals”** are those minerals not listed under strategic minerals.
23. **“Officer”** means an officer of the DGM authorized in writing by DGM to exercise powers conferred by the MMMA 1995, MMR (amended) 2002 and this Guideline.
24. **“Permit”** means an approval granted for prospecting and exploration issued under MMR (Amended) 2002 and this Guideline.
25. **“Permit Area”** shall mean the delineated or demarcated area by DGM, as reflected in the permit inside which prospecting or exploration activity shall be carried out.
26. **“Permit Holder”** shall refer to an individual or company, whose name is reflected in the permit and has the right to carry out prospecting or exploration.
27. **“Petrological Study”** is a scientific study of chemistry, crystal structure, and physical (including optical) properties of minerals for identification purpose.
28. **“Pitting”** is digging of shallow depth holes in the earth’s surface within permit area for determination of mineralization continuity, size and shape and sampling purpose.

29. **“Prefeasibility Study”** means the early stage analysis of mineral exploration conducted by a geologist or a certified firm employing the qualified professional as per the Guidelines.
30. **“Provision”** shall mean a condition or requirement in a legal document.
31. **“Qualified Person”** means any person who has a minimum qualification for a specified responsibility as defined in this guideline or who possess other documents issued or approved by the RGoB to carry out prospecting or exploration.
32. **“Reserve”** is that subgroup of a mineral resource that has been discovered, have a known size, and can be extracted at a profit at a given point of time.
33. **“Sampling”** is the process of taking a small portion of the target mineral such that the consistency of the part shall symbolize the whole entire property or only of the adjacent portion of the object under assessment.
34. **“Strategic Minerals”** means minerals that have wider implications on the economy in terms of having any one of the following characteristics:
 - i. being in short supply and essential for domestic industries
 - ii. Rare and high-value minerals and minerals with security implication.
35. **“Topographical Survey”** is defined as the study and mapping of the features on the surface of the land, including natural features such as mountains and rivers as well as constructed features such as highways and railroads.
36. **“Trenching”** is digging of shallow depth trenches on the earth surface within permit area for determination of mineralization continuity, size and shape and sampling purpose.

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INTRODUCTION

In terms of mineral resources, Bhutan Himalaya perhaps is an exception to other parts of Himalayas. The country is endowed with huge mineral resources of industrial minerals like dolomite, limestone, quartzite, gypsum, talc, marble, graphite and a fuel mineral coal. Most of these minerals are currently mined and form an important supply chain to the mineral-based industry in Bhutan that produces *calcium carbide, cement, ferrosilicon, chicken feeds and plaster of Paris (POP)*. Bhutan also has huge supply potential for construction materials.

The occurrence of significant metallic mineralization such as copper, lead-zinc, tungsten, gold and rare earth elements (REE) are also known in the country. Considering the rock types, their age and stratigraphy of Gondwana succession within Lesser Himalayan Section (LHS) in the south-east, Bhutan perhaps is also potential for hosting petroleum deposits. Further, geological mapping on a regional scale (1:50000) in the country is ongoing, and therefore the potential to unlock the hidden mineral treasures of the country is huge.

Since mineral resources and mining form backbone of socio-economic development of any country through industrialization; generation of revenue and employment; and providing construction materials for infrastructural development, the RGoB duly places and recognizes mining sector as one of the priority sectors and five jewels of Bhutan. Prospecting and Exploration of mineral resources form one of the key parameters for investment decision-making on mining. Thus, in exercise of the power conferred by Section 15 of the MMMA 1995 and in line with the Economic Development Policy 2016 and Mineral Development Policy 2017, the DGM under MoEA hereby approve and adopt this guideline hereafter known as “**Mineral Prospecting and Exploration Guideline 2018**”.

The guideline shall provide useful practical guidance on how mineral prospecting and exploration works be carried out in the Kingdom of Bhutan to meet the regulatory requirements and environmental standards under the MMMA 1995, MMR (amended) 2002 and other relevant legislation of the country. It is based on the principle that well-planned and managed prospecting or exploration projects should have little or no lasting impact on the social, economy and environment.

The guideline provides details on requirements, procedures, specifications, and standards for mineral prospecting and exploration projects in the Kingdom of Bhutan on : (1) Obtaining Mineral Prospecting Permit (MPP) and Mineral Exploration Permit (MEP); (2) Code of Practice on prospecting and two stages (general and detailed) of exploration; (3) Social and Environment Management of prospecting or exploration; (4) Inspection and Monitoring of prospecting or exploration projects; (5) Reporting Obligations of the Permit Holder; and (6) Other General Provisions related to best practices of prospecting and exploration.

Thus, **Mineral Prospecting and Exploration Guideline 2018** is developed and adopted: (1) to promote prospecting and exploration of mineral resources in the Kingdom of Bhutan; (2) to increase high-quality knowledgebase on geology and mineral resources; (3) to carry out prospecting and exploration with no or minimal adverse impacts on social, economy and environment; and (4) for optimal utilization of mineral resources of the country for sustained economic growth.

1 CHAPTER-I: MINERAL PROSPECTING AND EXPLORATION PERMITS

1.1 Issuing Authority for Permits

- i. DGM shall be the authority to issue the Prospecting and Exploration Permit including EC upon fulfilling requirements outlined in the MMR (amended) 2002 and this guideline.
- ii. DGM shall have the authority either on its own or authorize individual or company through permit issuance to carry out geo-scientific studies in any area of SRF land within the country under intimation to the NLC, MoAF and other concerned authorities.

1.2 Resources covered by the Permit

- i. The permit covers prospecting and exploration of only the mineral(s) of interest as mentioned in the application form [Form A (i) and Form A (ii) of Annex 1 of MMR (amended) 2002].
- ii. Any strategic mineral, fossil, and gemstone discovered must be reported to DGM within 30 days from the date of discovery using the Special Report Format mentioned under Chapter VI.

1.3 Permit Area

- i. The area to be prospected or explored shall be as per the Permit.
- ii. The area to be prospected or explored shall be as per the Permit. Prospecting and Exploration within private or corporate land shall be granted the permit only upon submitting the written consent from the landowner.
- iii. The area permitted for prospecting shall not exceed 10 km² and 3 km² for exploration.

- iv. Proposal for any change(s) in the demarcation of the permitted area must be submitted to DGM with reason(s).
- v. DGM shall vet the proposal and may grant approval for the change(s) proposed.
- vi. DGM shall facilitate in providing geological and mineral information on the regional scale (smaller than 1:50,000) such as Geological Map of Bhutan, Topo-Sheet wise Geological Mapping, Mineral Distribution Map of Bhutan, Published Geology and Mineral Report of Bhutan in PDF.
- vii. EC for Prospecting shall not be required.
- viii. EC for Exploration shall be issued by DGM as the designated Competent Authority by NEC.
- ix. Exploration work carried out by DGM shall require EC from NEC as per the Regulation for Environmental Clearance of Projects 2016.

1.4 Permit Validity, Surrender, and Renewal

- i. The permit is effective for the period of one year for Prospecting and two years for Exploration from date of issue.
- ii. The permit holder may surrender the permit at any time with notice in writing to DGM upon fulfilling all the environmental restoration as per the social and environmental management provisions outlined in this guideline.
- iii. No person shall be allowed to hold more than one permit at a time.
- iv. The permit may be renewed for another term based on feasibility and completion of more than half of the work in the earlier permit and submission of reports as per Chapter VI of this guideline, including expenditure report, to that effect. Please refer Table 3 under Chapter VI for more on renewal requirements.

1.5 Permit Fees

- i. The Permit Holder shall pay a fee as per the Schedule of Fees Annex 7 of MMMR (amended) 2002.

1.6 Activities of other parties in the Permit Area

- i. The Permit Holder shall respect all existing rights, and the permit does not entail restrictions of lawful activities carried out by other parties in the permit area.

1.7 Exploration Obligations

- i. The Permit Holder shall not be obliged for Corporate Social Responsibility (CSR) expenses.

1.8 Transfer of Permit

- i. The permit shall not be transferred or sublet to a third party.

1.9 Suspension, Revocation or Termination of the Permit

The permit may be suspended or revoked or terminated in the following circumstances:

- i. If the permit holder breaches the terms and conditions of the permit and EC or the provision(s) of MMMA and MMMR (amended) 2002.
- ii. If the permit holder submits false or misleading information to DGM.
- iii. If the permit holder goes into liquidation or is declared bankrupt, upon fulfillment of the required terms and conditions.
- iv. If the permit holder's activities endanger persons or third-party property or are liable to cause pollution or have a harmful effect on the environment exceeding what is acceptable in the opinion of DGM. In such case, DGM shall suspend the activities, wholly or partly, and order to rectify or mitigate within the determined time limit as the first option.

- v. Fails to provide proper field data, drill cores and other samples to officials of DGM during inspection and monitoring.
- vi. If the permit holder wishes to withdraw or discontinue the prospecting or exploration at any time during the permit term, the permit shall be cancelled after submission of application, in writing, upon fulfillment of the required terms and conditions.

1.10 Compensation in event of Surrender or Revocation

The compensation may apply for the following in line with MMMR (amended) 2002:

- i. Surrendering or revocation of the permit due to the discovery of strategic minerals, gemstones, and fossils, which may be determined as economically viable deposits.
- ii. Where the permit is revoked on the ground of national interest.

2 CHAPTER-II: APPLICATION PROCEDURES FOR PERMITS

To obtain a permit for prospecting or exploration, the following procedures and requirements shall be followed and fulfilled by the applicant:

2.1 Mineral Prospecting Permit (MPP)

2.1.1 Eligibility Criteria

The applicant shall:

- i. Be a Bhutanese national or firm possessing a valid business license.
- ii. Possess or hire a qualified person(s) with a minimum of Bachelors Degree in Geology and other relevant disciplines with at least five years of field experience.

2.1.2 Procedures for obtaining MPP

- i. The application shall be submitted in Form A(i) of Annex 1 of MMMR (amended) 2002 along with prescribed Schedule of Fees under Annex 7 of MMMR (amended) 2002 and documents to the Head of DGM.
- ii. The documents accompanying the application shall comprise of:
 - a. A written description of the area such as location, type of land, land use, accessibility, topography, vegetation, drainage, flora and fauna, the potential of mineral(s) of interest; purpose or objective of the proposal.
 - b. A map in the scale of 1:50000 or larger (KML or KMZ format) with clearly delineated proposed prospecting area boundaries.
 - c. A copy of Citizenship Identity Card in case of individuals and valid business license in case of a firm or company.
 - d. Proof of the qualified person(s) as per eligibility criteria as outlined in this guideline.

- e. A detailed program of work proposal containing work items or plan along with timeline; estimated amount to be expended, which may be supported by maps, figures etc.
 - f. Description of financial capability with evidence.
 - g. A valid Security Clearance in case of individuals and latest Tax Clearance in case of firm or company.
 - h. Copy of Revenue Receipt as paid under Schedule of Fees under Annex 7 of MMMR (amended) 2002.
 - i. Consent letter from the private or corporate landowner (if applicable).
- iii. CoG shall scrutinize the application and documents submitted in line with ToR of CoG.
- iv. DGM shall approve and issue MPP in Form D(i) of Annex 1 of MMMR (amended) 2002 based on the recommendation of CoG.
- v. MPP holder shall have the priority right to apply for MEP of the permissible mineral within the permit area. The right shall be exercised within one year from date of completion of prospecting and is subject to acceptance of Prospecting Report by DGM. Details on reporting for Prospecting is mentioned under Chapter VI of this guideline.

2.2 Mineral Exploration Permit (MEP)

2.2.1 Eligibility Criteria

The applicant shall:

- i. Be a Bhutanese national or firm possessing a valid business license.
- ii. Possess or hire a qualified person(s) with a minimum of Bachelors Degree in Geology and other relevant disciplines with at least five years of field experience

2.2.2 Procedure for obtaining MEP

- i. The application shall be submitted in Form A(ii) of Annex 1 of MMMR (amended) 2002 along with prescribed Schedule of Fees under Annex 7 of MMMR (amended) 2002 and documents to the Head of DGM.
- ii. The documents accompanying the application shall comprise of:
 - a. A written description of the area such as location, type of land, land use, cultural and heritage, accessibility, topography, vegetation, drainage, flora and fauna, the potential of mineral(s) of interest; settlements, demography, infrastructures, purpose or objective of the proposal, drilling plan and likely environmental impacts.
 - b. Mineral Prospecting Report fulfilling the requirements outlined in Chapter VI of this guideline.
 - c. Project proposal citing the reason(s) for exploration of the target mineral(s) with a detailed program of work proposal containing work items or plan along with timeline; estimated amount to be expended, which may be supported by maps, figures etc.
 - d. A map in the scale of 1:25000 or larger with clearly delineated proposed exploration area boundaries and geo-coordinates.
 - e. A copy of Citizenship Identity Card in case of individuals and a valid business license in case of firm or company.
 - f. Proof of the qualified person(s) as per eligibility criteria of this guideline.
 - g. Curriculum Vitae (CV) of the certified professionals to be engaged in the exploration activity.
 - h. A valid Security Clearance in case of individuals and latest Tax Clearance in case of a firm or company.

- i. Description of financial capability with evidence.
 - j. Copy of Revenue Receipt paid under Schedule of Fees of Annex 7 of MMMR (amended) 2002.
 - k. Consent letter from the private or corporate landowner (if applicable)
- iii. CoG shall scrutinize the application and documents submitted in line with ToR of CoG.
- iv. DGM shall approve and issue MEP in Form D(ii) of Annex 1 of MMMR (amended) 2002 based on the recommendation of CoG.
- v. MEP holder shall have the priority right to apply for mining of the permissible mineral explored. The right shall be exercised within five years from the date of completion of exploration and is subject to acceptance of Exploration Report(s) by DGM. Details on reporting for Exploration is mentioned under Chapter VI of this guideline.

3 CHAPTER-III: CODE OF PRACTICE

This Chapter shall provide the procedures, standards or specifications, requirements to be fulfilled pre-, during, and post-fieldwork for Prospecting or Exploration is carried out.

3.1 General Code of Practice

The MPP or MEP holder shall carry out the Prospecting or Exploration works by ensuring the following:

- i. Abiding by the Terms and Conditions of the Permit.
- ii. Inform in writing the concerned Local Government before the commencement of the Prospecting or Exploration works.
- iii. Abiding by the methods, specifications, and standards mentioned under this guideline.
- iv. Without disturbing or damaging cultural and heritage sites, properties of government, private and corporate, with exception to possession of prior approval or permission.
- v. Carried out with minimal interference to locals, other lawful activities and not expose a person or third-party property to danger.
- vi. Ship samples to other countries for analysis with prior approval from DGM.
- vii. The permit holder shall keep all data, drill cores and other samples for at least one year after the expiry of the permit. If the permit holder after this period should decide to discard the original field data, DGM shall be offered the data free of charge before the destruction of data.
- viii. Adequate first aid kits with proper signs are maintained.
- ix. Use of safety gears such as safety boots, helmets, goggles, hand gloves etc.
- x. Construction of approach path or roads with minimum width and slope disturbances.

Mineral Prospecting Code of Practice

3.2 Prospecting

Prospecting is the systematic process of searching for a mineral deposit by narrowing down areas of promising enhanced mineral potential. The objective is to identify a deposit which will be the target for further exploration. Reserves estimated for the deposits are with a low level of confidence. Estimates of quantities are inferred, based on interpretation of geological, geophysical and geochemical results.

3.2.1 Geological mapping

- i. Geological mapping on 1:25000 or larger scale using Toposheet of NLC or Digital Elevation Model (DEM) and geological tools.
- ii. Location of data must be collected using handheld GPS with coordinates in decimal degree and WGS 1984 datum.
- iii. Quantity and quality data must be collected and maintained based on a scale of mapping.
- iv. Use of airborne or Unmanned Aerial Vehicle (UAV) for geophysical exploration shall require approval from MoIC.
- v. Use of explosives for geophysical exploration shall require approval from MoHCA.

3.2.2 Sampling

- i. Sampling method recommended for Prospecting is Grab or Chip and Soil Sampling.
- ii. The samples collected shall be used only for analysis purpose.
- iii. Samples must be collected:
 - a. using handheld tools only;

- b. with wide spacing ranging from 50 to 100 meters;
- c. Samples collected must be representative of the area of interest;
- d. free of weathering and contamination;
- e. recorded with geo coordinates using WGS 1984 datum;
- f. packed properly with proper labeling;
- g. appropriate size weighing 1-2 kg for petrological or mineralogical studies, and geochemical tests for non-metallic minerals and 3-5 kg for metallic minerals and geotechnical tests;
- h. the total allowable weight of samples collected shall be determined by DGM based on the type of mineral and purpose of analysis.

3.2.3 Pitting and Trenching

The pitting and trenching for sampling and determination of extent, size and shape of mineral of interest shall be carried out fulfilling the following:

Pitting

- i. Limited pitting may be carried out, where the numbers and spacing may differ from area to area depending on the nature of the area and mineral occurrence or deposit. Spacing may range from 50- 100m.
- ii. Carried out by excavating about 1 X 1 m² or 1 m radius pits using handheld tools only.
- iii. The depth of the pits varies depending on the extent of weathering and location of mineral of interest.
- iv. The representative material recovered from each meter of the pit is stacked separately to collect samples for analysis to determine the variations across the mineralization.
- v. Rest of the materials excavated from each pit must be stacked properly in the adjacent sides with proper drainage for backfilling purpose.

Trenching

- i. Limited trenching may be carried out by excavating appropriate dimensions using handheld tools only.
- ii. The numbers and spacing may differ from area to area depending on the nature of the area and mineral occurrence or deposit. Spacing may range from 50- 100m.
- iii. The representative material recovered from each meter of the trench is stacked separately to collect samples for analysis to determine the variations across the mineralization.
- iv. Rest of the materials excavated from each trench must be stacked properly in the adjacent sides with proper drainage for backfilling purpose.

3.2.4 Drilling

- i. Limited or few, wide spaced (200 - 2000 m) drilling using handheld drilling tools may be used. The number and spacing of drilling will depend on type, and nature of the area and mineral deposit.
- ii. All drill hole locations must be indicated on a map of 1:25000 or larger scale with proper geo-coordinates.

3.2.5 Petrological and Mineralogical Studies, Sample Analysis

- i. The sample prepared for thin Section analysis must be standard.
- ii. Thin Section analysis may be carried using appropriate equipment such as Petrological Microscope, Scanning Electron Microscopy (SEM), Wavelength Dispersive Spectroscopy (WDS), depending on the type of mineral and purpose of the study.
- iii. Samples collected must be tested or analyzed in standard licensed or certified laboratory.

- iv. The parameters, radicals, or elements to be determined will depend on the type of mineral and purpose. For example, samples are tested in the chemical laboratory for mineral and in the geotechnical laboratory for construction materials.
- v. Analytical methods used must be documented properly and justified.
- vi. All samples analyzed must be Quality Controlled or satisfy Quality Assurance.
- vii. Targeting or prediction approach using the spatial analysis and other standard software may be used.
- viii. If samples are to be tested in Chemical Laboratory of DGM, samples must be submitted along with completed “Sample Analysis Request Form” enclosed as Annex-II under this guideline.

3.2.6 Reserve Estimation

The term “reserve” used in this guideline is equivalent to term “resource” in the United Nations Framework Classification (UNFC) for Energy and Mineral Resources. The usage of reserve category “Inferred” is United States Geological Survey (USGS) Classification System and reserve category “Possible” is Indian Classification System. This guideline shall follow Indian Classification System of Reserve.

- i. Reserve must be estimated using an appropriate method depending on type and nature of topography and mineral deposits. Recommended methods are provided in Table 1.
- ii. Reserve estimated must be at least in “Possible” Classification.
- iii. The error of the estimated reserve shall not exceed 50%.
- iv. The reserve estimated is based on limited geological, geochemical and/or geophysical information.
- v. The level of geological confidence on reserve is low.

Table 1. Conventional Methods of Reserve Estimation

Sl. No.	Geological Condition	Reserve Estimation Method
1	Moderately to Steeply dipping ore/mineral deposits	-Cross Section method -Longitudinal Section method -Level plan method
2	Horizontal to low dipping ore/mineral deposits	-Polygon method (triangular, square and rectangle) -Method of isograd/isopach

3.3 Preliminary Socio-Economic and Environment Assessment

The MPP holder may undertake Preliminary Socio-Economic and Environment Assessment using the information generated from the Prospecting stage before undertaking General Exploration.

Mineral Exploration Code of Practice

3.4 General Exploration

Based on the findings and recommendations of Prospecting and/or Preliminary Socio-Economic and Environment Assessment, General Exploration may be undertaken. General Exploration shall involve the initial delineation of an identified deposit. The objective is to establish the main geological features of a deposit, giving a reasonable indication of continuity and providing an initial estimate of size, shape, structure, and grade. The degree of accuracy should be sufficient for deciding whether a Detailed Exploration is warranted. Quantities estimated for the deposits are with a moderate (medium) level of confidence. Estimates of quantities are indicated, based on interpretation of geological, geophysical and geochemical results.

3.4.1 Topographical Surveying

Topographical surveying will form a key part of mineral exploration processes in terms of generating base information. Therefore, for obtaining reliable data and information, the following procedures shall be followed:

- i. Before taking over the task of topographical survey, proper desktop study and check for the existing data shall be carried out to avoid redundancy and for data consistency.
- ii. The topographical survey shall be carried out using appropriate technology and Instrument, serving accurate base map and data for geological maps, cross Sections. Modern technology or equipment such as Electronic Total Station, LiDAR, Drone, Global Navigation Satellite System (GNSS), RS are recommended.
- iii. In this stage of exploration, the topographical survey must be carried out on the scale of 1: 5000 to 10000 using Electronic Total Station or any other instrument that give moderately precise (x,y,z) of the locations.
- iv. The contour interval must range between 5 -10m.
- v. The topographical survey or any kind of data collection must be carried out using National Coordinate reference system (DRUKREF-03), selecting the correct projection system, and datum for the area.
- vi. In the process of map production and construction of cross Sections, state of art technology in data input, spatial database management, GIS, and relevant software shall be used. However, for digital data processing techniques, CAD-CAM software can be used for data input and processing.
- vii. The GIS layers should contain required attribute information with proper field names and standards.
- viii. The final maps should contain, inset of location Map, scale, orientation, with all map elements in proper standardized symbols, line works, and lettering in a legible size.

ix. Base Map/Fundamental Datasets may include but not limited to have the following layers/features:

- Contour
- Drainage
- Infrastructures
- Land Use

3.4.2 Geological Mapping

- i. Geological mapping on 1:10000 or larger scale using topographic survey data and geological tools.
- ii. Other requirements and standards shall be as per the provisions under Section 3.2.1 of Chapter-III.

3.4.3 Sampling

- i. Sampling methods recommended are Groove or Channel, Core sampling, and Soil Sampling.
- ii. Other requirements and standards of the samples collected shall be as per provisions under Section 3.2.2 of Chapter-III, except that sample spacing may range from 25 to 50 meters, drilling may be used for sample collection and the location recorded using Total Station.

3.4.4 Pitting and Trenching

Pitting

- i. Pitting may be carried out, where the numbers and spacing may differ from area to area depending on the nature of the area and mineral occurrence or deposit. Spacing may range from 25-50m.
- ii. The pitting shall be carried out in a systematic manner in grids system.

- iii. Other requirements and standards shall be as per provisions under Section 3.2.3 of Chapter-III.

Trenching

- i. Systematic trenching may be carried out by excavating appropriate dimensions.
- ii. The numbers and spacing may differ from area to area depending on the nature of the area and mineral occurrence or deposit. Spacing may range from 25 - 50m.
- iii. Other requirements and standards shall be as per provisions under Section 3.2.3 of Chapter-III.

3.4.5 Drilling

- i. Diamond drilling or other drilling methods may be used.
- ii. Grid or other appropriate plans must be used.
- iii. Boreholes must be moderately spaced (400 - 1000 m).
- iv. The number of drilling will depend on type, and nature of the area and mineral deposit.
- v. All borehole locations must be indicated on a map of 1:10000 or larger scale with proper geo-coordinates.
- vi. The width of the approach track must be not more than 2m.
- vii. Approach road, if deemed necessary, must be cleared by the concerned authority.
- viii. Quality Control or Assurance of drilling operations and cores must be maintained.
- ix. Systematic drill logs must be maintained by the concerned drilling professional and systematic core logs must be maintained by the geologist.

3.4.6 Petrological and Mineralogical Studies, Sample Analysis

- i. All the standards for petrological and mineralogical studies and sample analysis must be as per provisions under Section 3.2.5 of Chapter-III.

3.4.7 Reserve Estimation

- i. Reserve must be estimated using an appropriate method, which will depend on type and nature of topography and mineral deposits. Recommended methods are provided in Table 1.
- ii. Reserve estimated must be at least in “Probable” Classification.
- iii. The error of the estimated reserve shall not exceed 30%.
- iv. The reserve estimated is based on moderate geological, geochemical and/or geophysical information.
- v. The level of geological confidence on reserve is moderate.

3.5 Detailed Exploration

Detailed Exploration involves the detailed three-dimensional delineation of a known deposit size, shape, structure, grade, and other characteristics of the deposit are established with a high degree of accuracy. A decision whether to conduct a Feasibility Study can be made from the information provided by Detailed Exploration. Quantities estimated for the deposits are with a high level of confidence. Estimates of quantities are measured, based on interpretation of geological, geophysical and geochemical results.

3.5.1 Topographical Surveying

- i. In this stage of exploration, the topographical survey must be carried out on the scale of 1: 500 to 2000 using Electronic Total Station or any other instrument that give moderately precise (x,y,z) of the locations.

- ii. The contour interval must range between 0.5 -2m.
- iii. Other requirements and standards shall be as per provisions under Section 3.4.1 of Chapter-III.

3.5.2 Geological Mapping

- i. Geological mapping on 1:2000 or larger scale using topographic survey data and geological tools.
- ii. Other requirements and standards shall be as per the provisions under Section 3.2.1 of Chapter-III.

3.5.3 Sampling

- i. Sampling methods recommended are Groove or Channel, Core sampling, and Soil Sampling.
- ii. Other requirements and standards of the samples collected shall be as per provisions under Section 3.2.2 of Chapter-III, except that sample spacing may range from 5 to 50 meters, drilling may be used for sample collection, and the location recorded using Total Station.

3.5.4 Pitting and Trenching

Pitting

- i. Pitting may be carried out, where the numbers and spacing may differ from area to area depending on the nature of the area and mineral occurrence or deposit. Spacing may range from 5-50m.
- ii. The pitting shall be carried out in a systematic manner in grids system.
- iii. Other requirements and standards shall be as per provisions under Section 3.2.3 of Chapter-III.

Trenching

- i. Systematic trenching may be carried out by excavating appropriate dimensions.
- ii. The numbers and spacing may differ from area to area depending on the nature of the area and mineral occurrence or deposit. Spacing may range from 5 - 50m.
- iii. Other requirements and standards shall be as per provisions under Section 3.2.3 of Chapter-III.

3.5.5 Drilling

- i. Diamond drilling or other drilling methods may be used.
- ii. Boreholes must be closely spaced (less than 400m).
- iii. All borehole locations must be indicated on a map of 1:2000 or larger scale with proper geocoordinates.
- iv. Other requirements and standards shall be as per provisions under Section 3.4.5 of Chapter-III.

3.5.6 Petrological and Mineralogical Studies, Sample Analysis

- i. All the standards for petrological and mineralogical studies and sample analysis must be as per provisions under Section 3.2.5 of Chapter-III.

3.5.7 Reserve Estimation

- i. Reserve must be estimated using an appropriate method, which will depend on type and nature of topography and mineral deposits. Reserve estimation based on 3-D modeling and geo-statistical technique using standards software is highly recommended.
- ii. Reserve estimated must be at least in “Proven” Classification.

- iii. The error of the estimated reserve shall not exceed 20%.
- iv. The reserve estimated is based on detailed geological, geochemical and/or geophysical information.
- v. The level of geological confidence on reserve is high.

4 CHAPTER-IV: SOCIAL AND ENVIRONMENT MANAGEMENT

It is essential that the prospecting and exploration activities be carried out in social and environmentally-friendly manner. Therefore, to achieve prospecting and exploration with minimal social and environmental impact, the following requirements and standards provided in Table 2 shall be followed (where relevant). Apart from the standards mentioned in Table 2, the prospecting or exploration activities must comply with other relevant existing legislation of the Kingdom of Bhutan.

Table 2. Social and environmental management in prospecting and exploration projects.

TYPE	ACTIVITIES	POTENTIAL IMPACT	PRECAUTIONARY MEASURES	MITIGATION MEASURES
LAND USE	<ol style="list-style-type: none"> 1. Camping, surveying, mapping. 2. Drilling activities 3. Pitting and trenching. 4. Construction of approach tracks and roads. 	<p>Damages to land, clearing of vegetation and waste management.</p>	<ol style="list-style-type: none"> 1. Minimal clearing of vegetation 2. Selecting ideal camping location (appropriate distance from villages, safe and stable) 3. Drilling, pitting and trenching, construction of tracks carried out within standards of this guideline. 4. Proper segregation and disposal of waste. 5. Prevent the spread of forest fires 	<ol style="list-style-type: none"> 1. Re-plantation 2. Landscaping if necessary 3. Proper backfilling and sealing of any dug land, holes, pits and trenches. 4. Proper management of drainage. 5. Implementation of terms and conditions of clearance for approach road construction. 6. Disposal of waste in a safe or designated landfill. 7. Camp and field site with fire extinguishers is recommended. 8. Proper closure and any rectification to be ensured.
WATER	<ol style="list-style-type: none"> 1. Camping, surveying, mapping. 2. Drilling 	<p>Water pollution and water shortages to community</p>	<ol style="list-style-type: none"> 1. Minimal spillage of fuels and lubricants used for drilling. 2. Regular inspection of leakages of the fuels and lubricants containers and machines. 	<ol style="list-style-type: none"> 1. Cleaning of any spillage of fuels and lubricants from drilling. 2. Rectification of any leakages of fuels and lubricant containers and machines.

	<p>activities</p> <ol style="list-style-type: none"> 3. Pitting and trenching. 4. Construction of approach tracks and roads. 		<ol style="list-style-type: none"> 3. Proper location of drilling pump from the water source. 4. Responsible sharing of water with the local community. 5. Proper maintenance of sanitation and drinking water in the camp and field sites. 6. Responsible use of water and rivers. E.g. Washing clothes and swimming. 	<ol style="list-style-type: none"> 3. Rectification of any damages caused to community water source. 4. Proper dismantling and sealing of toilets and degradable waste pits, which shall not result in any fouling up of the surroundings or pollution of lakes or streams.
WILDLIFE	<ol style="list-style-type: none"> 1. Camping, surveying, mapping. 2. Drilling activities 3. Pitting and trenching. 4. Construction of approach tracks and roads. 	<p>Loss of wildlife and habitat</p>	<ol style="list-style-type: none"> 1. No encroachment of established habitat and corridor. 2. Proper advocacy must be provided to the prospecting/exploration team. 3. No poaching or hunting of wild animals. 4. No fishing. 5. No scaring, harassing, attracting or chasing of wild animals. 6. Picking up the remains (part or whole) of the wild animal is prohibited 	<ol style="list-style-type: none"> 1. Proper backfilling of all excavations resulted from prospecting/exploration activities. 2. Re-plantation or restoring of habitat.

<p style="text-align: center;">SOCIAL AND ECONOMIC</p>	<ol style="list-style-type: none"> 1. Camping, surveying, mapping. 2. Drilling activities 3. Pitting and trenching. 4. Construction of approach tracks and roads. 	<p>Impact on social and economy</p>	<ol style="list-style-type: none"> 1. Harmony with the community must be maintained. 2. No or minimal damages to the infrastructures, cultural and heritage, and properties. 	<ol style="list-style-type: none"> 1. Rectification of any damages to the infrastructures, cultural and heritage, and properties must be carried out on a common understanding of all parties involved. 2. Any pending social issues must be resolved before leaving the camp.
<p style="text-align: center;">OTHERS</p>	<ol style="list-style-type: none"> 1. Blasting 2. aerial survey 3. Camping, surveying, mapping. 4. Drilling activities 5. Pitting and trenching. 6. Construction of approach tracks and roads. 	<p>Noise and dust pollution; vibration</p>	<ol style="list-style-type: none"> 1. Prior notice must be served to the local government authority. 2. Ensure that the activities be carried out between 6 AM and 10 PM if near settlements. 	<ol style="list-style-type: none"> 1. Any damages resulted from blasting, drilling and aerial survey must be rectified properly. 2. Suppress the dust using appropriate measures 3. Use appropriate protective gears

5 CHAPTER-V: INSPECTION AND COMPLIANCE MONITORING

Field inspections of prospecting and exploration activities shall be carried out by DGM to monitor the progress and compliance by the MPP or MEP holder.

The following shall be the procedures and standards for inspection and monitoring:

- i. DGM shall appoint an officer (s) or inspector(s) to inspect and monitor all the prospecting and exploration activities.
- ii. The officer or inspector(s) shall be provided with proper identification, which must be shown during the inspection.
- iii. The officer or inspector(s) shall have full access to the permit area at any time for inspection and monitoring
- iv. The officer or inspector(s) shall inspect and monitor the activities in line with the provisions of MMMA 1995, MMR(amended) 2002, this guideline and other relevant laws of the Kingdom of Bhutan.
- v. The Permit Holder must cooperate with the officer or inspector(s) at all times when they are on inspection.
- vi. The officer or inspector(s) may take samples of minerals for verification and validation purposes.
- vii. The officer or inspector(s) may issue order or levy fines and penalties to the permit holder for any non-compliance or infringement of terms and conditions of the permit, MMMA 1995, and MMR (amended) 2002.
- viii. The Officer(s) or Inspector(s) shall submit a report to the Head Office after completion of the inspection and compliance monitoring of such activities.

6 CHAPTER-VI: REPORTING OBLIGATIONS

This Chapter provides detailed procedures, requirements, specifications, standards, and formats on reporting obligations on Prospecting and Exploration including report category, the requirement on report submission, renewal terms and conditions, the format and requirements on the report, map, and cross-Section.

6.1 Report Category

The main report category shall be **Prospecting Report** and **Exploration Report**. Other subsidiary reports shall include **Special Report** and **Expenditure Report**.

6.2 Reporting Requirement and Renewal Term and Conditions

The reporting requirement and renewal term and condition for different category of reports are provided in Table 3.

Table 3. Reporting requirement and renewal term and conditions for different category of reports.

Category of Report	Report Submission Requirements		Renewal Term	Renewal Conditions
	Year 1	Year 2		
<i>Prospecting Report</i>	Final Report submitted at the end of Year 1 within 3 months from the date of expiry of permit (if renewal is not required).	Approval for renewal required	Maximum up to 1 year	Interim report and annual expenditure submitted and accepted by DGM
<i>Exploration Report</i>	Interim Report submitted at the end of Year 1 within 6 months from the date of completion of Year 1 exploration.	Final Report submitted at the end of Year 2 within 6 months from the date of expiry of permit (if renewal is not required).	Maximum up to 2 years	Interim report and annual expenditure submitted and accepted by DGM
<i>Special Report</i>	A brief report on strategic minerals, gemstones, and fossils submitted within 1 month from the date of discovery			

6.3 Report Standards or Format

6.3.1 Prospecting and Exploration Report

Prospecting or Exploration Reports must be submitted to DGM in following standards or format:

- a. Font size 14-16 for headings, 12 for others.
- b. Font style must be “Times New Roman”.
- c. Paper size must be A4 for text and appropriate size (not less than A3) for maps and cross-sections.
- d. PDF form and one hard copies.
- e. Units used must be in the SI unit system.
- f. All pictures and photographs must be in colour form with proper annotations.
- g. Proper captions for tables, figures, annexures, appendices etc.
- h. All the maps, cross-sections, annexure, and appendix and other supporting documents must be enclosed with reports in proper sequence.

The following layout or outline shall be followed for Prospecting and Exploration Reports:

Cover page

The title, author, submission date (d/m/y), representative photo, company or firm logo (if relevant), permit number.

Abstract or Executive Summary

A brief description of background, purpose and objectives, study area, methodology, results, conclusion, and recommendations not more than 350-700 words.

Table of Content

With proper categorization of headings and page number, list of figures, tables, pictures, plates, and annexure etc.

1. Introduction

Should include: (1) Concise and appropriate background discussion of the problem and the significance, scope, and limits of your work; (2) clear aims, objectives or purpose of the study; (3) Detailed description on study area including locations, accessibility, topography, drainage, climate, flora and fauna; and (4) Outline what has been done before by citing truly pertinent literature, but do not include a general survey of semi-relevant literature.

2. Regional Geological Setting

A brief description of regional geology using existing information

3. Materials and Methods or Technique Applied

The Materials and Methods Section should succinctly describe what was done. It should include a description of the techniques used including the scale of mapping, sampling methods, analytical techniques with detection limits and name of the laboratory, geophysical methods, statistical procedures, drilling methods, surveying methods, data analysis, software used, etc. so someone could figure out how to replicate your work.

4. Results

- a. In this Section, present your findings with respect to methods or techniques used. The findings may include but not limited to: (1) Geology and Structures; Petrological Mineralogical Studies; Laboratory results; and Geological Reserve.
- b. Present the data, digested and condensed, with important trends extracted and described. Because the results comprise the new knowledge that you are contributing to the world, it is important that your findings be clearly and simply stated. Summarize the data collected and their statistical treatment. Include only relevant data but give sufficient detail to justify your conclusions. Use equations, figures or pictures, tables and maps where necessary for clarity and brevity.

- c. Maps, Cross-Sections, Models, Core and Sample Logs etc. must be attached with the report at the end as Plates or Annexures and properly numbered. Use of these data and information in the report must be properly cited. For layout and content requirements on maps, please refer Annex-IA and IB of this guideline.
- d. Any other raw data such as laboratory results must be attached at the end as Appendix and properly numbered.

5. Discussions

- a. The purpose of the discussion is to interpret and compare the results. Be objective; point out the features and limitations of the work. Relate your results to current knowledge in the field and to your original purpose in undertaking the project: Have you resolved the problem? What exactly have you contributed? Briefly state the logical implications of your results. Suggest further study or applications if warranted. Present your results and discussion either as two separate Sections or as one combined Section if it is more logical to do so.
- b. In the context of prospecting and exploration, discussions should help in decision-making process in terms of taking up the study further or not.

6. Conclusions and Recommendations

- a. Include summarized key findings or results.
- b. Key findings should be based on the evidence presented in the report.
- c. Include key recommendations based on conclusion and evidences presented in the report.

Acknowledgement

A brief acknowledgement to individual and/or organization.

References

- a. The purpose of the reference is to increase the credibility of the report and to help readers find the literature easily.
- b. The references must be in Standard Referencing System (e.g. Harvard, Chicago, APA etc.).
- c. The reference list must be arranged in alphabetical order using the surname of the main author.
- d. In-text citation for all the references listed under this Section must be provided in the report.

6.3.2 Special Report

This report shall be for reporting on the discovery of any strategic mineral including gemstone and fossils. The report shall constitute but not limited to: (1) brief description on location (with highest possible accurate location coordinates); (2) geology and mineralization; and (3) recommendations; the report shall not be more than two pages.

6.3.3 Expenditure Report

The report shall provide information on minimum annual expenditure made for Prospecting or Exploration work in the simplest format.

6.4 Other provisions

- i. DGM may request additional information on the received reports and the work accomplished.
- ii. The geological reports must be submitted within the timeline mentioned in Table 3. A time extension may be granted based on acceptable reasons.
- iii. The survey or field raw data must be submitted to the Survey and GIS Section, Geological Survey Division of DGM for archival in the system maintained by DGM.

- iv. All the digital data of GIS (in shapefile) and images (in JPEG or TIFF, GeoTIFF or PNG) shall be submitted to Survey and GIS Section, Geological Survey Division of DGM.
- v. The confidentiality of the reports and data submitted shall be maintained by DGM until an appropriate time for disclosure or sharing is determined.
- vi. Confidential material may be disclosed or shared with the Permit Holder's written consent. The Permit Holder shall not without good reason withhold such consent.
- vii. DGM may, without restrictions or conditions, make use (including publication) of reports or data that in the opinion of DGM is of public or national interest.

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The permit and the standard terms are in English and translations of these have no legal validity.



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<Sub-title: name of location, administration, geog,Dzongkhag>

<Map Scale, Representative Factor(RF)>

90°30'30"E

90°36'0"E

90°41'30"E

90°47'0"E

27°45'0"N

27°45'0"N

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27°40'0"N

27°35'0"N

27°35'0"N

27°30'0"N

27°30'0"N

Body of Map

Note:

Font and Symbols Size Guidelines

<https://www.esri.com/arcgis-blog/products/product/mapping/guidelines-for-minimum-size-for-text-and-symbols-on-maps/>

Dimensions of A3-A1 size paper

90°30'30"E

90°36'0"E

90°41'30"E

90°47'0"E


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<Name and Signature of Approving Authority>

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**Department of Geology and Mines
Chemical Laboratory Section**

Ref. No:

Date:

Sample Analysis Request Form

Sample Information	
Sample Name:	
Number of Sample(s):	
Sample ID:	
Location:	
Dzongkhag:	
Radicals to be analyzed:	
Purpose of Analysis:	
Analysis requested by:	DGM/MoEA <input type="checkbox"/> Private <input type="checkbox"/>
Intender/Client Information	
Name:	
Address:	
Contact No:	
Email ID:	

Signature of Intender/Client

Approved By:

Seal and Signature

Mineral Prospecting and Exploration Guideline 2018

Contact details:

Department of Geology and Mines
Ministry of Economic Affairs
P.O. Box No. 173
Thimphu: Bhutan

Phone: 00975-2-323096