Understanding Mining Feasibility Studies

The Commonwealth

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The Commonwealth Model Mining Feasibility Study Guidelines

The Commonwealth Model Mining Feasibility Study Guidelines support governments to operationalise their regulatory mandates, bridge gaps in current practice and align their mining sectors with modern expectations of sustainability, community benefit and investor confidence. Drawing on international best practice while remaining adaptable to local contexts, they provide a practical framework to:

- set minimum requirements for the content and quality of feasibility studies
- strengthen regulatory oversight
- embed sustainability principles
- build trust among stakeholders.

This paper is designed to supplement those Model Guidelines. Both documents can be downloaded from thecommonwealth.org/publications/model-mining-feasibility-study-guidelines

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Glossary

Competent or qualified person	A qualified person (QP) or competent person (CP) is a professional with expertise, experience and legal authority to prepare or approve technical reports on mineral resources, reserves and feasibility studies, particularly for public disclosure or regulatory compliance.
Environmental and social impact assessment (ESIA)	This is a process of identifying, predicting, evaluating and mitigating the potential environmental and social impacts of a proposed project, including alternatives and stakeholder engagement, to inform decision-making and promote sustainable development. It ensures that environmental protection, human rights and community well-being are systematically integrated into project planning, especially for large infrastructure and extractive projects inclusive of mining projects.
Feasibility study	In mining projects, a feasibility study is an in-depth analysis used to assess the viability of a proposed mining project. It evaluates whether the project is technically, economically, legally and environmentally feasible before significant investment is made.
Indicated resources	This refers to a category of mineral resources that is estimated with a moderate level of geological confidence. It is based on detailed and reliable exploration data and allows for the assumption of continuity in both geology and grade.
Inferred resources	This is the lowest confidence category of a mineral resource estimated based on limited geological evidence and sampling. It provides a reasonable indication of mineralisation but cannot be used for mine planning or reserve estimation due to its uncertainty.
Pre-feasibility study (PFS)	In mining projects, this is an early-stage analysis conducted to determine whether a mining project is technically and economically viable before committing to a more detailed and expensive feasibility study.
Probable reserves	These are the economically mineable part of an indicated resource and in some cases, will comprise the measured mineral resource, demonstrated through a pre-feasibility or feasibility study, and based on applying modifying factors such as mining, processing, environmental, legal and economic considerations.
Proven reserves	This is the highest-confidence category of economically mineable mineral reserves, derived from the measured mineral resources and supported by a feasibility study. They incorporate detailed engineering, economic, environmental, legal and operational assessments.

Acronyms and Abbreviations

CAPEX	capital expenditure
CCMA	Commonwealth Critical Minerals Alliance
CRIRSCO	Committee for Mineral Reserves International Reporting Standards
DFI	development finance institution
EIA	environmental impact assessment
ESG	environmental, social and governance
ESIA	environmental and social impact assessment
FPIC	free, prior informed consent
FS	feasibility study
GHG	greenhouse gas
HRDD	human rights due diligence
IFC	International Finance Corporation
IPO	initial public offering
IRR	internal rate of return
JORC	Joint Ore Reserves Committee (Australia)
NGO	non-government organisation
NPV	net present value
OPEX	operating expenditure
OECD	Organisation for Economic Co-operation and Development
PERC	Pan-European Reserves and Resources Reporting Committee
PFS	pre-feasibility study
QA/QC	quality assurance/quality control
QP	qualified person
SAMREC	South African Mineral Resource Committee
SDGs	Sustainable Development Goals

Background

The Commonwealth Secretariat is an inter-governmental organisation that supports its 56 member countries in development, democracy and peace. For over 55 years, member countries have requested and received independent expert advice on the effective management of natural resources for the benefit of present and future generations.

Within this mandate, the Secretariat's Energy and Natural Resources (ENR) Advisory Section delivers demand-driven technical assistance to member countries to maximise socio-economic benefits and effectively manage risks associated with energy and natural resource development. This support includes assistance on policy development, fiscal, legal and regulatory frameworks, and capacity building initiatives. In recent years, a growing share of this support has focused on minerals that are increasingly central to the global energy transition and digital transformation.

This growing focus reflects wider structural changes in the global economy. The global transition to a low-carbon economy and the rapid advancement of digital economies are driving an unprecedented demand for key minerals. These 'critical minerals' (for example, copper, lithium and rare earth elements) are essential for manufacturing renewable energy technologies, such as solar panels, wind turbines and batteries. Many Commonwealth member countries possess vast reserves of these minerals, presenting significant opportunities for trade, investment and industrial development. The surge in demand for these minerals could be a once in a lifetime opportunity to catalyse socio-economic development in many Commonwealth countries.

The increasing demand for critical minerals, however, also brings increased scrutiny to the overall governance, and environmental and social impacts, of mining practices. While the mining industry has great potential to positively impact the Sustainable Development Goals (SDGs), it is infamous for environmental degradation, human right abuses, corruption, conflict and for delivering limited tangible benefits to citizens. Women, indigenous peoples and other vulnerable groups are disproportionately negatively impacted and have fewer opportunities to benefit.

At the 2024 Commonwealth Heads of Government Meeting (CHOGM) held in Apia, Samoa, member countries:

> '*recognised the achievements of and the transformative support for members of the Commonwealth Natural Resources Programme over the last 57 years. Heads noted that one-third of small states and half of LDCs [least developed countries] are resource dependent which contributes to economic vulnerability and potential debt distress. Noting the importance of critical minerals for the clean energy transition, Heads renewed their commitment to support members in the sustainable use and equitable development of natural resources while balancing social and economic benefits, ensuring environmental protections and safeguarding for workers, Indigenous Peoples, all women, and affected communities, ensuring the transition is just, equitable and inclusive, leaving no one behind.*'

Following CHOGM, on 19 November 2024, the Commonwealth Secretariat convened a roundtable discussion with senior government officials from mining ministries on 'Redefining Critical Minerals: Future Proofing Mining Projects'. At this meeting, member countries raised the idea of forming a Commonwealth Critical Minerals Alliance (CCMA) as a vehicle to facilitate the sustainable development of critical minerals in the Commonwealth. Inputs were received from more than 30

officials from over a dozen member countries that attended the Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development's (IGF) Annual General Meeting.

Member countries discussed policy approaches, challenges and potential solutions regarding the development of critical minerals in their various countries and endorsed the need for knowledge resources under development by the Secretariat. They highlighted the need for bilateral technical assistance and requested the Secretariat to convene similar focused technical meetings on an ongoing basis to facilitate continued knowledge exchange and enhance collaboration.

In June 2025, at the Commonwealth Trade Ministers Meeting (CTMM) held in Windhoek, Namibia, trade ministers '*discussed ways to enhance sustainability in the critical minerals sector through individual and collective efforts to build capacity through knowledge sharing, technical assistance and supporting enabling environments*'.

Building on this request, in November 2025, the Secretariat convened the second Commonwealth Senior Mining Officials Roundtable in Geneva, reaffirming the Commonwealth's commitment to responsible mineral development, critical minerals collaboration and a just energy transition. To operationalise these commitments and support the work of the CCMA, the Secretariat has developed guidelines for mining feasibility studies for member countries.

This initiative responds to a persistent regulatory gap in many jurisdictions, where regulators lack robust legal requirements specifying what project planning documents must be submitted, and what information they should contain. As a result, government approval of a mining project or license is often not based on a holistic assessment of the merits and risks to the country and its citizens.

For their part, however, before making substantial investments in a mining project, companies do undertake detailed analyses across several aspects (for example, strategic, technical, economic, environmental, social) to inform their decision. These are typically scoping studies, pre-feasibility studies (PFS) and feasibility studies (FS). The FS is a critical moment in the project life cycle, as it largely determines how a mine is designed and developed and ultimately shapes the net benefits accruing to the host country over the life of the project. Although these studies are typically submitted to governments for review, they are often prepared by companies with limited or no guidance from public authorities.

This underscores the need for governments to establish clear expectations for the scope and content of feasibility studies while also developing a strong understanding of how these studies are prepared, the assumptions underpinning them, and how their findings should inform regulatory and investment decisions. Without the capacity to critically assess feasibility studies, economic, social and environmental risks may be overlooked and opportunities for long-term national benefit may be lost. By setting out minimum requirements aligned with international best practice, the non-binding *Commonwealth Model Mining Feasibility Study Guidelines* ('the *Guidelines*') aim to ensure that feasibility studies are comprehensive, transparent and tailored to national priorities. Strengthening government capacity at this early stage is essential to ensuring that mining projects are designed, approved and managed in ways that serve the public interest and support sustainable development.

Executive Summary

Mining projects move through a series of approval processes before any mineral is extracted. Among these decisions, the feasibility study stage plays a particularly important role: it provides the evidence on which governments/regulators judge whether a proposed development is technically achievable, financially sound, socially acceptable and environmentally responsible. However, in practice, feasibility studies vary widely in their structure and content, making it difficult for governments to compare projects, assess risks or ensure that proposals are aligned with national priorities.

The *Commonwealth Model Mining Feasibility Study Guidelines* ('the *Guidelines*'), published alongside this paper, have been developed to bring greater clarity and consistency to this process. They offer a common framework that governments can use to articulate expectations, guide proponents and strengthen internal review systems. The *Guidelines* recognise that feasibility studies sit at the intersection of multiple disciplines: geology, engineering, finance, environment, community engagement and public administration, and that governments require a coherent method for integrating these dimensions into decision-making.

Purpose and rationale

The *Guidelines* respond to a practical challenge observed across many Commonwealth countries: the absence of a nationally endorsed, structured reference for assessing mining proposals before key approvals are granted. While international reporting codes provide some technical standards, they do not address the broader governance, sustainability and development questions that governments must evaluate. Decision-makers, therefore, need tools that enable them to scrutinise core project assumptions, benchmark quality, and ensure that feasibility submissions support and align with national objectives.

This paper, published alongside the *Guidelines*, supplements the *Guidelines* by providing the conceptual underpinnings and governance frameworks required for their consistent interpretation and use. It positions pre-feasibility studies and feasibility studies within the overall project development process, delineates the expected depth and quality of information, and highlights recurring limitations and risks that government reviewers should be prepared to assess.

Together, these publications aim to meet this need for governments by providing a clear statement of their expectations, a consistent structure for feasibility documentation, and a template for improved co-ordination across public institutions. They emphasise proportionality, for the depth of analysis required should reflect the scale, sensitivity and risk profile of the mining project.

Key challenges the guidelines address

Consultations with member countries highlighted several recurring challenges in feasibility review, for example.

- Lack of documented guidelines for conducting feasibility studies;
- Differences in the content and quality of feasibility studies;
- Fragmented institutional processes, leading to gaps in assessment and duplication of effort;

- Limited integration across strategic, technical, economic, environmental, social and governance matters;
- Lack of clear minimum requirements for feasibility submissions;
- Dependence on proponent-generated data without standards for transparency or verification.

This paper, along with the *Guidelines*, provides clarity and structure to help governments overcome these challenges and strengthen early-stage project evaluation.

Structure and core components

This paper begins by defining pre-feasibility and feasibility studies, providing an overview of their functions, scope and distinguishing features. It proceeds to examine how regulators should assess each study, including typical constraints, and the implications for permitting and oversight. Finally, it outlines expected levels of detail at each stage and situates both studies within wider institutional and regulatory frameworks.

A holistic and integrated approach

Together with the *Guidelines*, this paper encourages governments to move beyond viewing feasibility studies purely as technical documents. Experience across jurisdictions shows that projects often encounter difficulties not because the ore body lacked value, but because broader risks, including environmental liabilities, community concerns, unrealistic cost assumptions and infrastructure gaps, were insufficiently understood early on.

Accordingly, the *Guidelines* promote integrated assessment that links:

- mine design with environmental mitigation and rehabilitation planning;
- economic analysis with realistic price, cost and fiscal assumptions;
- social baselines with clear engagement strategies and respect for community rights and cultural heritage;
- infrastructure requirements with national and regional development plans.

This holistic approach ensures governments have a full picture of long-term implications before making commitments.

Strengthening government review

A government review of feasibility studies can only be effective when supported by strong institutional processes. Many countries report delays, inconsistent assessments or duplication resulting from unclear roles or communication gaps between agencies. There is, therefore, an emphasis on the need for governments to better structure their feasibility review to ensure a co-ordinated, interdisciplinary approach to improve rigour without adding unnecessary bureaucracy,

Applicability across diverse contexts

The *Guidelines* are designed for use by countries with varying regulatory maturity and institutional capacity. They can support:

- emerging mining jurisdictions seeking to establish strong foundations;
- countries modernising outdated regulatory frameworks;
- administrations seeking clearer processes to engage with investors.

The adaptability of the *Guidelines*, adjusting for different levels of mine deposits and corresponding levels of detail necessary, ensures their relevance across the diverse contexts of Commonwealth member countries.

Conclusion

A feasibility study is an instrument of good governance. It helps governments decide whether a proposed project contributes to national development – whether through revenue generation, employment, infrastructure, environmental stewardship, community well-being or broader economic transformation.

The *Commonwealth Model Mining Feasibility Study Guidelines* provide a practical, coherent and adaptable framework to support governments in effectively assessing feasibility guidelines. By doing so, the *Guidelines* help to ensure that mineral development proceeds in a manner that is technically sound, economically beneficial, environmentally responsible and socially inclusive. The *Guidelines* support this by:

- linking feasibility evaluation to national development strategies;
- requiring proponents to demonstrate expected public benefits;
- encouraging assessment of alternative options or project designs and
- promoting transparency around major project decisions.

This development-oriented approach ensures that feasibility studies are not treated as procedural requirements, but as tools for shaping better outcomes.

1. Introduction

Effective regulation of the mining sector requires governments to make informed decisions at each stage of the mineral development process. Central to these decisions is the ability to understand, interrogate and evaluate the technical, economic, environmental and social viability of proposed projects before licenses are granted. Yet in many Commonwealth jurisdictions, the content and role of pre-feasibility studies (PFSs) and feasibility studies (FS) are not clearly defined in legislation, leaving governments dependent on documents prepared primarily for corporate investment decisions rather than for public interest oversight.

To support governments in addressing this gap, the Commonwealth Secretariat has developed the *Commonwealth Model Mining Feasibility Study Guidelines*. These *Guidelines* provide a regulatory framework that member countries may use to articulate minimum standards for feasibility documentation and strengthen their internal review systems. This paper has been prepared to deepen understanding of the study levels that underpin those *Guidelines* and to assist governments in adapting them to their national legal and institutional contexts.

This paper has five main objectives.

1. To explain the purpose, scope and timing of the PFS and FS, describing their similarities and differences, and situating them within the mining or mineral development life cycle.
2. To provide an overview of the critical role the PFS and FS play in government evaluation of mining proposals, particularly as evidence for licensing decisions, negotiations and the design of regulatory conditions.
3. To demonstrate how these studies may be incorporated in jurisdictions where legislation does not mandate their requirement for licensing through the use of other complementary studies such as environmental impact assessments (EIAs) or financial or development agreements.
4. To outline globally recognised norms and expectations for the PFS and FS, referencing international reporting frameworks and industry practice.
5. To present a model toolkit that government officials may adopt or adapt to institutional and cultural contexts or to the specific characteristics of mineral deposits under consideration.

The overarching goal is to ensure that governments have line of sight to the same information companies use to make investment decisions, enabling regulators to assess whether a project is not only technically and financially viable, but also capable of delivering net benefits to the host country. Strengthening feasibility study requirements helps create a more transparent, predictable and development-oriented licensing system, ultimately supporting better project outcomes and reducing the risk of costly errors.

The *Commonwealth Model Mining Feasibility Study Guidelines*, published alongside this paper, draw on best practices across Commonwealth jurisdictions, alignment with major international reporting codes (such as the CRIRSCO (Committee for Mineral Reserves International Reporting Standards) framework, National Instrument (NI) 43-101 (Canada), the JORC (Joint Ore Reserves Committee) Code (Australia), the PERC (Pan-European Reserves and Resources Reporting Committee) Standard (United Kingdom and European Union-aligned), and the SAMREC (South African

Mineral Resource Committee) Code (South Africa), and the evolving role of feasibility studies in environmental assessments, ESG integration, reserve classification and investment decision-making. They recognise that while feasibility studies are produced by companies, governments rely on them as a regulatory tool to evaluate risks and opportunities and frame licensing conditions.

This paper, therefore, complements the *Guidelines* by providing the conceptual and governance foundations needed to interpret and apply the *Guidelines* effectively. It situates the PFS and FS within the broader project development life cycle, clarifies expected information requirements at different study levels, and identifies common limitations and risks that government reviewers should anticipate. It also highlights the importance of linking feasibility findings to regulatory decisions downstream, such as environmental approvals, fiscal terms, community development obligations, etc.

Together, the *Guidelines* and this document aim to strengthen government capacity, enhance transparency and support informed decision-making throughout the mining development process. By embedding the PFS and FS more firmly within licensing systems, governments can better safeguard the public interest and ensure that mineral development contributes meaningfully to sustainable national development.

Lastly, this need for clearer feasibility requirements is especially important in the context of the global energy transition, where demand for critical/energy transition minerals is accelerating and project timelines often tend to be compressed. Governments must evaluate increasingly complex proposals while ensuring strong ESG performance and alignment with national development priorities. Embedding robust PFS and FS expectations into licensing processes would enable countries to navigate this pressure, by assessing critical mineral projects with confidence, ensuring that development proceeds responsibly in the long-term interest of the public.

2. Defining the Pre-feasibility Study and Feasibility Study

2.1 Pre-feasibility study

A pre-feasibility study (PFS) in mining is an early-stage analysis conducted to determine whether a mining project is technically and economically viable before committing to a more detailed and expensive feasibility study. The relevance of a pre-feasibility study in mining lies in its role as a strategic decision-making tool that bridges the gap between exploration and full-scale project development. It provides a preliminary assessment of the project's potential, helping stakeholders decide whether to proceed with more detailed investigations. The main purpose is to decide whether to proceed to a full feasibility study, modify the project scope or abandon the project due to lack of viability.

2.2 Feasibility study

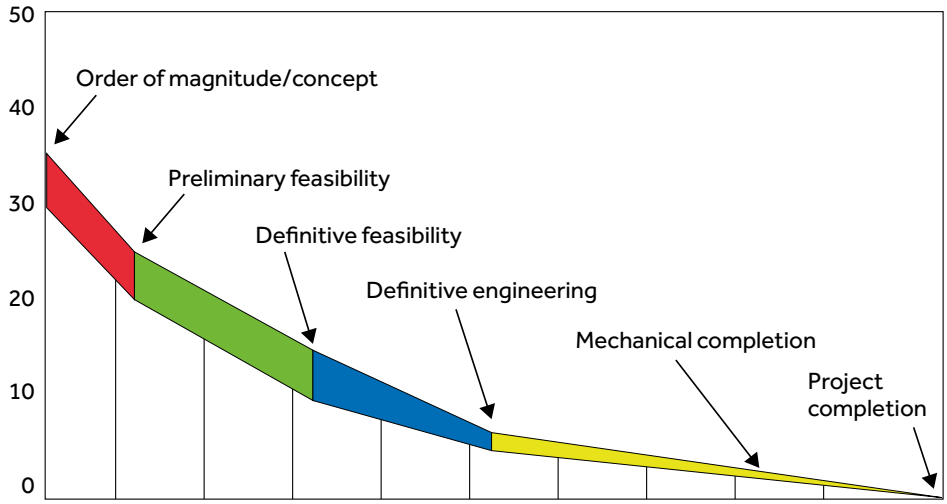
A feasibility study (FS) in mining is an in-depth comprehensive analysis used to determine whether a proposed mining project is technically, economically, legally, environmentally and operationally viable before significant investment is made. It represents the highest form of detail produced before a project moves into development and production and it forms the definitive basis for making investment decisions, financing arrangements, mine design and regulatory approvals. At the FS stage, mineral resources – both measured and indicated – may be converted into proven/probable reserves, providing the level of certainty required for mine development. Thus, a well-executed study allows decision-makers to determine whether to proceed, pause, rescope or abandon a project, based on a clear understanding of the technical, financial and environmental realities. By providing a comprehensive roadmap from planning to production, feasibility studies significantly increase the likelihood of project success.

However, from a mineral operations and licensing perspective, an FS is not the first point at which viability must be assessed. The progression from a prospecting licence to a mining or development licence normally requires a demonstration that the mineral deposit identified is of potential commercial interest. This determination is expected at the PFS stage, which evaluates various development options, assesses the economic potential of the deposit, and establishes whether advancing the project to a full feasibility study is justified. A PFS therefore serves as the critical bridge between exploration results and a formal application for a development or mining licence, while the FS provides the definitive case for project approval and investment.

3. Overview of Pre-feasibility Study and Feasibility Study Levels and Purposes

Commonalities exist across Commonwealth member countries and within mining PFSs and final FSs. The consensus is that the use of both tools can enhance and improve the decision-making process as well as the planning and implementation of mining projects. Their use greatly improves the understanding and expectations of both the investor and the host country of the specifics surrounding the project. The studies cover a myriad of areas and typically fall between the conceptual stage and the development stage of the project life cycle. Figure 3.1 highlights the stages of a mining project and where PFSs and FSs fall while Table 3.1 highlights the accuracy and degree of detail that can be obtained from each. The PFS and FS form important stage gates in the development of mining projects.

Figure 3.1. Mine project stages and where pre-feasibility/feasibility falls, showing level of uncertainty and detail



Degree of project definition

From AusIMM Monograph 27 Cost Estimation Handbook

Source: https://www.amcconsultants.com/experience/feasibility-studies-for-mining-projects

Modern mining PFS and FS are increasingly expected to address a range of globally recognised environmental, social and governance (ESG) norms and non-technical risks, not just geology, metallurgy and economics. These expectations often stem from: lender/investor standards such as International Finance Corporation (IFC) or Equator Principles; regulatory requirements; best practices among responsible mining companies; and growing pressure for ESG transparency in mining operations.

Table 3.1. Types of feasibility studies and levels of detail

Category	Pre-feasibility studies	Pre-feasibility studies	Feasibility studies (bankable/definitive)
Purpose	Early-stage assessment of project viability.	Evaluate options and identify the next best approaches.	Final detailed assessment used for financing and investment decisions.
Level of detail	Low	Medium	High
Level of uncertainty	30–50%	20–30%	10–15%
Key components	Basic geology and mineral reserve estimates; conceptual mining method; rough cost estimates; initial economic indicators. Does not include any detailed designs or engineering considerations.	More reliable reserve/ resource estimates; preliminary mine design and extraction schedule; environmental baseline data; CAPEX and OPEX cost estimates; financial modelling (IRR, NPV estimates); risk and sensitivity analysis.	Detailed reserve estimates (probable and proven reserves); final mine plan and extraction or production schedule; detailed engineering and designs; specifications of required equipment; legal and permitting requirements review; full environmental and social impact assessment; final CAPEX and OPEX; detailed and robust financial modelling; detailed project risk assessment.

Note: CAPEX = capital expenditure; IRR = internal rate of return; NPV = net present value; OPEX – operating expenditure.

Table 3.2. Level of detail in feasibility study and its key components

Component	Level of detail
Resource and reserve estimation	Based on measured and indicated resources; conversion to proven/probable reserves.
Mine design	Final pit/underground layout, scheduling, sequencing, mine life planning.
Geotechnical and hydrology	Full geotechnical and hydrological assessments, pit slope and groundwater models.
Metallurgy and processing	Complete metallurgical test work; final process flowsheet and equipment specifications.
Infrastructure design	Detailed engineering drawings for roads, power, water, tailings and logistics.
Capital cost estimate (CAPEX)	Line-item CAPEX estimate with contractor quotes; ±10–15% accuracy.
Operating cost estimate (OPEX)	Detailed per-tonne operating cost estimates by department/process.
Environmental and social	Full environmental and social impact assessment (ESIA) with mitigation strategies, stakeholder consultation outcomes.
Permitting requirements	List of required permits with status and timelines for acquisition.
Financial modeling	NPV, IRR, payback analysis, tax/royalty model, price sensitivity scenarios.
Risk analysis	Identification and mitigation of technical, financial, environmental, political risks.
Execution plan	Construction schedule, procurement plan, commissioning and staffing timeline.
Climate risk and resilience assessment	Climate risks (physical and transition), resilience measures.
Greenhouse gas (GHG) emissions and decarbonisation strategy	GHG baselines, targets, low-carbon technologies, Scope 1-2-3 considerations.
Stakeholder engagement plan	Stakeholder mapping, consultation outcomes, grievance mechanisms.
Gender and inclusion analysis	Gender-disaggregated data, employment policies, inclusion metrics.
Human rights due diligence (HRDD)	Human rights screening, risks, and mitigation aligned with UN Guiding Principles (UNGPs).
Conflict sensitivity assessment	Conflict analysis, peace building alignment, community safety.
Indigenous peoples and FPIC (if applicable)	Cultural heritage, land rights, consent procedures, FPIC documentation.
Community development and social license strategy	Community benefits, local hiring, procurement, long-term development.
Implementation schedule	Timeline, including ESG milestone integration.
Monitoring and evaluation plan	Key performance indicators (KPIs) for ESG performance, audit mechanisms, adaptive management.

3.1 Similarities and differences in the pre-feasibility study and feasibility study

The pre-feasibility study and feasibility study share an overarching purpose: both assess the potential of a mining project across technical, economic, environmental, social, operational and legal dimensions before significant investment decisions are made (Table 3.3). Each study helps determine whether a mineral deposit can progress responsibly and profitably through the development pipeline.

Despite this shared foundation, the two study levels differ substantially in their degree of detail, level of certainty and intended outcomes. A PFS provides an initial integrated assessment of the project's potential, testing a range of development options, identifying key risks and establishing whether the project is sufficiently promising to justify the cost and effort of a final feasibility study. At this stage, resource estimates are more preliminary, engineering designs are less precise and economic projections carry wider uncertainty ranges.

By contrast, the FS delivers a definitive, high-confidence evaluation of the selected development option. It provides detailed engineering, refined cost estimates, final mine design, environmental and social management plans, and a firm economic model upon which investors, lenders and regulators can rely (Table 3.4). Whereas a PFS asks, *'Does this project appear viable, and should it advance to the next stage?'* the FS answers, *'Is this project proven to be viable, and should final investment and licensing decisions be made?'*

Together, the PFS and FS form a sequential decision-making framework, whereby the PFS screens and optimises the concept, while the FS confirms viability and readiness for development.

Table 3.3. Commonalities between the pre-feasibility study and feasibility study

Area	Commonalities
Purpose	Assesses technical and economic viability of the project.
Basis in resource data	Uses geological data, drilling and resource estimates.
Project scope	Covers mining, processing, infrastructure, environmental and social aspects.
Cost and revenue estimation	Includes CAPEX, OPEX and revenue projections.
Economic analysis	Computes NPV, IRR and payback period.
Risk identification	Identifies technical, financial, environmental, political and social risks.
Regulatory compliance	Aligns with mining codes.
Decision-making tool	Supports key investment and development decisions.
Stakeholder engagement	Involves stakeholder input, engagement and communication.
ESG considerations	Addresses environmental, social and governance (ESG) factors.

Table 3.4. Differences between the pre-feasibility study and feasibility study

Area	Pre-feasibility study (PFS)	Feasibility study (FS)
Purpose	Determines if project is potentially viable.	Confirms technical and economic feasibility.
Level of detail	Moderate – based on indicated resources and preliminary designs.	High – based on measured and indicated resources, finalised designs.
Level of uncertainty of estimates	±25–35%	±10–15%
Engineering design	Conceptual to preliminary designs.	Detailed engineering designs and specifications.
Mining method and schedule	Proposed method; approximate schedules.	Confirmed method; detailed mine plan and schedule.
Metallurgical testing	Bench-scale or preliminary test work.	Pilot-scale or full programme to confirm recovery.
Environmental and social (ESG)	Initial impact assessment; identifies key risks.	Full ESIA and mitigation planning.
Capital and operating costs	Preliminary estimates with contingencies.	Definitive and itemised cost estimates.
Project economics	Preliminary NPV, IRR, payback analysis.	Full economic analysis with sensitivity tests.
Regulatory use	Supports initial licensing or financing discussions.	Supports final investment and full permitting.
Funding readiness	Supports internal decisions or preliminary financing.	Used for project financing and investment.
Reporting standards	Aligned with host country standards (less stringent).	Meets strict standards (bankable).
Decision outcome	Decide to proceed to FS.	Decide to build the mine.
Time and cost to produce	3–9 months, lower cost	6–18 months, higher cost.

4. Assessing the Pre-feasibility Study, its Limiting Factors and Regulatory Significance

4.1 Assessing the pre-feasibility study

A PFS is an essential early-stage analysis that determines whether a mining project is technically and economically viable. It acts as a crucial filter that helps companies assess the value of continuing to a full feasibility study, which is significantly more detailed and costly. By identifying the potential of a project early on, a PFS plays a vital role in resource allocation and strategic decision-making.

One of the primary functions of a PFS is the early evaluation of project potential. It provides a foundational assessment of whether a mineral deposit can be developed profitably. This allows project proponents to decide whether it is worthwhile to invest in a more comprehensive feasibility study. Without this step, companies may risk spending substantial resources on projects that are not economically feasible. From a technical and geological standpoint, the PFS provides a preliminary understanding of the ore body, including estimates of reserves, grades and mineralisation characteristics. It examines potential mining methods and evaluates whether current technology is sufficient to support the project. This stage also assists in selecting the most suitable extraction and processing methods, laying the groundwork for efficient operations.

Risk identification and reduction are among the most significant benefits of a PFS. It helps uncover potential geological, technical, financial and environmental risks before substantial investment is made. Early identification of such risks allows for the development of mitigation strategies, ensuring that the project team can address or avoid major obstacles. In some cases, the PFS may reveal that the project is not viable, enabling stakeholders to pivot or abandon the plan before further resources are expended.

The study also includes a preliminary economic assessment, offering early-stage cost estimates for capital expenditure (CAPEX) and operating expenses (OPEX). It generates initial financial forecasts, including metrics such as net present value (NPV) and internal rate of return (IRR), which are key indicators of a project's financial health. These early figures help inform investment decisions by providing a glimpse into potential revenue, cash flow and long-term profitability. In terms of strategic planning, a PFS guides decision-makers in defining the project's scope, scale and timeline. It supports the prioritisation of multiple exploration targets based on comparative viability, allowing companies to allocate resources more effectively. This phase also informs the critical decision of whether to proceed to a full feasibility study or reconsider the project entirely, thereby minimising the risk of pursuing unviable opportunities.

Environmental and social considerations are also addressed at this stage. A PFS typically includes an early assessment of potential environmental impacts and identifies any social or community-related concerns. Understanding these issues early allows companies to begin planning for environmental mitigation and community engagement strategies. Furthermore, it sets the stage for a more thorough environmental and social impact assessment (ESIA) in subsequent project phases. Infrastructure and logistics play a crucial role in the viability of a mining

project. The PFS evaluates the basic infrastructure needs, such as access roads, power supply, water sources and workforce requirements. It highlights potential logistical challenges, including remote site access or limitations in local support services. This information is essential for realistic planning and budgeting.

A comprehensive pre-feasibility study also addresses regulatory and permitting factors. It examines the legal framework in which the project will operate, including licensing requirements and environmental regulations. Identifying regulatory hurdles early on allows companies to anticipate delays or complications in the permitting process and better understand the timelines involved in achieving full compliance.

Finally, a well-executed PFS can significantly improve a project's attractiveness to investors and other stakeholders. By demonstrating technical viability, financial potential and responsible planning, the study builds credibility. It can help secure early-stage funding or partnerships and reassures regulatory bodies and local communities that the project is being developed thoughtfully and transparently.

In conclusion, a PFS is a vital step in the mining project life cycle. It provides a solid foundation for informed decision-making, reduces risk, supports responsible development and improves the likelihood of long-term project success. Without this early assessment, companies face the danger of investing in projects that may ultimately prove unworkable or unprofitable.

Table 4.1. Focus areas/importance of the pre-feasibility study (summary table)

Focus area	What is evaluated
Geology and mineral resources	Confirms details on mineral deposit: size, grade, quality and mine ability of the ore deposit.
Mining methods	Identifies suitable mining techniques, methods and preliminary designs.
Processing options	Assesses best extraction and processing options for the selected mineral.
Economic viability	Evaluates profitability (NPV, IRR, payback period).
Capital and operating costs	Provides early estimates of total costs (CAPEX and OPEX).
Infrastructure needs	Identifies needs in terms of power, water, roads, housing, logistics.
Social impact	Considers effects on local communities and stakeholder engagement.
Environmental impacts	Flags or highlights potential environmental issues and permits needed.
Risk analysis	Identifies and assesses project risks (technical, economic, geopolitical, etc.).
Regulatory factors	Identifies legal requirements and potential hurdles or obstacles.

4.2 Limiting factors in assessing the pre-feasibility study

The successful execution of a PFS is often constrained by several limiting factors. These challenges can impede progress, delay timelines, increase costs or influence the quality and reliability of the study. Generally, these constraints arise from technical, financial, legal, logistical, social or regulatory factors and understanding them is essential for effective project planning (Table 4.2).

Table 4.2. Limiting factors in conducting a pre-feasibility study

Limiting factor	Description
Insufficient geological data	Lack of reliable exploration data; uncertainty in resource estimation.
Legal and land access issues	Licensing delays, ownership disputes or community opposition.
Limited funding/ unfavourable market conditions	High costs and low investor appetite in early stages. Low commodity prices or oversupply reduce economic viability.
Time constraints	Seasonal/weather delays; external pressure to bypass PFS.
Lack of technical expertise	Inexperienced team or shortage of skilled personnel.
Infrastructure constraints	No access to roads, power, water, or logistical support.
Social and environmental barriers/constraints	Impact on protected areas or social resistance or opposition.
Political or regulatory instability	Unstable laws, taxes, corruption or nationalisation risks.
Metallurgical uncertainty	Poor recovery rates or unclear processing methods.

4.3 Integrating the pre-feasibility study in regulatory frameworks

Integrating PFS into mining legislation or regulatory frameworks can significantly enhance project due diligence, attract responsible investment and align domestic mining activities with global best practices. A systematic approach to embedding the PFS in law ensures that only technically and economically feasible projects proceed to next steps, while also reinforcing environmental and social safeguards (Table 4.3). Below there follows a guide on how to effectively incorporate PFS requirements into legislation and regulatory frameworks.

Table 4.3. Benefits of incorporation of the pre-feasibility study in mining legislation

Advantage	Outcome
Promotes high-quality project evaluation	Reduces failed or speculative applications
Attracts responsible investment	Increases investor confidence
Enhances regulatory oversight	Provides a strong basis for license assessment
Supports ESG and sustainable development	Improves community and environmental protection

- **Define the PFS in law/regulation:** establishing a clear legal definition within mining regulations removes any ambiguity and ensures that all relevant stakeholders understand its scope and purpose.

  Example clause:

  '"Pre-Feasibility Study" means a study conducted to determine the preliminary economic and technical viability of a mining project, including resource estimates, proposed mining methods, environmental and social risks and financial projections.'

- **Make the PFS a prerequisite for mining license applications:** applicants for mineral rights exploration, including mining licenses, should be required to submit a complete PFS as part of the licensing process, to ensure that only projects with technical and economic justification advance to the exploitation phase.

  Example clause:

  'An applicant for a mining lease shall submit a Pre-Feasibility Study report demonstrating the project's preliminary economic viability, technical feasibility and environmental considerations.'

- **Link the PFS to environmental and social impact requirements:** mandating the use of a PFS in environmental and social impact assessments (ESIA) encourages the early integration of ESG considerations, ensuring community concerns and environmental risks are addressed at the earliest stage.

  Example clause:

  'The Pre-Feasibility Study shall include a preliminary Social Impact Assessment (SIA) identifying the potential socio-economic effects of the proposed mining operations on local communities. The study shall assess population displacement, livelihood impacts, indigenous peoples' rights, land use changes, cultural heritage and access to social services. The assessment must:

  (a) engage potentially affected stakeholders through meaningful consultation

  (b) identify vulnerable groups and outline mitigation and benefit-sharing strategies

  (c) be aligned with the country's environmental and social impact assessment legislation

  (d) conform to international best practices such as the IFC Performance Standards and the OECD [Organisation for Economic Co-operation and Development] Guidelines for Multinational Enterprises.'

- **Mandate the PFS for investment and fiscal incentive applications:** access to tax incentives, infrastructure support or development agreements should be contingent upon submission of a credible PFS, ensuring that incentives are only granted to projects that demonstrate technical viability and responsible planning.

  Example clause:

  'Any application for a Mining Lease, Mineral Development Agreement or related investment and fiscal incentive under this Act shall be accompanied by a comprehensive Pre-Feasibility Study (PFS). The PFS shall demonstrate the technical and economic viability of the proposed mining project and shall include, at a minimum:

  (a) an indicative mineral resource estimate in accordance with an internationally recognised reporting standard (e.g., CRIRSCO-aligned)

  (b) preliminary mine design and production scheduling

  (c) preliminary capital and operating cost estimates

  (d) a conceptual infrastructure and logistics plan

  (e) an outline of environmental and social impacts and proposed mitigation strategies

  (f) a preliminary financial model including projected government revenue flows (e.g., royalties, taxes, dividends) for use in fiscal analysis.

  The competent authority shall not evaluate any application for fiscal incentives, stability agreements or state participation without such a study, prepared and signed by a Qualified Person.'

- **Align PFS requirements with recognised international reporting codes:** aligning with codes such as NI 43-101 (Canada), the JORC Code (Australia) or the UNFC (United Nations Framework Classification), especially in jurisdictions lacking domestic reporting standards, standardises reporting requirements and so improves the quality, comparability and investor confidence in submitted studies.

  Example clause:

  'All Pre-Feasibility Studies submitted in support of mineral rights applications, investment proposals or development agreements shall be prepared in accordance with an internationally recognised reporting code for mineral resources and reserves that is aligned with the CRIRSCO Template. Acceptable standards include, but are not limited to, the JORC Code (Australia), NI 43-101 (Canada), the SAMREC Code (South Africa) and PERC Reporting Standard (UK/EU).

  The study shall be prepared under the supervision of, and signed by, a Qualified or Competent Person as defined by the applicable reporting code, and shall contain:

  (a) a mineral resource statement supported by geological and technical data, clearly distinguishing between Inferred, Indicated and Measured Resources

  (b) mine design assumptions and preliminary economic evaluation.

  (c) the study shall disclose all material assumptions and modifying factors affecting the economic viability of the project, including technical, financial, legal, environmental and social considerations.

(d) the format and level of detail shall be sufficient to support preliminary project investment decisions and government evaluation of fiscal and environmental risk exposure.'

- **Set clear qualifications for the PFS authors:** regulations should specify that PFS reports must be prepared or endorsed by a qualified person (QP) or competent person, as defined by internationally accepted codes, to ensure accuracy and integrity.

  Example clause:

  'All Pre-Feasibility Studies (PFS) submitted pursuant to this Act shall be prepared, reviewed and signed by one or more Competent or Qualified Persons. For the purposes of this provision:

  (a) A 'Competent Person' shall be an individual who:

  – *is a member in good standing of a recognised professional organisation relevant to the discipline (e.g., geology, mining engineering, metallurgy)*

  – *has a minimum of five (5) years of relevant experience in the style of mineralisation and type of deposit under consideration and*

  – *is independent of the applicant or license holder, unless otherwise permitted by applicable reporting standards.*

  (b) The Competent Person shall provide a signed certificate attesting to their qualifications, independence and professional responsibility for the accuracy and integrity of the information disclosed in the PFS.

  (c) Where the study includes multiple disciplines (e.g., geology, metallurgy, infrastructure, environment), each discipline shall be covered by an appropriately qualified Competent or Qualified Person.'

- **Establish review mechanisms:** Regulatory authorities such as the Department of Mines or environmental agencies should be empowered to review, approve, reject and request clarifications or updates to submitted PFS reports.
- **Integrate into mining cadastre/licensing systems:** By digitalising and storing submitted PFS documents in a centralised system, regulators can facilitate compliance tracking and provide accessible information to investors, communities and other stakeholders, enhancing transparency and long-term monitoring.

Figure 4.1. Sample legal text: PFS study requirement

Sample legal text – Mining Act Amendment

Section X: Pre-Feasibility Study Requirement

1. An application for a mining lease shall be accompanied by a Pre-Feasibility Study.
2. The study shall include and demonstrate:
    i) mineral resource estimates in compliance with recognised reporting codes
    ii) preliminary mine design and processing methods
    iii) environmental and social risk identification
    iv) capital and operating cost estimates and financial analysis
    v) an assessment of project risks and mitigating strategies.
3. The Pre-Feasibility Study shall be prepared by a Qualified or Competent Person.

5. Assessing the Feasibility Study, its Limiting Factors and Regulatory Significance

5.1 Assessing the feasibility study

An FS plays a critical role in mining projects as a key decision-making tool that determines whether a project is economically, technically, environmentally, socially and legally viable before major capital investments are committed. By providing a comprehensive assessment of all aspects of a proposed mining operation, it ensures that companies and investors can make informed decisions, minimise risks and optimise project planning.

One of the primary benefits of an FS is risk reduction. It identifies and defines a wide range of potential risks, including technical risks such as the complexity of the mineral deposit, ore body characteristics and appropriate mining methods. Financial risks are also assessed, including low projected returns on investment, potential cost overruns and high hurdle rates. Furthermore, feasibility studies evaluate environmental impacts and legal risks, ensuring that companies can anticipate and mitigate potential challenges before they escalate into costly obstacles.

Feasibility studies also support investment decisions by providing robust, detailed financial models. Key metrics such as net present value (NPV) and internal rate of return (IRR) help determine whether a project is economically viable. These analyses not only guide internal decision-making but also enhance the project's ability to attract investors and secure financing from banks and development finance institutions (DFIs). In addition, a feasibility study provides reliable economic forecasts. It estimates both capital expenditure (CAPEX) and operating expenditure (OPEX), enabling project stakeholders to understand potential revenue streams, cash flows and overall profitability. By evaluating economic indicators such as NPV and IRR, the study offers a clear view of financial risks and expected returns.

Another critical function of a feasibility study is to ensure regulatory compliance. Many governments require feasibility studies as part of the process for obtaining mining licenses, land-use approvals and environmental permits. Regulatory agencies and environmental authorities rely on these studies to verify that the project is responsibly designed, and that its environmental and social impacts are properly addressed. Feasibility studies further guide project planning and design by defining the optimal mining methods, processing techniques, equipment needs and infrastructure requirements. This technical guidance ensures that operations are designed efficiently and in alignment with both resource characteristics and operational constraints.

Meeting investor and international standards is another key area where feasibility studies add value. Many investors and DFIs require alignment with recognised frameworks, including the IFC Performance Standards (covering gender, human rights, indigenous peoples and environmental risks), the Equator Principles (focusing on ESIA, climate risk and stakeholder engagement), the OECD Due Diligence Guidance for Minerals (addressing human rights, conflict sensitivity and supply chain risks), the Global Reporting Initiative (GRI) (for social and environmental impact reporting), and the Task Force on Climate-related Financial Disclosures (TCFD) (focused on climate risk and resilience). Incorporating these standards into the feasibility study builds credibility and supports sustainable project development.

Table 5.1. Key focus areas/importance of feasibility studies (summary table)

Focus area	What is evaluated
Geology assessment	Confirms the size, grade, quality and distribution of the mineral or ore deposit.
Mining method evaluation	Determines the most suitable mining techniques, methods.
Metallurgical testing	Assesses how the ore or mineral can be processed and what recovery rates are achievable.
Economic analysis	Includes capital cost (CAPEX) and operating cost (OPEX) estimates, revenue forecasts and financial modeling (NPV and IRR).
Environmental and social impacts	Analyses potential environmental effects and community impacts and how to mitigate them.
Legal and regulatory review	Ensures compliance with local laws, permits and land rights.
Climate risk and resilience assessment	Assesses climate-related physical and transition risks to project viability
Greenhouse gas emissions and decarbonisation strategy	Plans to reduce GHG emissions across life cycle.
Stakeholder engagement plan	Comprises stakeholder mapping, identification of key stakeholders and strategies for consultation.
Gender and inclusion analysis	Assesses how gender dynamics and social inclusion affect and are affected by the project.
Human rights due diligence (HRDD)	Ensures the project respects internationally recognised human rights.
Conflict sensitivity assessment	Understands and mitigates risks in fragile or conflict-prone settings.
Indigenous peoples and FPIC (if applicable)	Ensures free, prior and informed consent, where applicable.
Community development and social license strategy	Ensures community acceptance and support beyond legal compliance.
Implementation schedule	Outlines scheduling and timelines, including ESG milestone integration.
Monitoring and evaluation plan	Tracks project performance using metrics to determine if the project is on scope, time, budget and meets quality targets.

5.2 Limiting factors in conducting the feasibility study

Several factors can delay, derail or hinder the successful completion of a mining feasibility study, and these factors are often interconnected. Their impact is typically seen across legal, environmental, financial and technical dimensions, affecting both the quality and timeline of the study (Table 5.2).

Table 5.2. Limiting factors in conducting a feasibility study

Category	Limiting factor	Description/impact
Geological	Insufficient geological data	Poor resource estimation; hinders accurate technical and economic assessment.
	Unverified resource classification	Only inferred resources; not sufficient for feasibility-level studies.
	Lack of geotechnical/ hydrological studies	Prevents proper mine design and risk analysis.
Financial	High cost of feasibility study	Millions of dollars required; financial burden for juniors or early-stage projects.
	Investor reluctance	High risk deters funding for detailed studies.
	Unfavourable commodity prices	Reduces potential returns, discouraging study investment.
Technical	Complex deposit geometry	Increases design and extraction complexity.
	Metallurgical challenges	Low or uncertain recovery rates affect processing efficiency.
	Unproven technologies	Use of experimental or non-standard techniques introduces risk.
Legal/ regulatory	Licensing and permit delays	Administrative bottlenecks delay the study process.
	Unclear land rights or tenure	Legal disputes or land access issues hinder site development.
	Restrictions in sensitive areas	Protected zones, indigenous lands or heritage sites may block access.
Infrastructure	Remote location	Inaccessible terrain makes site work and logistics difficult.
	Lack of existing infrastructure	Need for new roads, power or ports increases costs and complexity.
	Political instability	Deters investment and makes long-term planning risky.
Market/ economic	Commodity price volatility	Affects revenue projections and project viability.
	Difficulty securing off-take agreements	Uncertainty in market demand creates revenue risk.
	Inflation and cost escalations	Increases CAPEX/OPEX, undermining original assumptions.
Environmental/ social	Environmental risks	Potential ecological damage requires extensive mitigation and compliance.
	Community opposition	Social unrest or resistance can delay or block project approval.
	Lengthy ESIA processes	Environmental and social impact assessments can take years.

Although there is an inter-relationship between the influencing factors, and factors can vary in significance by project, commodity or location, they may be ranked based on the frequency that the factors have caused delay or failure of feasibility studies across the mining sector. Table 5.3 details a proposed ranking by factor and provides a rationale for each.

Table 5.3. Limiting factors ranked by importance

Rank	Category	Limiting factor	Rationale
1	Financial	High cost of feasibility study	Without funding, no study can proceed; this is a universal blocker.
2	Geological	Insufficient geological data	Foundation for all technical/economic modelling; quality data is essential.
3	Legal/ regulatory	Licensing and permit delays	Can stall or prevent feasibility work regardless of other project readiness.
4	Environmental/ social	Community opposition	Can halt studies or trigger social license failure.
5	Market/ economic	Commodity price volatility	Can invalidate project economics and delay decision-making.
6	Technical	Metallurgical challenges	Poor recovery or unknown behaviour can make projects unfeasible.
7	Infrastructure	Lack of existing infrastructure	Drives up CAPEX significantly; affects logistics and project design.
8	Environmental/ social	Lengthy ESIA processes	Adds long lead time; required for permitting.
9	Legal/ regulatory	Unclear land rights or tenure	Legal uncertainty can deter investors and delay studies.
10	Technical	Complex deposit geometry	Can complicate mine planning, but often managed through design optimisation.
11	Market/ economic	Difficulty securing off-take agreements	Affects financing but is less of a blocker at study phase.
12	Infrastructure	Remote location	Adds logistical complexity but not always prohibitive.
13	Technical	Unproven technologies	Risky, but only applies if cutting-edge methods are considered.
14	Environmental/ social	Environmental risks	Typically manageable with mitigation, unless in ecologically sensitive areas.
15	Financial	Investor reluctance	May be overcome with compelling data or risk-sharing.
16	Legal/ regulatory	Restrictions in sensitive areas	Location-specific; not all projects face this issue.
17	Infrastructure	Political instability	Context-specific; not always present.
18	Geological	Unverified resource classification	Can be resolved with further exploration.
19	Market/ economic	Inflation and cost escalations	Often factored into sensitivity analyses.
20	Geological	Lack of geotechnical/ hydrological studies	Usually addressed during PFS or FS phases.

5.3 Integrating the feasibility study in regulatory frameworks

To effectively incorporate an FS into legislation or regulations, it is essential to establish legal clarity, ensure alignment with international standards such as NI 43-101 (Canada) and JORC (Australia), and integrate FS requirements into the mining project life cycle from licensing to investment approval and public disclosure. Below, there follows a guide on how to effectively incorporate FS requirements into legislation and regulatory frameworks.

Table 5.4. Key benefits of integrating a feasibility study into legislation

Benefits	Impact
Improved project vetting	Ensures only viable, well-planned projects are permitted
Aligned with investor requirements	Facilitates bankable project status and access to financing
Enhanced ESG integration	Strengthens regulatory scrutiny of environmental and social risks
Legal certainty for development deals	Clarifies what is required for agreements, incentives and leases
Better public oversight	Allows for meaningful review by regulators and stakeholders
Greater project success rate	Reduces speculative or non-viable license approvals
Technical sound decisions	Ensures government reviews are based on reliable and complete data

- Define an FS in legislation/regulation. Legally defining an FS provides clarity on the content and scope of the study and ensures all relevant stakeholders share a common understanding of what constitutes a compliant FS.

  Example clause:

  '"Feasibility Study" means a comprehensive technical and economic analysis used to determine the viability of a mining project, incorporating detailed resource estimates, mine plans, processing designs, environmental and social impacts, risk assessments and financial projections with a defined level of accuracy.'

- Make FS mandatory for mining rights/mining lease renewal. Mandating government approval of an FS and linking it to license issuance ensures that only technically and financially robust projects proceed to the exploitation phase.

  Example clause:

  'The application for a mining lease shall be accompanied by a comprehensive Feasibility Study, demonstrating the project's technical, environmental and economic viability.'

- Use an FS in environmental and social impact assessments (ESIA). Requiring FS data in ESIA enables early integration of ESG considerations into mine design and infrastructure planning, ensuring environmental risk mitigation and community development obligations.

Example clause:

'The Environmental and Social Impact Assessment (ESIA) required under this Act or its associated environmental regulations shall incorporate and be informed by the technical and economic assumptions, project design and operational parameters described in the Feasibility Study (FS) submitted for the mining project. Specifically:

(a) The ESIA shall reflect the mine layout, infrastructure siting, extraction methods and processing techniques proposed in the FS.

(b) All estimated material and energy balances, waste generation volumes and water use projections shall be derived from or consistent with the FS.

(c) Socio-economic impact projections shall be based on employment, land use and community development assumptions described in the FS.

(d) The FS shall be included as an appendix or referenced document to the ESIA submission.

(e) Any significant change to the FS shall require a corresponding update to the ESIA and its approval conditions.'

- **Require an FS in bankable investment and fiscal agreements.** Development agreements, investment contracts and applications for tax incentives, customs waivers or public–private partnerships (PPPs) should all be contingent on a bankable feasibility study. This ensures that fiscal incentives and government support are directed toward viable and responsibly planned projects.

  Example clause:

  'No Investment Agreement, Mineral Development Agreement or Fiscal Stability Agreement related to a mining project shall be negotiated, approved or executed unless the applicant has submitted a Bankable Feasibility Study (BFS) that demonstrates the technical and economic viability of the proposed operation. The BFS shall:

  (a) be prepared in accordance with an internationally recognised reporting code (e.g., CRIRSCO-aligned such as JORC, NI 43-101, SAMREC)

  (b) be certified and signed by one or more Qualified or Competent Persons

  (c) include comprehensive estimates of capital and operating costs, cash flow forecasts and government revenues (taxes, royalties, dividends)

  (d) detail infrastructure requirements, environmental and social impacts and permitting assumptions

  (e) be reviewed and deemed acceptable by the designated technical and fiscal authorities prior to agreement execution.'

- **Align the FS with recognised global reporting standards.** To enhance credibility and facilitate access to international financing, the submitted FS should align with frameworks such as NI 43-101 (Canada), JORC (Australia), SAMREC (South Africa) or the UNFC (United Nations Framework Classification), ensuring that studies meet internationally accepted standards of technical reporting, are comparable across jurisdictions and can be easily reviewed by potential investors.

Example clause:

'Every Feasibility Study (FS) submitted in support of a mining lease application, investment agreement or fiscal arrangement under this Act shall be prepared in accordance with internationally recognised mineral reporting standards which include the following.

(a) The FS shall comply with a CRIRSCO-aligned code, including but not limited to the JORC Code (Australia), NI 43-101 (Canada), SAMREC Code (South Africa) or PERC Standard (UK/EU).

(b) The study must be prepared, signed and dated by a Qualified or Competent Person as defined under the applicable code.

(c) All classifications of Mineral Resources and Mineral Reserves must be disclosed in accordance with the definitions and categories of the applicable standard.

(d) All technical and economic assumptions, including Modifying Factors, must be clearly stated and justified in accordance with the principles of transparency, materiality and competence.

(e) The regulatory authority may reject any study that fails to meet these standards or is not certified by a duly qualified professional.'

- **Require qualified person (QP) or competent person certification.** The quality and accountability of feasibility studies can be strengthened by mandating that they be prepared or endorsed by a qualified person (QP), or competent person (CP) as defined under the relevant international reporting codes. This ensures that the study reflects professional standards and can withstand both regulatory and investor scrutiny.

  Example clause:

  'All Feasibility Studies (FSs) submitted in support of a mining lease, investment agreement or regulatory approval under this Act shall be prepared and certified by one or more Qualified or Competent Persons.

  (a) A "Qualified or Competent Person" shall be defined as a professional who:

  – *is a member in good standing of a recognised professional organisation relevant to the technical discipline (e.g., geology, mining engineering, metallurgy)*

  – *has a minimum of five (5) years of relevant experience in the type of mineral deposit and activity under consideration; and*

  – *is subject to enforceable professional standards and a code of ethics and capable of being held accountable for their professional work.*

  (b) Each Competent or Qualified Person shall provide a signed statement that includes:

  – *their name, professional affiliation and qualifications*

  – *a declaration of independence, where applicable; and*

  – *confirmation that the information presented in the FS is true, accurate and prepared in accordance with internationally recognised reporting codes (e.g., CRIRSCO, JORC, NI 43-101, SAMREC or PERC).*

  (c) Feasibility Studies not accompanied by such certification shall be deemed non-compliant and may be rejected by the competent authority.'

- **Establish a formal review and approval protocol.** To promote accountability, designated authorities, such as the Mining Commission, Department of Mines etc., should be empowered to evaluate, approve or reject the FS and to request updates or clarifications when necessary.
- **Include FS requirements in mining cadastre and licensing system.** Digitising and archiving approved FS reports in the national mining cadastre or land management database ensures transparency, supports compliance monitoring and facilitates public accountability (if applicable).
- **FSs in public disclosures and listing rules.** In the case of publicly listed mining companies, feasibility studies should comply with securities disclosure requirements in line with international listing rules. This ensures that the FS is accurate, independently verified and publicly disclosed according to standards like NI 43-101 or JORC, protecting investors and maintaining market integrity.

Table 5.5. Sample legal text: feasibility study requirement.

Sample legal text – Mining Act Amendment

Section Y: Feasibility Study Requirement

1. An application for a mining lease shall be accompanied by a Feasibility Study.
2. The Feasibility Study shall include and demonstrate:
    i) resource and reserve estimates with classification
    ii) final mine design and processing flow sheets
    iii) environmental and social impact assessments
    iv) capital and operating cost estimates
    v) the financial model, including NPV, IRR, payback period
    vi) risk assessment and mitigation plans.
3. The Feasibility Study shall be prepared by a Qualified or Competent Person.

6. Level of Detail in the Pre-feasibility Study and the Feasibility Study

The depth or level of feasibility assessments is not the same across every mining project. These assessments are dependent on, and proportional to, several interrelated factors – such as project scale and complexity, stage of resource development, perceived risk and uncertainty, regulatory requirements, and financing needs. A 'one-size-fits-all' approach could lead to either PFS or FS overspending, with studies covering areas that are not required, or to underpreparing PFS and FS, with studies not satisfying the requirements or providing necessary information to inform sound decisions. These factors that determine the required level or scope of FS analysis include the following.

- **Project scale.** Small-scale or pilot mining projects, such as artisanal operations or short-life mines, may only require a simplified or abbreviated FS, focusing on basic technical, economic and environmental aspects, especially if self-funded or under light regulatory regimes. In contrast, large-scale projects with major capital investments or multi-million-tonne deposits require a comprehensive, multidisciplinary FS with full engineering design, detailed financial modelling and extensive ESG assessments to justify significant investment and long-term development.
- **Stage of exploration or geological confidence.** Early-stage projects, such as those with inferred or partially indicated resources, are typically limited to utilising or scoping or early PFS, requiring lower confidence levels and broader assumptions. Advanced-stage projects, such as those with indicated or measured resources, typically develop a full PFS or FS with more specific engineering designs and cost estimates, and should demonstrate proven and probable reserve estimates for financing and permitting.
- **Risk profile.** Low-risk projects with known geology and existing infrastructure, and those in stable jurisdictions, may justify smaller or more streamlined PFS and FS efforts. Projects that are high risk, because of factors such as remote location, politically unstable jurisdictions, complex geology and ore bodies, commodity price volatility, or ESG issues, require deeper or more expanded multidisciplinary assessments, to reduce uncertainty, paying keen attention to alternative project scenarios, expanded risk mitigation plans and with greater sensitivity analysis.
- **Financing strategy.** Privately funded or joint venture (JV)-funded projects, which typically apply to smaller ventures, may proceed with a simplified PFS, depending on investor risk appetite, and may require less detailed studies. On the other hand, projects targeting equity investors, bank debt or public equity markets require a definitive FS for high-capital projects, where verified reserve statements are provided, CAPEX and OPEX estimates are included, and ESG due diligence is carried out. The FS in these cases must have a high confidence level and are typically compliant with standards such as NI 43-101 (Canada), JORC (Australia) or SAMREC (South Africa).
- **Regulatory or legislated requirements.** Some jurisdictions or countries, such as Botswana and Ghana, legally require formal feasibility documentation before licensing or mining permits are issued. Other countries may apply proportional permitting (staggered submissions or modular approvals), allowing different levels of study depending on project size and impact (this often applies for small-scale projects or artisanal mining).

Table 6.1. Summary matrix for feasibility study depth by project type

Project type	Recommended feasibility level	Depth of analysis	Justification	Jurisdiction type	Financing method
Small-scale local project	Basic PFS or scoping study	Limited detail; focus on conceptual design and rough cost estimates.	Minimal works, low scale development	Stable with simplified permitting	Self-funded or local equity
Junior exploration (early stage)	Pre-feasibility study (PFS)	Moderate technical and financial detail; some assumptions allowed.	Still defining resource and concept	Stable with exploratory licensing	Seed capital or venture capital
Medium-scale with indicated resources	Full PFS	Detailed mine plan, metallurgy, and CAPEX and OPEX estimates (+/- 25–30%).	Demonstrates potential viability, supports investment	Regulated with formal licensing	Private equity or early-stage institutional
Large-scale greenfield project	Definitive feasibility study (DFS)	Comprehensive study with engineering, permitting and reserve declaration (+/- 10–15%).	Required for regulatory approval and financing	Highly regulated and capital intensive	Project finance, strategic partnerships, IPO (initial public offering)
Expansion of existing mine	Targeted PFS or FS update	Update based on existing infrastructure and known reserves; targeted analysis.	Builds on previous infrastructure and reserves	Known permitting path	Internal reinvestment, brownfield capital
High-risk jurisdiction or ESG-sensitive	Enhanced feasibility study with risk and ESG focus	Expanded risk assessment, ESG analysis, legal review, stakeholder engagement.	Additional layers of scrutiny and mitigation	Politically or environmentally sensitive	Blended finance, ESG aligned investors, DFIs

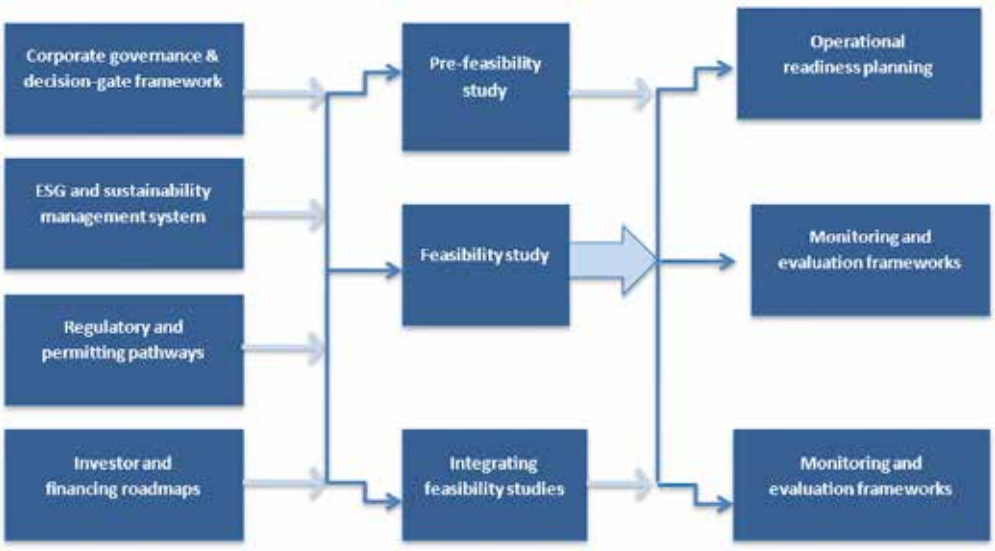
7. Integrating the Pre-feasibility Study and the Feasibility Study into Broader Frameworks

Integrating PFS and FS into broader frameworks ensures that they are not treated as standalone documents, but rather as dynamic tools embedded within the full project life cycle, governance, ESG and investment processes. This integration is increasingly expected by regulators in host countries, investors and development finance institutions, non-governmental organisations (NGOs) and local communities, and from corporate boards of the private companies, and offers various advantages.

By aligning technical, ESG, legal and financial planning, integrating PFS and FS into broader frameworks avoids fragmented planning, enabling adaptive decision-making. This integration also ensures that the FS become a part of an iterative risk management cycle, and facilitates ESG mainstreaming, ensuring environmental and social issues are proactively built into decision choices and decisions. By ensuring board and stakeholder alignment from the early stages, it supports transparent governance and attracts diverse financing, DFIs, blended finance and green bonds.

Feasibility studies should be seen as strategic integration points. When embedded within governance, ESG, financing, permitting and operational systems, they provide the foundation for responsible mine development, resilient project performance and strengthened stakeholder legitimacy (Figure 7.1). Some mechanisms for the integration of PFS and FS into broader frameworks include those shown in Figure 7.1.

Figure 7.1. Diagram showing PFS and FS integration with ESG, financing and permitting.



- **Corporate governance and decision-gate framework:** PFS and FS should be embedded within a stage-gate project development model, ensuring that each study informs board approvals, guides investment committee reviews and supports the achievement of key project milestones. Tables 7.1 and 7.2 detail the type of study required and the related phase in the life cycle of the mining project and how these studies are expected to be utilised by different users, respectively.

Table 7.1. Decision-stage gates and use of studies

Project phase	Type of study required	Decisions/expected outcome
Early exploration	Scoping study	Continue exploration efforts or divest resources
Strategic planning	Pre-feasibility study	Proceed to FS or revise project scope
Investment due diligence	Feasibility study	Secure funding, attract investors, prepare for the development of the mine
Project development	Feasibility study and environmental social impact assessment	Final investment decision, mine construction and operation

Table 7.2. PFS and FS use by entity/user

User/entity	How PFS and FS are utilised
Lender	To evaluate project bankability and debt-servicing capacity.
Investor	To assess risk versus reward of the project, resource quality and quantity, potential cash flows and ESG alignment.
Government	To approve mining licenses or permits and ensure environmental/social compliance.
NGOs/CBOs (community-based organisations) / communities	To understand local impacts, benefits and mitigation measures.
Internal company board	To approve capital allocation and strategic alignment.

- **Regulatory and permitting pathways.** Feasibility Study milestones should be aligned with environmental and social impact assessment (ESIA) submission schedules, with permitting requirements, such as water access, biodiversity safeguards and indigenous land considerations systematically incorporated into the study scope.
- **ESG and sustainability management systems.** Pre-feasibility and feasibility studies can serve as delivery tools for ESG objectives by integrating climate resilience planning, human rights due diligence and net-zero commitments, while also aligning outcomes with international frameworks such as the IFC Performance Standards, The Initiative for Responsible Mining Assurance (IRMA), International Council on Mining and Metals (ICMM), and the UN SDGs.
- **Investor and financing roadmaps.** The FS should directly inform project finance documentation, investment prospectuses and IPO disclosures, while also providing the foundation for lender technical assessments and ESG due diligence.
- **Operational readiness planning.** The FS can be used to initiate early procurement strategies, conduct local supplier assessments, design workforce and gender inclusion plans, and establish community development agreements (CDAs) and benefit-sharing mechanisms that build long-term stakeholder value.

- **Monitoring and evaluation (M&E) frameworks.** Assumptions captured in the FS should be translated into key performance indicators (KPIs), environmental and social monitoring systems, and adaptive management frameworks that remain relevant through construction and into operations.

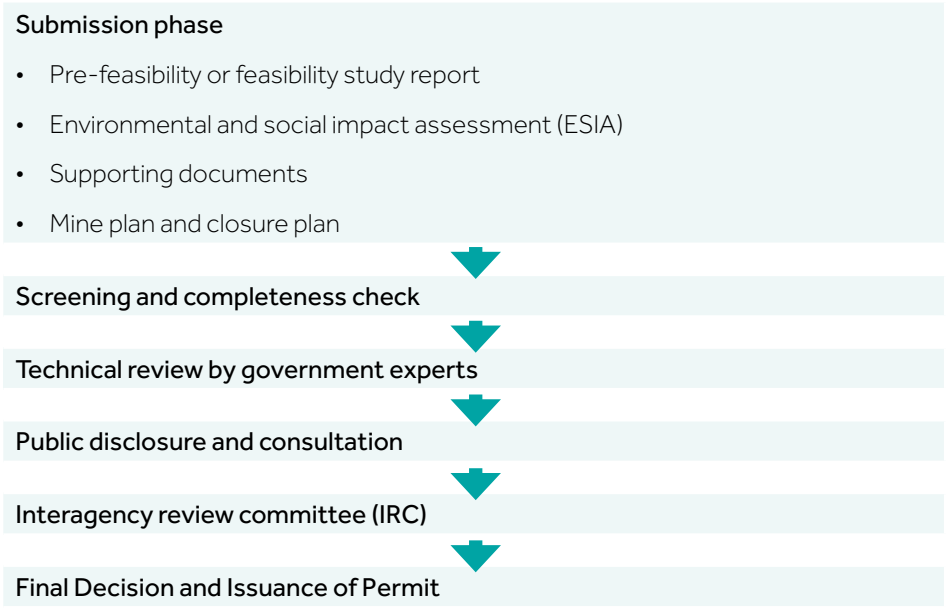
Table 7.3. Practical integration tools and approaches for an FS.

Framework	Integration role
Stage-gate models	Link FS milestones to internal approval and funding decisions.
Environmental and social management system (ESMS)	The FS delivers inputs such as mitigation plans and indicators.
Integrated risk register	FS risk feeds into corporate and ESG risk systems.
Sustainable development roadmaps	The FS identifies ESG targets and sustainability performance pathways.
Lender's due diligence checklist	The FS becomes the technical foundation for ESG compliance evaluation.

8. Review Procedures for the Pre-feasibility Study and the Feasibility Study

The review procedure for the PFS and FS by a regulator or host country authority often varies by jurisdiction. Nonetheless, the procedure generally follows a structured, multi-agency process that evaluates technical, legal, environmental, social and economic dimensions before a project is approved. Typically, regulatory review procedures at each stage include those shown in Figure 8.1.

Figure 8.1. Regulatory review process for the PFS and FS



Each of these steps are described in detail below.

- **Submission phase.** This involves documentation being submitted by the company or developer to the mining authority, environmental agency and other relevant bodies such as agencies responsible for water, land and energy (Table 8.1).

Table 8.1. Documents necessary for submission and their purpose

Document submitted	Purpose
Pre-feasibility or feasibility study report	Demonstrates the project's technical and financial viability.
Environmental and social impact assessment (ESIA)	Is required for permitting and approval.
Supporting documents (maps, resource statements, etc.)	Provide baseline and contextual data.
Mine plan and closure plan	Show life cycle planning and post-mining land use.

- **Screening and cross-check for completeness.** This phase typically takes 1–2 months (varies by country/region), with an outcome of either a Notice of Acceptance or Request for Revisions. This is carried out in two steps.
    i. Administrative review. This confirms all required documents are received.
    ii. Screening for major deficiencies. This ensures technical, legal and ESG elements are covered.
- **Technical review by government experts.** This involves a review by technical experts within the government, which may also include the use of technical advisers or third-party consultants and often includes site visits and stakeholder consultations.

Table 8.2. Key review areas and institutions involved for review.

Review areas	Key institutions involved
Mining and processing plans	Mining Authority, Geological Survey
Financial viability	Ministry of Finance, Investment Authority
Environmental and social risks	Environmental Agency, Labour Ministry, Social Affairs
Community and land issues	Land Commission, Indigenous Affairs Office (if applicable)
ESG and human rights	Specialised committees or inter-ministerial panels

- **Public disclosure and consultation.** ESIA and FS summaries or full documents are disclosed publicly (online, via gazettes, local offices or newspapers), and community/public consultations and/or hearings are held. These comments are recorded and eventually integrated into the final evaluation. This process may also be required by law in some Commonwealth jurisdictions, such as Canada, Ghana, Papua New Guinea (PNG) and South Africa.
- **Interagency Review Committee (IRC).** Also called a Minerals Board Review, a joint review of the submission is carried out by a multidisciplinary team, which may include investors or development partners as observers, particularly in high-profile projects. Typical steps for this process include:
    i. Multidisciplinary review meeting. This ensures alignment between mining, environment, land and finance agencies and any other relevant agency.
    ii. Risk-benefit evaluation. This balances national interests, local impacts and economic gains and determines the net positive effects for the country.
    iii. Final recommendations. These may require PFS or FS revisions or additional studies.
- **Final decisions and issuance of permits/licences.** The final decision may be subject to certain restrictions/conditions for operations and development, such as the inclusion of monitoring plans, local content or local hiring thresholds. Typically, the approval process can take between 3 and 12 months, with the timeline being highly dependent on the jurisdiction and the project scale.

Table 8.3. Decision types and issuing agencies.

Decision types	Issued by
Mining license or lease or permit	Ministry of Mines/Mining Cadastre Office
Environmental clearance (EIA certificate)	Environmental Protection Agency or equivalent
Land use and water permits	Land/Water Boards or Lands Commission

Post-approval compliance and reporting. FS implementation is monitored by quarterly or annual reports submitted by the company or the operator, along with environmental and social audits, and can include independent verification, particularly in DFI-supported projects.

9. Structure and Core Components of the Model Guidelines

The *Commonwealth Model Mining Feasibility Study Guidelines* ('the *Guidelines*'), published alongside this paper, are structured to reflect the full lifecycle of a feasibility assessment, from preparation to submission, to review, and to its final decision. The *Guidelines* clearly set out their objectives and how they may be used. Additionally, they set out the standardised content requirements for technical, economic, financial, environmental, and social components of a study, covering the following specific technical elements.

- Project description and tenure.
- Geological setting and deposit type.
- Exploration data, sampling and data verification.
- Mineral resource and reserve estimates.
- Metallurgical and processing methods.
- Mining methods and production (including human resource and management plans, procurement plans, gender and inclusion analysis, and the implementation schedule).
- Infrastructure and logistics.
- Environmental impacts (including environmental and social considerations, climate risk and resilience assessment, and a greenhouse gas emissions and decarbonisation strategy).
- Social impacts (including human rights due diligence, conflict sensitivity assessment, a community development and social licence strategy, consideration of indigenous peoples and free, prior and informed consent (FPIC) where applicable, and a stakeholder engagement plan).
- Project economics.
- Project schedule, planning and execution.
- Other information.
- Recommendations.

The presentation of each element includes an explanatory note to help understand the rationale for its inclusion. These elements form a practical reference that countries can adapt to their legal frameworks and capacity realities. They are intended to assist governments in answering the core questions that a mining feasibility study is expected to answer, which include the following.

1. Can the project work? Is the geology proven, is the mine plan technically sound, and can the resource be extracted safely?
2. Will the project deliver value? Are the economics robust, will the project contribute to national revenues and local benefits, and are financial risks well understood?
3. Is the project sustainable? Have environmental and social risks been properly assessed, are communities engaged and does the project advance long-term development rather than short-term gain?

10. Conclusion

Sound regulation of the mining sector requires governments to base licensing and approval decisions on a clear and consistent understanding of project risks, trade-offs and long-term implications. Pre-feasibility studies (PFSs) and feasibility studies (FSs) are central to this task. They contain the core technical, economic, environmental and social information that determines whether a proposed mining project is viable, under what conditions it should proceed, and how its benefits and risks are likely to be distributed over time. Where these studies are poorly defined, inconsistently required, or weakly assessed, regulatory decisions risk being made without adequate evidence or alignment with national development objectives.

The Commonwealth Model Mining Feasibility Study Guidelines provide governments with a practical tool for establishing minimum expectations for the scope, content and timing of feasibility studies submitted in support of mining applications. This paper, *Understanding Mining Feasibility Studies,* complements those *Guidelines* by equipping regulators with the conceptual and analytical foundation needed to interpret and apply them effectively. It clarifies how the PFS and FS are prepared, what distinguishes them at different stages of project development, and how their assumptions, uncertainties and limitations should be assessed in a regulatory context.

Together, the *Guidelines* and this paper support a more deliberate and informed use of feasibility studies within licensing systems. They assist regulators in asking the right questions, identifying gaps or inconsistencies in submitted studies, and linking feasibility findings to downstream regulatory decisions, including environmental approvals, fiscal terms, community development obligations, and project monitoring arrangements. Strengthening this capacity enables governments to engage more confidently with project proponents, negotiate more balanced outcomes, and reduce the likelihood of approving projects that later prove unsustainable or unviable.

This regulatory capability is especially important in the context of the global energy transition, where demand for critical minerals is accelerating and project timelines are often compressed. By embedding clear PFS and FS expectations within licensing frameworks, governments can ensure that speed does not come at the expense of due diligence, public interest or long-term development outcomes.

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Understanding Mining Feasibility Studies encourages governments to treat feasibility studies as more than mere technical documents. Rather, they are opportunities to understand and address the risks – including environmental liabilities, community concerns, unrealistic cost assumptions and infrastructure gaps – that often cause difficulties for even the most promising projects.

This paper supplements the *Commonwealth Model Mining Feasibility Study Guidelines* by providing the conceptual underpinnings and governance frameworks required for their consistent interpretation and use. It defines pre-feasibility studies and feasibility studies and positions them within the overall project development process and wider institutional and regulatory frameworks; delineates the expected depth and quality of information; and highlights recurring limitations and risks that government reviewers should be prepared to assess.

It also considers how regulators should assess each study, including typical constraints and the implications for permitting and oversight, and outlines expected levels of detail at each stage.