GROUP ENVIRONMENTAL STANDARD 1 REHABILITATION AND MINE CLOSURE

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1. INTENT

IGO is committed to the progressive rehabilitation of our mine sites and exploration areas. Furthermore, at some point, all mine sites and exploration areas must be closed and rehabilitated. This Standard details the requirements for planning and management of rehabilitation and closure activities in line with IGO's Values and our Environmental Policy.

2. APPLICATION

This standard shall apply to all IGO operations, projects, and exploration areas. All IGO sites and exploration projects shall comply with the provisions of this standard, and all relevant legislative requirements for each location.

For the purpose of this standard, the term 'mine site' shall be taken to include exploration areas.

3. OBJECTIVES & REQUIREMENTS

IGO's overarching rehabilitation and closure objectives are:

a) To ensure rehabilitated mines and exploration project areas are (physically) safe to humans and animals, geo-technically stable, geo-chemically non-polluting & non-contaminating, and are capable of sustaining an agreed post-mining land use,

b) To minimize closure liability by minimizing our impacts and completing progressive rehabilitation, and

c) To ensure our reputation is preserved or enhanced through the full 'life-cycle' of mining.

4. CLOSURE STRATEGY

IGO will ensure that a closure strategy is developed and maintained for each mine site and exploration project, such that IGO is prepared and understands the work required, and hence the cost of affecting the closure of each mine site or exploration project.

The closure strategy is the process by which the site will work towards obtaining agreement on, and thereafter achieving the 'completion criteria'. Completion criteria include both a 'basis of design' (BoD) and an agreed set of indicators which, upon being met, will demonstrate successful closure of a site. Typically, closure criteria are developed in consultation with both internal and external stakeholders, and generally must be approved by the site's regulating agency. For new mines and exploration projects, the completion criteria must be defined prior to the commencement of mining or other land disturbance. For existing mines, completion criteria are to be completed no later than five years prior to the end of the Life of Mine (LOM) Plan.

Planning for mine closure must be fully integrated in the life of mine planning, and should start as early as possible and continue through to final closure and relinquishment. For new projects, closure planning should start in the project feasibility stage (before project approvals).

The Closure Strategy must explicitly include Progressive Rehabilitation (Section 5).

The Closure Strategy must be documented in the Mine Closure Plan (Section 6).

5. PROGRESSIVE REHABILITATION

Progressive rehabilitation is defined as the rehabilitation of land disturbed by the Company's activities, the rehabilitation of new landforms created by the Company, and the disposal or demolition and rehabilitation of mining or process facilities, or parts thereof, as and when they become available for rehabilitation.

Progressive rehabilitation involves the staged treatment of disturbed areas during exploration, construction, development and mining operations as soon as these areas become available, rather than undertaking large scale rehabilitation works at the end of planned exploration and/or mining activities.

At an operational mine site, some rehabilitation works cannot commence until the end of the mine's operational life. However, IGO is committed to the completion of progressive mine site rehabilitation when practicable. Consequently, IGO requires that:

- Mine planning and scheduling include consideration of the opportunities to complete progressive rehabilitation.
- A 5-year progressive mine rehabilitation plan be maintained, and that the plan supports the Closure Strategy (Section 4).
- In so far is practical, progressive rehabilitation of available disturbed land or new landforms is completed as part of annual planned works.
- Annual operational budgets provide for progressive rehabilitation works.

In general, land, landforms or a facility, or parts thereof, shall be deemed available when:

- The current mine plan will result in no further work in a disturbed area or new landform within the coming three years, or
- Land, landforms or a facility, or parts thereof, have not been used in the preceding five years.

Mine planning and engineering decision-making processes should identify opportunities for progressive rehabilitation consistent with the post-mining land use(s) and closure objectives.

Progressive rehabilitation activities should be fully integrated into the day-to-day mining operations to ensure materials and resources are available to undertake the work required, and should include:

- The construction of landforms and drainage structures to a predefined basis of design.
- Estimating, reconciling, and scheduling rehabilitation material inventories such that materials required for mine closure are not wasted or lost.
- Revegetation research and trials are completed through the life of mine such that proven rehabilitation techniques have been established prior to mine closure.
- Inherited or other historic mine areas are rehabilitated as soon as possible.

Note: The intention of the above requirements is to avoid the historic practice of deferring rehabilitation indefinitely based on the rationale that the land or facility may be used at some indeterminate time in the future. This approach defers cost but creates a larger final liability and is contrary to accepted best practice.

6. DOCUMENTED MINE CLOSURE PLAN

IGO will ensure that all IGO mines have a Closure Plan.

Individual exploration projects do not require a closure plan. Rather the IGO Exploration team must maintain a closure plan addressing all exploration projects.

The structure and content of Mine Closure Plans are often defined in statutory regulation. Where such regulation exists, the plans should be structured accordingly. However, as a minimum requirement, IGO mine closure plans must contain the following information:

- the Closure Strategy (Section 4);
- the specific aspects and impacts listed in Appendix 1;
- the scope of work required (task register) to achieve the Completion Criteria in accordance with statutory regulations and IGO Environmental Standards;
- a Basis of Design for each domain requiring major earthworks. Specifically, with regard to mines, a final landform design must be established for each tailings storage facility (TSF) and waste rock dump (WRD). Cut and fill volumes must be determined to produce final landforms for likely as-built structures or disused structures; material sources must be defined; and demolition quotes must be sought, thus enabling quantitative closure costing;
- a schedule of works based on a current LOM Plan, and must clearly define i) the schedule of progressive rehabilitation works and ii) the schedule of closure works post the cessation of production; and
- document arrangements for a 'care and maintenance' scenario in anticipation of such circumstances prior to active mine closure.

6.1 Level of Detail

In recognition of the mining life cycle, closure planning and the associated cost estimation should be refined over time. The level of detail and accuracy of planning must increase as the project moves from feasibility, into construction and during operation to closure. Table 1 provides guidance on the elements that must be completed at each stage.

Table 1 - Level of Closure Plan Detail

Project stage	Key components to captured in the closure plan
Feasibility	A clear understanding of known and potential impacts that must be remediated or mitigated at closure or during progressive closure works.
Pre-Construction Approvals	A fully defined Closure Strategy
Operations (LOM >10 years)	Work program required to obtain an understanding of the specific aspects and impacts listed in Appendix 1
Operations (LOM 5-10 years)	A defined schedule of progressive rehabilitation works A defined schedule of work (including rehabilitation trials) to obtain approval of closure criteria.
Operations (LOM <5 years)	Efficacy of trials demonstrated to State and stakeholders Internally and externally approved closure criteria Final landform designs developed

Operations (LOM <6 month)	Care & Maintenance Plan established A defined schedule of closure works
Announcement of Closure	Scope of work for tenders finalized.

6.2 Obligations and commitments

A mine closure plan must include an Obligations Register. The register must contain a list of all specific legal obligations and public commitments relevant to rehabilitation and closure at a given mine site. The register should form part of the IGO's overarching legal register for all operations on the site.

6.3 Stakeholder Engagement

Stakeholder engagement is a key component of mine closure planning. Early and continuous engagement with stakeholders enables operators to better understand and manage stakeholder expectations and the potential risks associated with closure. Failure to undertake a stakeholder engagement program may compromise the approval process and mine closure outcomes.

An IGO mine closure plan must include:

- a register of all stakeholders relevant to mine closure planning;
- reference the site's Stakeholder Engagement Plan; and
- reference the site's records of stakeholder engagement regarding mine closure planning.

6.4 Data collection and analysis

In overview, our capacity to successfully effect mine closure is premised on IGO possessing:

a) a sound understanding of the environment in which we are operating; and

b) a clear understanding of the mines known and potential impacts.

With this information we can then consider post-mining land use, closure objectives, & closure criteria (refer to 6.8).

6.4.1 Baseline Data

An IGO mine closure plan must:

a) reference the baseline studies completed prior to the commencement of mining; and

b) include ongoing studies to assess the mine's spatial and temporal impacts during operations.

The Mine Closure Plan must provide a summary of the best available data on aspects of the physical and biological environments, as well as the social and economic aspects (where relevant) that are critical for successfully meeting mine closure outcomes. The following information should include (where relevant and as determined by the impact assessment):

- Local climatic conditions and projected future climate change for the area;
- Local physical conditions – topography, geology, hydrogeology, hydrology, seismicity and geotechnical data;
- Local and regional environmental information on flora, fauna, ecology, communities and habitats;
- Local water resources details – type, location, extent, hydrology, quality, quantity and environmental values (ecological and beneficial uses); and
- Soil and waste materials characterisation – soil structure and stability (e.g. erodibility), growth medium type and block modelling of waste materials; solubility, mobility and bioavailability of hazardous materials (e.g. radioactive materials, heavy metals and materials with potential to produce contaminated drainage).

Comprehensive characterisation of materials (including soils and wastes) is critical to effective closure planning and successful progressive rehabilitation. This process should start during the exploration phase and continue throughout the life of the mine. Characterisation of materials allows for separation and selective placement of materials considered beneficial to rehabilitation and materials that may inhibit rehabilitation.

Note: The ongoing characterisation of the geochemical properties of the waste rock streams and tailings is central to effective closure planning. Materials characterisation should include the identification of materials with potential to produce acid, metalliferous or saline drainage, dispersive materials, erosive rock, fibrous and asbestiform materials, and radioactive materials, as well as benign materials intended for use in mine rehabilitation activities. The identification of good quality rehabilitation material (e.g., benign, fresh rock) should also be completed.

6.4.2 Other closure related data

An IGO mine closure plan must address as relevant:

- Design and construction of landforms and voids, including a diagram or map showing the final landform design concept based on the post-mining land use(s), to illustrate in visual form (e.g., a 3D diagram/map or a cross-sectional diagram/map) what the surrounding landscape and the final landforms will look like post-mining;
- Availability and volumes of key materials required for rehabilitation such as competent waste rock, subsoil, topsoil and low-permeability clays (i.e., encapsulation material);
- Relevant scheduling information with respect to material stockpiling and deployment to ensure that rehabilitation materials mined early in the process are appropriately segregated and preserved for later use;
- Mathematical models to predict long term performance or environmental impacts (specifically inclusive of long term erosion modelling);
- Revegetation and habitat restoration trials, and
- Lessons from closure experience generated from other mines

Relevant technical reports must be referenced in the Mine Closure Plan.

6.4.3 Data analysis and implications for mine closure

Analysis of the collected data is a critical element in understanding the issues impacting mine closure and identifying knowledge gaps. Knowledge gaps should also be included in the risk assessment. This will enable the information gaps to be prioritised and acted upon appropriately.

Where appropriate, the data analysis should take into account the natural background levels of particular elements (such as naturally occurring radioactive materials or heavy metals) and possible environmental impacts from other sources including nearby mining operations and other land uses which may affect the closure strategy or management of the site.

The Mine closure plan must include data analysis and discussion on the implications for progressive rehabilitation and closure.

6.5 Identification and management of closure issues

Beyond those matters defined in Appendix 1, Mine Closure Plans must provide adequate information on the processes and methodologies undertaken to identify the closure issues and their potential environmental impacts post-mining, and must propose workable management mechanisms. This will allow strategies, mitigation measures and closure designs to be developed and refined, assessed and reviewed in the years leading up to closure and will address standard or site-specific management of inherent issues as well as identifying any continuous improvement actions which may be required to mitigate any residual issues.

This process should be integrated with the stakeholder engagement process (see Section 6.3) and should take into account concerns from key stakeholders and learnings from previous experience. The information can be presented in a tabulated format and included as an appendix.

Detailed information on the key issues and mitigation/management measures should be provided in the text, where applicable. Depending on the size and complexity of the project, this may be done across the whole project/site or broken down into domains or features.

6.6 Risk Assessment

The Mine closure plan must include a closure risk assessment.

Consistent with a risk-based approach, IGO requires a structured risk management process to be undertaken to identify, assess and manage the potential risks associated with closure issues, particularly those identified in Appendix 1.

This approach allows a systematic review and analysis of risk and cost benefit in both engineering and environmental terms, as well as identification of opportunities associated with closure. The risk assessment process must adhere to IGO Common Management System Standard 3 – Risk Management.

6.7 Research, investigation, and trials

IGO is committed to the completion of such research, investigation and trials as reasonably required to complete rehabilitation and ultimately effective closure of a mine site.

The Mine closure plan must address research, investigation and trials.

6.8 Post-mining land use, closure objectives, & closure criteria

An IGO mine closure plan must address post-mining land use, closure objectives, & closure criteria. The post-mining land use and closure objectives must be defined first as they are necessary to provide the basis for developing completion criteria.

6.8.1 Post-mining land use

The post-mining land use(s) must be defined. The use(s) must be:

- Relevant to the environment in which the mine will operate or is operating;
- Achievable in the context of post-mining land capability;
- Acceptable to the key stakeholders (land owners and regulators); and
- Ecologically sustainable in the context of local and regional environment.

Agreed end land use(s) may change as new iterations of the Mine Closure Plan are developed over the mine life and as more information is acquired through progressive rehabilitation and continued stakeholder engagement.

The Mine Closure Plan should identify all potential (or pre-existing) environmental legacies (including contaminated sites) which may restrict the post-mining land use.

In the early stages of a mining project, it may be acceptable for provisional or proposed post-mining land use(s) to be identified, provided that there has been adequate engagement with the key stakeholders and that there is a clear process and timeline to further identify or refine the agreed post-mining land use(s), as part of the stakeholder engagement process.

6.8.2 Closure objectives

The Mine Closure Plan must include Closure Objectives.

Closure objectives define the closure outcomes for the project and should be realistic and achievable. These objectives must be developed based on the proposed post-mining land use(s) and be as specific as possible to provide a clear indication to Government and the community on what the proponent commits to achieve at closure. Development of closure objectives should consider each of the environmental factors impacted by the operation. They may include, but should not be limited to, compliance, landforms, revegetation, fauna, water, infrastructure and waste. The ability to specify closure objectives will depend on the amount and quality of the environmental data collected at the time. Therefore it is essential that adequate baseline data, such as materials characterisation, flora and fauna surveys, and/or the best available data are used for this purpose.

At the project approval stage, it may be acceptable for the closure objectives to be more broadly identified and further refined in the stakeholder engagement process, provided that they are based on the best available data at the time and specific enough to guide closure development and design.

6.8.3 Closure Criteria

The Mine Closure Plan must include Closure Criteria.

Closure Criteria are indices used to assess the success or otherwise of rehabilitation and mine closure.

Closure Criteria must be:

- developed in consultation with key stakeholders.
- specific enough to reflect a unique set of environmental, social and economic circumstances;
- measurable to demonstrate ecological restoration is trending towards analogue indices;
- achievable or realistic so that the criteria being measured are attainable;
- relevant to the objectives that are being measured and the risks being managed and flexible enough to adapt to changing circumstances without compromising objectives; and
- Time-bound so that the criteria can be monitored over an appropriate time frame to ensure the results are robust for ultimate relinquishment.

Development of completion criteria and associated performance indicators must commence upfront in the project approval stage for new projects or as early as possible for existing operations, and be reviewed and refined throughout the development and operation of the project to respond to monitoring, research and trial information and any other information or change as appropriate.

In developing closure criteria, the closure plan must identify criteria that inform the design and construction of final landforms, voids and ecosystems, and upon being met, will demonstrate achievements of closure objectives of the mine being closed. The final landforms, voids, and ecosystems must be designed and constructed in the context of the agreed land use and closure objectives. The closure criteria should include performance indicators to demonstrate that rehabilitation trends are following the predicted performance, particularly where mathematical modelling is utilised to predict any long term environmental impact (usually 300 years or longer). Where applicable, details on the mathematical modelling including assumptions and limitations should be provided as an appendix to the Mine Closure Plan.

6.9 Suspended operations under care and maintenance

For operational mine sites, five years or less from closure, the Mine Closure Plan must include a basic plan for care and maintenance given that operations must be suspended temporarily.

6.10 Decommissioning

For operational mine sites nearing the end of mine life, the Mine Closure Plan must include a decommissioning plan. This should include information on:

- The safe demolition and decommissioning of plant and infrastructure;
- Construction of final landforms and drainage structures;
- Completion of rehabilitation;
- Compliance with the requirements of the Contaminated Sites legislation including remediation of contaminated areas; and
- Ongoing monitoring and measurement against closure criteria.

6.11 Post closure monitoring and maintenance

The Mine Closure Plan must include appropriate detail on closure performance monitoring and maintenance framework during the post closure phase of mining, including the methodology, quality control system and remedial strategy.

The performance monitoring results must be reported annually. The report must document progress against the agreed closure criteria and rehabilitation targets. Any remedial action taken where the results are outside the agreed targets must also be reported.

A minimum monitoring period after closure should be provided for in the Mine Closure Plans, usually in the order of 10 years.

7. REVIEW OF MINE CLOSURE PLANS

Mine closure plans should be updated annually as required.

Mine closure plans must be comprehensively reviewed and the cost estimates revised:

- at least every three years, or
- when there is a material change to the life of mine or the scale of operation, or
- as directed by the State.

8. RESPONSIBILITIES: CLOSURE PLANNING & IMPLEMENTATION

It is the responsibility of the Resident Manager ensure that their site has a current Mine Closure Plan.

It is the responsibility of the Chief Operating Officer (COO) to direct the Resident Manager to implement the Closure Plan.

9. PUBLIC AVAILABILITY OF MINE CLOSURE PLANS

As a general principle, IGO will make Mine Closure Plans publicly available. However, approval of the release of any given document shall only be permitted subject to the approval of the COO.

10. CLOSURE COSTING & PROVISIONING

10.1 Cost Estimation

Closure costing shall be completed using the standard *IGO Group Financial Standard 1 – Provisions for Mine Closure*.

The cost estimate must include two components; a) a cost estimate based on the current rehabilitation obligations (ie the liabilities associated with the site should closure be immediately required), and b) the cost estimate based on the rehabilitation requirements for the site given LOM works are completed to plan (ie LOM planned closure costs).

Cost estimates must be based on a defined ‘basis of design’ and thereafter reference physical quantities as determined by survey (preferably LiDar and aerial imagery).

Where the LOM exceeds five years, cost estimates requiring production rates for equipment shall use production and construction handbooks (eg Caterpillar Performance Handbook, or Rawlinsons Australian Construction Handbook).

Where the LOM is less than five years, cost estimates for all earthworks, contaminated site clean-up and demolition shall be based on third party quotes.

Note: All costing shall be completed on the basis that closure earthworks and demolition works will be completed by contracted third parties.

Note: All Exploration projects must include a provision for closure.

Note: In Western Australia, Mine Rehabilitation Fund payments as required under the Mining Rehabilitation Fund Act 2012 and the Mining Rehabilitation Fund Regulations 2013 are determined on the based on a closure cost evaluation developed using a formula provided by the state. It should be noted that this methodology is not adequate for the estimation of closure liabilities.

Note: The process and methodology for calculating the cost estimates must be transparent and verifiable. In many jurisdictions (including WA) the state may require a fully detailed closure costing report to be submitted for review, and/or an independent audit to be conducted on the report to certify that the company has adequate provision to finance closure.

10.2 Accuracy of Costing

In recognition of the mining life cycle, closure planning and the associated cost estimation should be refined over time. The level of detail and accuracy of planning must increase as the project moves from feasibility, into construction and during operation. Cost estimation should follow the project development outlined in Table 2.

Table 2 – Closure Cost Methodology and Accuracy for Various Stages of the Project

Project Stage	Closure Cost Methodology	Closure Cost Estimate Accuracy
Feasibility	Indicative	+/- 30%
Construction	Closure liability calculator	+/- 25%
Operations (LOM >10 years)	First principles	+/- 20%
Operations (LOM 5-10 years)	First principles, earthwork costs quantified	+/- 15%
Operations (LOM <5 years)	Market derived estimates, including earth working and demolition quotes	+/- 10%
Operations (LOM <6 months) and into Care & Maintenance	Quotes on all works	+/- 10%
Closure (Passive or active)	Executed closure contracts	

10.3 Closure Cost Estimate Report

Each site shall prepare a Closure Cost Estimate Report presenting the cost estimate associated with the Mine Closure Plan.

The Closure Cost Estimate Report must address:

- Major risks and or assumptions associated with the closure cost estimate
- Major opportunities to improve the accuracy of the estimate
- Cost estimate basis

These reports must conform to the IGO standard format for such reports. Refer to the IGO Group Environment Manager.

10.4 Provisioning

IGO Group Finance Standard 1 –Provisions for Mine Closure defines IGO's requirements for the establishment, maintenance and management of Mine Closure Provisions (MCP) for closure, environmental rehabilitation, and asset retirement costs. This standard provides specification on:

- the initial recognition of a closure or liability,
- the development and subsequent revision of a MCP, and
- management of expenditure from the MCP.

11. DATA MANAGEMENT

IGO will maintain a database for each domain or feature, where all available information is collated and reviewed with the objective of building a "base" of information for that particular domain or feature. Information may include, but not be limited to, the current status of the domain or feature, information from spatial datasets and databases, design and construction information, operation and monitoring information or other information that meets a specific purpose (e.g. maps, area statistics, species lists or modelled environmental impacts). All technical reports should be referenced and included in the database.

12. RELATED DOCUMENTS

IGO Group Finance Standard 1 –Provisions for Mine Closure

13. APPENDIX 1 MATTERS TO BE ADDRESSED

IGO Mine closure plans must specifically address the following matters as relevant to the site:

- Hazardous materials;
- Hazardous and unsafe facilities;
- Contaminated sites;
- Acid and metalliferous drainage (AMD);
- Radioactive materials;
- Fibrous (including asbestiform) materials;
- Non-target metals and target metal residues in mine wastes;
- Management of mine pit lakes;
- Adverse impacts on surface and groundwater quality;
- Dispersive and sodic materials;
- Land form geotechnical stability, erosive materials and the long-term erosion of landforms;
- Design and maintenance of surface water management structures;
- Dust emissions;

- Flora and fauna diversity/threatened species;
- Challenges associated with rehabilitation and revegetation;
- Visual amenity;
- Heritage issues;
- Alteration of the direction of groundwater flow;
- Alteration of the depth to water table of the local superficial aquifer; and
- Alteration of the hydrology and flow of surface waters.

Note on materials characterisation: Adequate characterisation of materials is critical to the identification and management of closure issues, and should include potentially problematic materials (such as acid-generating or sulphidic mineral waste, sodic, radioactive and asbestiform materials). Proponents should estimate the location of problematic materials and the amount that may be disturbed during operations. Characterisation of materials should also be carried out for the benign materials intended for use in mine rehabilitation activities so that the physical, chemical and nutrient characteristics of the material is sufficiently well understood to ensure it will perform according to planning expectations. The volumes of rehabilitation materials required to fulfil closure plans should be reconciled against inventories.

Note on contaminated sites: When assessing closure issues, the potential for contamination over the life of a mine needs to be considered so that the contamination can be removed, treated, contained or managed to meet the purposes of the agreed post-mining land use(s) and where practicable, to maximise the beneficial use(s) of the land after mining. To ensure compliance with the CS Act and Contaminated Sites Regulations 2006, closure strategies will need to be designed to incorporate investigation and remediation of contamination.