



Standard 4

4 WASTE ROCK MANAGEMENT STANDARD

4.1 STANDARD

The purpose of this Standard is to define the requirements for the management of waste rock (i.e., mineral waste) to prevent any adverse environmental impacts, the re-handling of mineral wastes, to promote beneficial post-mining land uses and to reduce post-mining reclamation and closure liabilities.

This Standard covers waste rock disposal facilities and other infrastructure utilising waste rock for construction (e.g., haul roads, dams etc.), as well as ore stockpiles (relating to their potential to generate acid), site quarries and borrow material from excavations.

This Standard addresses the characterisation of waste rock, design and construction of waste rock disposal facilities, management of potential acid generation from waste rock, stormwater controls, monitoring, reclamation and closure.

4.2 CRITERIA AND REQUIREMENTS

4.2.1 Regulatory Compliance

Waste rock disposal facilities shall be designed, constructed, rehabilitated and closed in compliance with all relevant in-country regulatory requirements, licence conditions and any other applicable requirements.

4.2.2 Determination of Acid Rock Drainage Potential

Waste rock shall be physically and geochemically characterised prior to the design of waste rock disposal facility, during operations and where applicable, during reclamation and closure phases.

Acid rock drainage (ARD) potential shall be determined using reliable and proven acid-base accounting methodologies, inclusive of the leaching of harmful contaminants at near-neutral pH.

4.2.3 Baseline Conditions

Area baseline conditions shall be determined prior to siting and design of a waste rock disposal facility. Baseline conditions shall be determined through technical studies that address geographic and temporal variations. These studies shall include at a minimum: groundwater and surface water hydrology, meteorological, flora, fauna, cultural heritage, geology, seismicity and soils.

4.2.4 Waste Rock Management Plan

Sites with known net acid generating ore and waste rock shall develop, implement, communicate, adhere to and maintain a Waste Rock Management Plan that defines all relevant strategies, operational controls and management practices for all phases to ensure that the potential and actual impacts of ARD are minimised.



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Sites shall consider and document relevant waste rock and impacted drainage risks during site management of change processes. Sites shall also consider and document waste rock and impacted drainage risks during the technical and financial evaluation of relevant capital projects.

4.2.5 Waste Rock Disposal Facility Design

Waste rock disposal facilities shall be designed, constructed and operated to:

- incorporate control measures to minimise the generation of acid;
- prevent the release of pollutants to the receiving environment, including surface runoff, toe seepage and infiltration to groundwater;
- be geotechnically stable. A minimum factor of safety of 1.3 for static and 1.0 for pseudo-static conditions is required. Waste rock design and ongoing disposal practices shall be periodically reviewed (at least biennially) by a qualified engineer; and
- control surface water ingress and run-off during construction, operation, reclamation and closure/post-closure, to ensure slope stability and minimise the generation of low-quality seepage, erosion and sedimentation.

During the design phase, a balance of potentially acid generating and non-acid generating material shall be developed to evaluate and design controls to isolate any potential acid generating material from the environment in the short and long-term, through effective mine planning and formal scheduling of the placement of waste rock. The balance shall be updated annually to assess the adequacy of available material (e.g., topsoil and capping material) for long-term reclamation/closure.

Permanent surface water diversion structures around the perimeter of waste rock disposal facilities shall be sized at a minimum to convey flow from a 100-year, 24-hour storm event. For sites up-gradient of sensitive regions (e.g., habitations, high-value ecosystems, etc.), additional capacity, or protection, shall be considered based on the risk associated with failure.

Designs for waste rock disposal facilities with the potential to generate low quality runoff shall include retention basins sufficiently sized to contain the runoff from waste rock disposal facilities resulting from a 100-year, 24-hour storm event, or greater, depending upon the risk posed by any potential contaminant release from the facility.

4.2.6 Use of Waste Rock for Construction

Potentially acid generating material shall not be used for construction purposes outside of a controlled water management system for which potential adverse impacts will be addressed at closure.

4.2.7 Acid Rock Drainage (ARD) Management

Where ARD risks exist, sites shall characterise and estimate the long-term geochemical and physical behaviour of waste rock dumps.

Where adverse surface ARD and/or elevated contaminants are detected, groundwater monitoring bores shall be installed up-gradient to establish background conditions, and down-gradient to monitor for seepage from the waste rock disposal facility or any other source of ARD.



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4.2.8 Waste Rock and Ore Tracking System

Sites shall develop and implement a waste rock and ore tracking system, inclusive of an inventory comprising quantities, locations and representative characteristics of chemically reactive waste rock.

Where ARD risks exist, sites shall demonstrate that waste rock has been properly characterised and disposed within designated locations of nominated waste rock disposal facilities. Records of waste rock material types disposed at designated waste rock disposal facilities shall be retained for Life-of-Mine (LOM) to support lease relinquishment.

4.2.9 Waste Disposal in Waste Rock Disposal Facilities

Disposal of any non-mineral solid or hazardous waste in the waste rock disposal facility requires a scientifically defensible study to demonstrate that the waste is compatible (i.e., does not adversely affect human health or the environment), complies with laws and permits, and will not compromise reclamation and closure success.

4.2.10 Progressive Reclamation

Stabilisation and/or progressive reclamation activities shall be scheduled and completed as soon as practical after designated areas of the waste disposal facility become available.

Waste rock disposal facility design, construction and operation shall provide for both trial and progressive reclamation.

Waste rock disposal facilities shall be constructed, rehabilitated and closed to ensure geotechnical stability, geochemical stability, to minimise erosion and to leave landforms that are aesthetically acceptable to external stakeholders.

During the reclamation and closure of waste rock disposal facilities, sites shall consider the physical and geochemical characteristics of the waste rock during the design of the cover system (i.e., to control infiltration through and seepage from the waste rock disposal facility).

Cover design for waste rock disposal facilities containing acid forming materials or materials that elevate contaminants, shall utilise suitable predictive models to evaluate suitable reclamation and closure design options (e.g., infiltration, store-and-release, vegetative cover, etc.).

Waste rock disposal facilities shall be closed in accordance with defined reclamation objectives and agreed closure criteria.

4.2.11 Inspection and Monitoring

ARD predictions based on static test results shall be confirmed as part of an ongoing monitoring program using kinetic tests.

Waste rock disposal facilities shall be monitored to verify they are being constructed in accordance with geotechnical design criteria. Waste rock disposal facilities shall be inspected quarterly at a minimum to detect any abnormal conditions such as subsidence and to verify the integrity of controls. Records of these inspections shall be retained.

Waste rock disposal facilities shall be inspected following periods of heavy rainfall. Inspection processes shall document any observed surface ponding, slumping on slopes, discoloration or seepage from the toe. All drainage diversion and sediment control structures shall also be periodically inspected to verify they remain fully operational.

All groundwater monitoring bores located around waste rock disposal facilities shall be periodically monitored.



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Reclamation success criteria and objectives shall be established and monitored to validate agreed reclamation and closure completion criteria in accordance with B2Gold Environmental and Biodiversity Performance Standard 8 – Closure and Reclamation Planning.

4.3 TERMS AND DEFINITIONS

Relevant key terms and definitions that relate to B2Gold's Waste Rock Management Standard are provided below:

Acid Rock Drainage: Drainage of acidic water from facilities that contain acid generating material (e.g., open pits or waste rock disposal facilities). It is caused by the oxidation of sulfide minerals in rock following their exposure to oxygen. Water that percolates through or comes in contact with these minerals becomes acidic and may mobilize metals.

Baseline Conditions: The existing environmental conditions, i.e., the physical, chemical, or biological setting, of a proposed project area prior to disturbance by project-related development.

Closure: The process followed when a site has reached the stage in its life cycle where the intended mining use has been permanently concluded. This generally includes issues such as decommissioning activities, reclamation and revegetation of disturbed areas for long-term physical and chemical stabilisation of the site. This also often includes stakeholder consultation regarding post-mining use.

Closure Success Criteria: An agreed standard or level of performance which demonstrates successful closure of a mine site. Specific milestones that indicate progress towards achievement of mine closure objectives, as agreed with stakeholders.

Decommissioning: The process that begins near or at the cessation of mineral processing and ends with the removal of all unwanted infrastructure and services.

Environmental Impact: Any change to the environment whether adverse or beneficial, wholly or partially resulting from a site's activities.

Hazardous Waste: Any waste containing significant quantities of a substance that may present danger to human health and the environment when released into the environment or is improperly managed. Possesses at least one of five characteristics (ignitable, corrosive, reactive, toxic, radioactive), or is listed in-country as a hazardous waste.

Monitoring: The gathering, analysis (especially for trends) and interpretation of information for the assessment of performance.

Examples of monitoring subjects are: occupational health and safety, air, soil and water quality, flora and fauna, reclamation, social aspects including complaints, operational dust, noise, vibration, property damage, community health, community investment, historical and cultural sites.

Monitoring may be continuous, short-term or long term and may be undertaken manually or automated.

Reclamation: The return of disturbed land to a physically and chemically stable, self-sustaining condition compatible with future land use objectives.



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4.4 REFERENCE MATERIAL

Nil

4.5 DOCUMENT CONTROL

Revision	Approved	Date	Description
Final	Ken Jones	17 th August 2014	Original 2014 issue of the B2Gold Environmental and Biodiversity Performance Standards
Final	Ken Jones	24 th May 2018	2018 revision, update and issue of the original 2014 B2Gold Environmental and Biodiversity Performance Standards