Tasiast Mauritania Limited SA
Tasiast Gold Mine Expansion Project

Phase 1b: Supporting Infrastructure and Preliminary Upgrades: Tailings Storage Facility 3 Starter Cell, Foundations, Power Plant, Fuel Farm, Waste and Water Management Facilities, Accommodation Camp, Airstrip, and Expansion of Borefield

Environmental Impact Assessment

Final
31 July 2011

Prepared for

KINROSS Tasiast

Revision Schedule

Phase 1b Environmental Impact Assessment

31 July 2011

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List of Abbreviations

Abbreviation	Definition
ACP	African, Caribbean and Pacific
ANFO	Ammonium Nitrate Fuel Oil
BIF	Banded Iron Formation
BIM	Banded Iron Magnetite
BP	Before Present (i.e. period in years before the present day)
BS	British Standard
C	Construction
CCTV	Closed Circuit Television
CIL	Carbon-in-Leach
Cl	Chlorine
CNRE	Centre National des Ressources en Eau
CO2	Carbon Dioxide
D	Closure
dB(A)	DeciBels Adjusted
dB LAeq	DeciBels Sound pressure level
DEC	Department of Environmental Control
DIV	Dutch Intervention Value (guideline values for soil contamination)
DMG	Mines and Geology Directorate
EBRD	European Bank for reconstruction and Development
EHS	Environmental, Health, and Safety

Abbreviation	Definition
EIA	Environmental Impact Assessment
EIN	Environmental Impact Notice
EMS	Environmental Management System
ENG	Energy
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EITI	Extractive Industries Transparency Initiative
EU	European Union
FAO	Food and Agriculture Organisation
FRY	Rhyolite
FVC	Felsic Volcanic rock
GDP	Gross Domestic Product
GIS	Geographic Information System
GNI	Gross National Income
GPS	Geographical Positioning System
GST	Garnetiferous green schist
HDPE	High-density polyethylene
HFC	Hydrofluorocarbon
HFO	Heavy Fuel Oil
HWSF	Hazardous Waste Storage Facility
IFC	International Finance Corporation
IMRS	Institut Mauritanien de Recherches Scientifiques
ISO	International Organisation for Standardisation
IUCN	International Union for Conservation of Nature
K	Potassium
Km	Kilometre
LFO	Light Fuel Oil
m	Meter
mm	Millimetre
Mm^3	Million cubic metres

Abbreviation	Definition
MLA	Mining Licence Area
MESD	Delegated Ministry of Environment and Sustainable Development (Ministère Délégué auprès du Premier Ministre chargé de l'Environnement et du Développement Durable)
MDO	Dolerite
MDG	Millennium Development Goals
Mg	Magnesium
MGB	Gabbro
mg/l	Milligrammes per liter
MPEM	Ministry of Petroleum, Energy and Mines (Ministère de Petr oléum, Énergie et des Mines)
MW	Mega Watt
MWS	Ministry of Water and Sanitation (Ministère de l'Hydraulique et de l'Assainissement)
Na	Sodium
NAPA	National Action Plan for Adaptation to Climate Change
NEAP	National Environmental Action Plan
NGO	Non Government Organisation
NO2	Nitrogen Dioxide
O	Operation
ONS	Office of National Statistics
PAN-LCD	National Action Plan for Desertification
PCDP	Public Consultation and Disclosure Plan
PDALM	Plan Directeur d'Aménagement du Littoral Mauritanien
PF	Processing Facility
pH	Potential of Hydrogen
PNBA	Parc National Banc D'Arguin
PM	Particulate matter
Ppm	Parts per million
PRISM	Project for Institutional Strengthening of the Mining Sector
RIM	Islamic Republic of Mauritania
RL	Reduced Level
RO	Reverse Osmosis
SIA	Social Impact Assessment

Abbreviation	Definition
SO_2	Sulphur Dioxide
SQZ	Quartzite
TDS	Total dissolved solids
TM	Transport Management
Tpa	Tonne per annum
Tpd	Tonnes per day
ToR	Terms of Reference
TMLSA	Tasiast Mauritanie Limited SA
TSF	Tailings Storage Facility
TSS	Total suspended solids
UK	United Kingdom
UNESCO	United Nations Educational, Scientific and Cultural Organisation
µs/cm	Micro Siemens per Centimetre
WA	Water supply
WHO	World Health Organisation
WMF	Waste Management Facility
WMP	Waste Management Plan

1. Introduction

1.1 Background

The Tasiast Gold Mine (the Mine) is an operational gold mine, situated in the Inchiri Wilaya of north western Mauritania. Refer to Figure 1-1 for site location.

Operations at the Mine commenced in July 2007, initially under the ownership of Rio Narcea Gold Mines and subsequently, following acquisition, under Red Back Mining Inc. Kinross Gold Corporation (Kinross) completed the acquisition of the Mine on September 17, 2010 as part of its combination with Red Back Mining Inc. Tasiast Mauritanie Limited SA (TMLSA), a wholly owned subsidiary of Kinross, is the operator of the Mine.

On commissioning, the Mine had a predicted life of ten years, at a nominal milling rate of 3,200 tpd. As a result of recent development activities permitted under previous impact assessments (SNC Lavalin, 2004, Scott Wilson, 2008a, b, c, d and 2009a, b, 2010a), the Mine currently operates at a nominal milling rate of 9,000 tpd.

However, as a result of identifying further gold resources through its continuing exploration within the mining licence area (MLA), TMLSA plans to expand the Mine's operations further through the Expansion Project (the Project).

1.2 The Project

TMLSA has now completed an internal mine scoping study to expand operations at the Mine to a nominal milling rate of approximately 70,000 tpd to 80,000 tpd. Based upon the internal mine scoping study, there will be an expanded series of open pits and significant new infrastructure including a mill, Carbon-in-Leach (CIL) process plant, a third Tailings Storage Facility (TSF) and additional waste rock dumps. The Project will be developed in Phases.

Project energy demands for both construction and operations will be supplied, in phases, through additional new power plants and a new fuel farm. An initial new power plant will be installed in Phase 1 followed by a second, larger power plant in Phase 2 of the Project. Existing diesel power facilities at the existing water supply borefield and intermediate pump station will be expanded. In addition, a separate, off-site power plant is currently proposedto supply power for the proposed sea water extraction and supply system.

Increased water demands will be required for the Project's construction activities, ongoing interim operations and expanded operational capacity. It is proposed that the increased water demand for construction and ongoing interim operations will be met through the temporary (approximately four years) expansion of the existing borefield. To support this temporary expansion it is proposed that additional wells are developed within and adjacent to the existing borefield and a new water supply pipeline be constructed. New water treatment facilities and water storage ponds will also be developed on the existing Mine site. To meet the Project's expanded operational water demands, it is proposed that a sea water extraction and supply system is developed.

To improve accessibility to the Mine, it is proposed to both upgrade the existing 60 km access road and to develop a new airstrip. There will also be development of new ancillary facilities such as, but not limited to, maintenance workshops, sewage and waste management facilities, new accommodation camps, new offices, new warehouse facilities and other similar supporting infrastructure. Construction of the proposed Project infrastructure and ancillary facilities will be phased over an approximate three year period. During this time current mining operations will continue, and the Project is expected to be fully commissioned by early 2014. It is anticipated

that the Project will have a 16 year operational lifespan (following the three year construction period) although there is some potential to further extend the mine life beyond 2030.

Further to the internal mine scoping study, a feasibility study is currently being developed for the Project and is scheduled for completion in mid 2011. The feasibility study will assess project alternatives that may be included in future permitting phases for the Project.

Kinross has commissioned URS Scott Wilson to undertake the Environmental Impact Assessment (EIA) requirements for the Project.

1.3 Phased Approach to Permitting

In order to achieve the Project's goal for commissioning by early 2014, it is necessary to phase the construction works and commence some early preparatory works in 2011. The overall Project has therefore been divided into three phases, based on the type of works to be carried out (Project components), construction timing, geographical location, Mauritanian permitting and EIA requirements.

Each phase will be subject to EIA processes and any cumulative impacts will be assessed and mitigation actions will be incorporated into and implemented via the Mine's existing Environmental Management System (EMS) (Scott Wilson, 2010b).

A series of meetings with the Ministry of Petroleum, Energy and Mines (MPEM), the Ministry of Environment and Sustainable Development (MESD) and the Ministry of Water and Sanitation (MWS) have been held to present and discuss the proposed Project phasing. In addition, a Project Cordiantion Committee has been established between TMLSA/Kinross and several key Ministries to facilitate Project implementation.

The Project has been divided into two distinct areas:

- **On-site**: within the Mine, comprising the active Mine site and its associated infrastructure, the access road corridor and the existing borefield. Operations shall remain on-going in this area, which has already experienced a degree of general disturbance. As part of national permit requirements for mining operations, this area has previously been subject to several studies and EIA reports (SNC Lavalin 2004, Scott Wilson, 2008a, b, c, d, 2009a, b, and 2010a); and
- **Off-site**: areas outside of the Mine (as defined above). These areas may or may not be already disturbed and have not previously been subject to EIA for mining-related operations.

The proposed Project Phases, permitting requirements and geographical areas are summarised in Table 1-1 below. This Report is relevant to Phase 1b EIA only.

Table 1-1: Approach to Permitting

Project Phase	Location	Overview[1]	Permitting Requirement
1a(i)	On-site	Supporting infrastructure and preliminary upgrades. • Access road upgrade • Borrow pits and mobile crusher • Incremental increase in borefield water extraction • New water pipeline	EIN
1a(ii)	On-site	Supporting infrastructure and preliminary upgrades. • New accommodation camp • New warehouse and office facilities • Expanded fuel farm	EIN
1b	**On-site**	**Supporting infrastructure and preliminary upgrades.** • **New accommodation camp**	**EIA**

Project Phase	Location	Overview[1]	Permitting Requirement
		• **New TSF (TSF 3 starter cell)** • **Power plant expansion** • **New fuel farm** • **Temporary borefield water extraction increase** • **Foundation works for new mill and new power plant** • **New airstrip**	
2	On-site	Main infrastructure developments (on-site). • Expanded open pit • New CIL process plant and mill • New waste rock dumps • New power plant • New water storage facilities • New TSF (remaining cells of TSF3) • New ancillary facilities	EIA
3	Off-site	Main infrastructure developments (off-site). • New sea water extraction system • Other off-site infrastructure facilities as determined necessary in the Project feasibility study	EIA

[1] *The list of project components for each Phase is indicative and not exhaustive. A comprehensive listing of Phase 1b components is detailed in Section 3.3 of this report.*

Phase 1b components are classified as Category A developments, in line with Mauritanian Decrees No. 2004-094 and No. 2007-105, and are subject to an EIA.

This EIA will assess the significance of potential impacts resulting from the proposed components of Phase 1b and is relevant to Phase 1b EIA only.

1.4 Reporting

The EIA for Phase 1b Project components has been prepared in accordance with Mauritanian legislation, in particular, the Environment Code No. 2000-045 and Decrees No. 2004-094 and No. 2007-105.

In addition to Mauritanian legislation, the EIA is also being undertaken to the World Bank Group's International Finance Corporation (IFC) Performance Standards, it's supporting applicable IFC Environment Health and Safety (EHS) Guidelines and other general international industry best practice.

The EIA comprises three reports, namely:

- **Terms of Reference (ToR) Report:** The ToR Report provided an overview of the proposed Phase 1b, the potentially significant environmental issues and the approach for the EIA, including baseline study requirements. The ToR was submitted to the MPEM and approved in May 2011. A copy of the ToR report is presented in Appendix 1;
- **EIA Report**: This EIA Report documents the full assessment process and its conclusions in accordance with the ToR Report; and
- **EIA Non-Technical Summary**: The Non-Technical Summary presents a summary of the EIA Report in simplified language, it assists and facilitates stakeholder understanding at the Public Inquiry stage of the permitting approval process.

This document presents the EIA Report for the Phase 1b of the Project. The EIA Non-Technical Summary is provided as a separate document in French, Arabic and English.

1.5 Report Structure

This EIA is structured in line with Mauritanian legislation as follows:

- **Section 1: Introduction**; Background and Report Structure.
- **Section 2: Legislation and Policy Framework**; a summary of relevant Islamic Republic of Mauritania (RIM) legislation including international treaties and conventions ratified by Mauritania and the associated national strategies and action plans; international standards being adopted for the Project and TMLSA's overarching sustainability policy for the Project.
- **Section 3: The Project – Phase 1b**; an outline of current mining operations and the proposed Phase 1b components.
- **Section 4: Project Setting**; a summary of Project setting and baseline conditions.
- **Section 5: Environmental Impact Assessment**; a description of the overall methodology used for the impact assessment.
- **Sections 6 – 16: Technical Assessments**; on a discipline-by-discipline basis includes a description of baseline conditions, an identification of the important issues and an assessment of potential impacts to people and the environment, proposed mitigation measures and residual impacts;
- **Section 17: Analysis of Alternatives**; a summary of the alternatives considered.
- **Section 18: Environmental Management**; framework of the mitigation measures proposed for managing the Project's potential impacts;
- **Section 19: Preliminary Rehabilitation and Closure**; measures to be implemented and costs required for the decommissioning of this phase's components;
- **Section 20: Consultation**; a summary of the consultation process and feedback from stakeholders;
- **Section 21: Timeline**; a summary program of key activities; and
- **Section 22: References**; a list of all documents used as reference material.

2 Legislation and Policy Framework

2.1 Introduction

The Section has been divided into three sub-sections, namely:

- **National**: presents the legislative framework, international protocols/agreements/treaties to which Mauritania is party and the key national regulatory authorities;
- **International**: outlines the IFC Performance Standards and EHS Guidelines, which the Project is applying to complement national legislation and to satisfy the additional environmental and social requirements of financial institutions investing in the Project; and
- **Kinross/TMLSA**: presents an outline of the overarching sustainability policies for the management and monitoring of the Project.

2.2 National

This Section presents the national legislative framework relevant to Phase 1b of the Project, international protocols, agreements and treaties to which Mauritania subscribes and the key national regulatory authorities.

2.2.1 National Legislative Framework

The Mauritanian legal hierarchy comprises the constitution, international treaties and agreements, primary legislation (laws and codes), decrees and orders (arrêtes).

A law or code is generally a framework of intervention within a specific sector. To be applied, each law needs regulatory instruments called implementation decrees. A summary of Mauritanian environmental and social legislation and guidelines, as of July 2011, that are relevant to the Project and the Phase 1b EIA is presented in Table 2-1 below.

Table 2-1: Summary of Relevant Mauritanian Legislation and Guidelines

Legislation	Summary
Mining	
The Mining Code Law No. 2008-011 (27 April 2008)	The Code is restricted to provision of: • Legal and property rights framework for mining; • Measures for protection of property, services, etc; • Safe and efficient working practices; and • Taxes and royalties.
Decree No. 2004-054 (6 July 2004) providing for application of the Law for the Mining Code	Provisions relating to environmental issues in mining activities are determined by this decree.
Decree No. 139/2000 relating to the mining inspectorate (21 November 2000)	The establishment of the Mining Inspectorate to regulate and enforce the provisions of the former Mining Code (Law No. 99-013) of 23 June 1999.
Decree No. 99-160 on the mining titles (30 December 1999)	Provides provisions relating to exploration and exploitation permits.

Legislation	Summary
Law No. 2002-02 relating to the Model Mining Convention (20 January 2002)	Provides provisions for fiscal and tax issues relating to mineral exploitation and exploration permits.
Environment	
Environment Code No. 2000-045 (26 July 2000)	Provides legislation relating to: • Protection of natural resources; • Protection of environmental conditions; and • Protection of sites of cultural and national interest.
Decree No. 2004-094 relating to Environmental Impact Assessment (24 November 2004)	Defines the legal regime covering EIA, as provided for in Articles 14 to 20 of Law No. 2000-045 of 26 July 2000 (Environment Code).
Decree No. 2007-105 modifying and supplementing certain provisions of Decree No. 2004-094 (13 April 2007)	Modifications to Decree No. 2004-094 of 24 November 2004 relating to EIA including; project categorisation, content; and timeline for Approval.
Protection of Vegetation Law No. 2000-042 (26 July 2000)	Law No. 2000-042 for the protection of vegetation provides legislation on the protection of natural resources and the import and export of vegetation.
Law No. 2007-055 abrogating and replacing Law no. 97-007 of 20 January 1997 relating to the Forestry Code.	The Forestry Code defines the guiding principles of national policy in forestry matters, including the creation, management and protection of forests and wooded areas, as well as the framework of communal and community involvement. In addition the code includes a list of tree species that have complete or partial protection.
Decree 2009-104 applying Law 2007-055 abrogating and replacing Law no. 097-007 relating to the Forestry Code	Applies the dispositions of Law No. 2007-055, namely with regard to exploitation rights, the exploitation of forest products, the classification of forests, and forest clearance.
Law No. 2000-024 concerning the PNBA	Outlines rules concerning management and conservation of the Parc National du Banc D'Arguin (PNBA). The boundaries of the Park are also defined in this law.
Hunting Code No. 1997-006 (20 January 1997)	Allows for the management of zones by individuals or organisations in the interests of hunting and provides a list of faunal species that are protected.
Guide to carrying out an Environmental Impact Assessment, Mining Sector, November 2006	Provides a guideline on the content and impact assessment techniques for an EIA for a mining operation.
Guide to carrying out a Notice of Environmental Impact, Mining Sector, November 2006	Provides a guideline on undertaking an EIA, a less rigorous impact assessment process for a smaller mining operation.

Legislation	Summary
Guide to preparing an Environmental Management System, Mining Sector, November 2006	Provides a guideline on the process of developing an Environmental Management System (EMS) for a mining operation.
Guide to the preparation of site rehabilitation document, Mining Sector, November 2006	Provides a guideline on the process of developing a site rehabilitation plan for a mining operation.
Cultural Heritage	
Framework Law No. 2005-046 on the Protection of Tangible Cultural Heritage (25 July 2005)	This law defines and classifies tangible cultural heritage, its protection, and the sanctions for contravention of the law.
Water	
The Water Code No. 2005-030 (2 February 2005)	Defines the legal regime for continental surface and groundwater (excluding seawater), provisions include: • Legal and property rights framework for water use; • Protection of existing water resources and search for new resources; • Protection of water resources from any form of pollution; • Reduction of water waste and over use; • Ensuring the equitable allocation of water resources to all users.
Decree No. 2007-047 regarding the creation of strategic water resource zones	Allows for the creation of Strategic Water Resource Zones. These zones provide rules on how surface and sub-surface waters can be managed and can be enacted through a decree (arrête).
Social	
Law No. 2004-017 concerning the Labour Code (6 July 2004)	Defines the rights of employers and employees, including provisions for occupational health and safety.
The Estate and Land Organisation Ruling No. 83-127 (5 June 1983)	Provides the framework conditions for land granting and acquisition in rural and urban areas.
Decree No. 2000-89 of 17 July 2000 abrogating and replacing decree No. 90.120 of 31 January 1990 concerning application of The Estate and Land Organisation Ruling of 5 June 1983	Provides details on the process and procedures for land acquisition.

Legislation	Summary
The Electricity Act No. 2001-019, 25 January 2001	Supports the private sector for both electricity production and distribution.
Pastoral Code No. 2000-044 (26 July 2000)	Defines the rights of pastors (nomads) to use natural resources.
Decree No. 2004-024 Implementing the Pastoral Code	The Decree states that pastors have free access to and right to use pastoral resources. Any development of pastoral resources must take into account economic, social and ecological aspects, and must be subject to prior authorisation by the MESD in line with the Environment Code (Law No. 2000-045).

2.2.2 International Protocols, Agreements and Treaties

In line with generally accepted good practice (such as defined in the World Bank's Operational Policy 4.01 on Environmental Assessment and the EU EIA Directive 85/337/EEC as amended), Table 2-2 and Table 2-3 identify the relevant international environmental and social development agreements to which Mauritania is a party.

Table 2-2: International Environmental Agreements relevant to Mauritania

Issue	Convention and Objective	Mauritanian Status	Date of Signature
Agriculture	Constitution of the Food and Agriculture Organisation (FAO) of the United Nations Objective: To tackle world poverty and hunger and to promote primarily agriculture and sustainable rural development.	Multilateral	16/10/1945
Biodiversity	International Plant Protection Convention - New revised text approved by Resolution 12/97 of the 29th Session of the FAO Conference in November 1997 - Declaration Objective: To prevent the spread and introduction of pests of plants and plant products and to promote measures for their control.	Multilateral	07/11/1997
	Convention on biological diversity Objective: To ensure the conservation of biological diversity; the sustainable use of its components and the fair and equitable sharing of the benefits.	Multilateral	05/06/1992
	Convention on the conservation of migratory species of wild animals (Bonn Convention) Objective: To protect migratory species of wild animals and their habitat.	Multilateral	23/06/1979
	Convention on International Trade in Endangered Species of Wild Flora and Fauna Objective: To ensure that international trade in specimens of wild animals and plants does not threaten their survival.	Multilateral	13/03/1998
Crime and Corruption	United Nations Convention against Corruption Objective: To promote and strengthen measures to prevent and combat corruption; to promote international cooperation; to promote integrity, accountability and	Multilateral	31/10/2003

Issue	Convention and Objective	Mauritanian Status	Date of Signature
	proper management of public affairs and public property.		
	United Nations Convention Against Transnational Organised Crime Objective: (a) to prevent and combat trafficking in persons; to protect and assist the victims of such trafficking; and to promote cooperation among States Parties.	Multilateral	15/11/2000
Climate Change	Kyoto Protocol to the UN Framework Convention on Climate Change Objective: To reduce or limit the emission of gases contributing to the "greenhouse effect" and causing climate change in the industrialised countries.	Multilateral	11/12/1997
	United Nations Framework Convention on Climate Change Objective: To achieve stabilisation of greenhouse gas concentrations.	Multilateral	09/05/1992
Democracy	Partnership agreement between the members of the African, Caribbean and Pacific (ACP) Group of States of the one part, and the European Community and its Member States, of the other part, signed in Cotonou on 23 June 2000 - Protocols - Final Act - Declarations Objective: To promote and expedite the economic with a view to contributing to peace and security and to promoting a stable and democratic political environment.	Multilateral	23/06/2000
Desertification	United Nations Convention to Combat Desertification in Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa Objective: To combat desertification and mitigate the effects of drought with a view to achieving sustainable development.	Multilateral	17/06/1994
Fisheries	Fisheries Partnership Agreement between the European Community and the Islamic Republic of Mauritania Objective: to promote responsible fishing in Mauritanian fishing zones.	Bilateral	04/08/2008
	Agreement on cooperation in the sea fisheries sector between the European Community and the Islamic Republic of Mauritania Objective: To establish the general framework for the access of Community fleets to the waters of Mauritania.	Bilateral	11/05/1998
	Agreement relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982 Objective: to facilitate international communication and promote the peaceful uses of the seas and oceans, the conservation of their living resources and the protection of the marine environment.	Multilateral	28/07/1994
	United Nations Convention On The Law Of The Sea	Multilateral	10/12/1982
	International Convention for the Prevention of Pollution	Multilateral	24/11/1997

Issue	Convention and Objective	Mauritanian Status	Date of Signature
	from Ships		
Ozone	Amendment to the Montreal Protocol on substances that deplete the ozone layer, adopted at the ninth meeting of the Parties Objective: To ensure effective protection of the ozone layer by regulating trade in substances that depletes it.	Multilateral	17/09/1997
Trade	Rotterdam Convention on the prior informed consent procedure for certain hazardous chemicals and pesticides in international trade Objective: To promote shared responsibility and cooperative efforts in order to protect human health and the environment from potential harm and to contribute to their environmentally sound use.	Multilateral	10/09/1998
Waste	Basel Convention on the control of transboundary movements of hazardous wastes and their disposal Objective: To lay down obligations with regard to ensuring that the transboundary movement of wastes is reduced to the minimum consistent with the environmentally sound and efficient management of such wastes.	Multilateral	22/03/1989

Mauritania is also a signatory to a range of labour and human rights conventions which are summarised in Table 2-3 below.

Table 2-3: International Social and Labour Conventions

Issue	Convention	Ratification
Women's Rights	The United Nations Convention on the Elimination of all Forms of Discrimination Against Women.	2000
	International Labour Organisation (ILO) Convention No. 89 on Women's Rights and Working Conditions.	1963
Rights of Children	Additional Protocol on Sale of Children and Child Abuse.	2004
	Minimum Age Convention	2001
	Worst Forms of Child Labour Convention	2001
	United Nations Convention of Child Rights.	1991
	ILO Convention No. 90 on Child Rights and Working Conditions.	1963
	ILO Convention No. 182 on Child Working Conditions.	1963
	Night Work of Young Persons Convention	1963
	Night Work of Young Persons Convention	1961
Slavery	United Nations Convention on People Trafficking.	1986
Human Rights	United Nations Convention on Torture, Cruel, Inhuman or Degrading Treatment.	2004
	Right to Organise and Collective Bargaining Convention	2001
	Equal Remuneration Convention	2001
	Abolition of Forced Labour Convention	1997

Issue	Convention	Ratification
	Discrimination (Employment and Occupation) Convention	1963
	Equality of Treatment Convention	1963
	Holidays with Pay Convention	1963
	Labour Inspection Convention	1963
	Night Work Women Convention	1963
	Safety Provisions Convention	1963
	Workmen's Compensation Convention	1963
	Weekly Rest Convention	1961
	Minimum Wage-Fixing Machinery Convention	1961
	Forced Labour Convention	1961
	Freedom of Association and Protection of the Right to Organise Convention	1961
	Protection of Wages Convention	1961

Being a signatory to such international devices imposes obligations on the host country to address the topics raised in those documents. In many cases, those obligations are directly transposed into national laws; for example, the workers' rights conventions are reflected in the RIM Labour Code (Law No. 2004 017 concerning the Labour Code). In other cases, implementation may be more complex and therefore require more detailed analysis of what needs to be done, prioritisation of required actions, budgeting, capacity building and/or resource planning; such examples are normally addressed through the establishment of national strategies and action plans.

A number of national strategies and action plans have been articulated in Mauritania and, as such, may have implications for the impact assessment of the Project and the proposals for mitigation actions. Accordingly, this EIA has included a review of the pertinent findings and conclusions of various plans, studies, or assessments prepared by relevant government authorities or other parties that are or may be relevant to the Project and/or its area of influence. These include, *inter alia*:

- Agro-food Strategy;
- Livestock Strategy;
- National Biodiversity Strategy;
- National Action Plan for Adaptation to Climate Change (NAPA);
- National Action Plan for Desertification (PAN-LCD);
- National Environmental Action Plan (NEAP);
- National Strategy of Decentralization and Local Governance;
- Plan Directeur d'Aménagement du Littoral Mauritanien (PDALM); and

- Strategic Framework to Combat Poverty (such as, Cadre Stratégique de Lutte contre la Pauvreté, 2011-2015).

2.2.3 National Regulatory Authorities

The key national regulatory authorities involved in permitting and environmental management of the mining industry in Mauritania are outlined below:

Ministry of Petroleum, Energy and Mines (MPEM): is the government agency responsible for regulating the mineral industry in Mauritania. The Ministry has a function to prepare and implement mining policy and regulation, promote exploration and develop geological studies and maps. To accomplish this, the minister oversees a cabinet comprising the chief representative to the minister, three technical counsellors, a general internal inspector and the general secretary (chief-of-staff). This administrative unit manages technical departments including the Mines and Geology Directorate (DMG), the Mining Cadastral Unit, the Mauritanian Office of Geological Survey and the Project for Institutional Strengthening of the Mining Sector (PRISM). The MPEM maintains a permanent government presence at the Mine and liaises with management across a wide range of issues, including environmental and social concerns.

Ministry of Environment and Sustainable Development (MESD): is the government department responsible for ensuring the inclusion of sustainable development in public policies and in the management of natural resources and industry. The MESD is comprised of a number of technical departments including the Department of Programming and Coordination of Environmental Information; Department of Environmental Control (DEC); Department of Pollution and Environmental Emergencies; Department of Protected Areas and Coastal Areas, and the Department of Nature Protection. The DEC has overall responsibility for the national process for managing development project EIAs and environmental management plans (EMP) and also undertakes a general regulatory role.

Ministry of Water and Sanitation (MWS): is responsible for the protection and integrated management of water resources, and the coordination of all activities involving the abstraction, distribution and use of water including the treatment and discharge of effluents. There are three main technical departments including the National Centre of Water Resources (the Centre National des Ressources en Eau or CNRE); the National Water Company (Société Nationale d'Eau) and the National Drilling and Wells Company (Société Nationale des Forages et Puits). The CNRE is responsible for authorising and monitoring abstraction from the Mine's existing borefield.

It is also acknowledged that further national and regional regulatory agencies may be active in monitoring the Mine's performance against their requirements (such as, workplace health and safety, work permits, etc.).

2.3 International Standards

Where appropriate, this EIA also makes due reference to internationally recognised standards in order to establish a transparent regulatory framework for the Project which is in line with both national requirements and the expectations of international stakeholders.

RIM legislation does not usually specify detailed requirements for many environmental considerations such as ambient air quality parameters, atmospheric emission limits, noise levels, potable water quality or effluent discharge characteristics. In order to obviate the non availability of such national standards, TMLSA decided to apply – wherever possible – suitable equivalent standards as cited or referenced in recognised international guidance such as World Health Organisation (WHO) and World Bank Group documents.

TMLSA is committed to applying the IFC Performance Standards and the applicable EHS Guidelines to the Project's impact assessment and mitigation process. The IFC is part of the World Bank Group and its standards and guidelines define both a robust approach to managing risks and impacts, and determine good international industry practice for significant project components.

Where appropriate, due reference has been made in this EIA to those IFC Standards and supporting EHS Guidelines[1] - and any specific third party standards incorporated into this assessment process - that are relevant to the Project. The IFC Performance Standards and EHS Guidelines relevant to the Phase 1b are briefly outlined below.

2.3.1 International Finance Corporation Performance Standards

In essence, the IFC Performance Standards set out the underlying principles for sustainable project management, including impact/risk assessment, mitigation strategies, public consultation and performance monitoring.

Their relevance to the Project is briefly summarised below:

- **IFC Performance Standard 1: Social and Environmental Assessment and Management Systems**: Establishes requirements for social and environmental performance management throughout the life of a project through initial baseline studies and risk/impact assessment, identification of mitigation options, stakeholder consultation and application of management system to monitor and improve performance.
- **IFC Performance Standard 2: Labour and Working Conditions**: Highlights the need for workers rights regarding income generation, employment creation, relationship management, commitment to staff, retention and staff benefits. It identifies and outlines the need to provide workers with a safe and healthy working environment. This Performance Standard is guided by international conventions, in particular those of the ILO that have been ratified by Mauritania.
- **IFC Performance Standard 3: Pollution Prevention and Abatement**: Defines an approach to pollution prevention and abatement in line with current internationally disseminated technologies and good practice. It deals with ambient and cumulative considerations, resource conservation and energy efficiency, hazardous materials and waste management, pesticide use and management, and emergency preparedness and response provisions.
- **IFC Performance Standard 4: Community Health, Safety and Security**: Specifies requirements for mitigating any potential for community exposure to risks and impacts arising from equipment accidents, structural failures and releases of hazardous materials. In addition, communities may be affected by impacts on their natural resources, exposure to diseases, and the use of security personnel.
- **IFC Performance Standard 5: Land Acquisition and Involuntary Resettlement**: Outlines a policy to avoid or minimise involuntary physical resettlement as a consequence of the project. Where it is unavoidable, it requires suitable measures to mitigate adverse impacts on affected stakeholders, including appropriate compensation for any economic displacement such as loss of subsistence or commercial livelihood.

[1] The IFC Performance Standards and associated guidance are available in English, French and Arabic and can be freely downloaded from http://www.ifc.org/ifcext/sustainability.nsf/Content/PerformanceStandards. In addition, the IFC EHS Guidelines can be freely downloaded at http://www.ifc.org/ifcext/sustainability.nsf/Content/EHSGuidelines.

- **IFC Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management**: Sets out an approach to protect and conserve biodiversity, including habitats, species and communities, ecosystem diversity, and genes and genomes, all of which have potential social, economic, cultural and scientific importance.
- **IFC Performance Standard 7: Indigenous Peoples**: Recognises that Indigenous Peoples can be marginalized and vulnerable (such as, if their lands and resources are encroached upon by or significantly degraded by a Project). Their languages, cultures, religions, spiritual beliefs, and institutions may also be under threat.
- **IFC Performance Standard 8: Cultural Heritage**: Aims to protect irreplaceable cultural heritage and to provide guidance for protecting cultural heritage throughout a Project's life cycle.

It should be noted that the IFC has undertaken a review of the Performance Standards and approved a number of modifications as well as some enhanced requirements for evolving sustainability issues associated with climate change, biodiversity and 'eco-system services', human rights and gender, labour and supply chains, and stakeholder engagement with affected communities.

As the definitive versions of the revised Performance Standards are yet to be published (now expected during the second half of 2011), the 2006 versions are being used where relevant in this EIA. However, certain elements of the revised versions are being actively addressed so reference has been made to them in the text where appropriate.

2.3.2 Environmental Health and Safety Guidelines

The IFC EHS Guidelines were designed to broadly define 'good international industry practice' and set specific minimum design and operating standards (such as for emissions, discharge or exposure limits) in regard to the environment, occupational health and safety, community health and safety, and life cycle impacts including during construction, operaration and decommissioning.

The detail in these standards is generally derived from globally recognised sources (such as the World Health Organisation) and are basically intended for application where host government's legislation is either not available or is potentially deficient in regards to good international practice. Stipulated performance levels and measures are "generally considered to be achievable in new facilities by existing technology at reasonable costs".

However, there is also some flexibility in regard to both their application to existing facilities and the fact that less stringent measures can be adopted, provided that there is a detailed justification for any proposed alternatives as part of the site-specific EIA. In the event of any unavoidable deviation from a performance measure stipulated in an EHS Guideline, the justification should be clearly explained.

The **General EHS Guidelines** are designed to apply to all projects and all sectors, but the detailed requirements can be superseded by sector guidelines, where factors such as facility size, technology and associated impacts merit specific attention. Due to the range and nature of the proposed components, a number of industry sector EHS Guidelines may be applicable. These will include the examples on Mining, Water and Sanitation, Thermal Power Plants and Electric Power Transmission and Distribution.

Further **Sector EHS Guidelines** may also need to be used depending upon what choices are made in terms of the early phase components (such as, Construction Materials Extraction in relation to new, off-site quarries/borrow pits and Camp Health Care Facilities in the event that a

larger clinic is provide for) and some of the possible future options under consideration (such as, Ports, Harbors and Terminals if a facility is developed at Nouâdhibou etc.).

The following briefly summaries the key EHS Sector Guidelines relevant to this phase of the Project:

- **IFC EHS Sector Guidelines – Mining**: Provides a description of and management techniques for the specific impacts of mining sector activities, including definition of detailed compliance requirements (emission/discharge limits, noise, etc.), abatement measures to ensure compliance, suggested performance indicators and monitoring requirements.
- **IFC EHS Sector Guidelines – Water and Sanitation**: Provides a description of and management techniques for the abstraction, treatment and discharge of water in regards to process, drinking and sanitation uses.

2.3.3 Kinross/TMLSA Policies

Following its acquisition by Kinross in 2010 (through Kinross' combination with Red Back Mining Inc.), TMLSA is currently in the process of updating its overarching suite of policies to incorporate the various requirements of corporate commitments and management systems on a range of issues including employment, occupational health and safety, corporate responsibility and the environment. At the time this report was being finalised, a draft document was being circulated for comment and it is anticipated that the definitive version shall be available late 2011.

In addition to Kinross/TMLSA policies, the Project has been designed to comply with the following Kinross Standards as per the Kinross Corporate Responsibility Management System:

- Kinross Standard 6.1: Project Planning;
- Kinross Standard 6.2: Project Design;
- Kinross Standard 6.3:Project Construction;
- Kinross Standard 10.05: Air Emissions Control;
- Kinross Standard 10.06: Water Management;
- Kinross Standard 10.07: Wastewater and Process Solution;
- Kinross Standard 10.08: Stormwater;
- Kinross Standard 10.09: Chemicals and Petroleum Management;
- Kinross Standard 10.10: Waste Rock;
- Kinross Standard 10.11: Tailings Management;
- Kinross Standard 10.12: Waste Management;
- Kinross Standard 10.13: Land Use; and
- Kinross Standard 10.14: Biological Resources.

3 The Project – Phase 1b

3.1 Introduction

This Section outlines the existing operations at the Mine and presents a detailed description of the proposed Phase 1b Project components.

3.2 The Existing Mine

The Mine presently covers an area of approximately 700 ha. The Mine comprises three overall areas; the operational Mine site, the existing borefield for water supply and the access road corridor Operations are on-going in these areas as illustrated in Photographs 3-1 to 3-11; as such, they have already undergone a degree of disturbance from both exploration and mining activities.

Mine site

Operations are on-going in this area, as such the area has already undergone a degree of disturbance from both exploration and mining activities (see Photographs 3-1 to 3-8). The current site layout is shown in Figure 3-1. The perimeter of the Mine site is currently being fenced for safety and security risks and comprises the following components:

- **Open Pits:** a series of open pits covering approximately 82 ha;
- **TSF**: there are two facilities, TSF 1 has reached capacity and is being formally closed and TSF 2 is operational and has capacity for 21.8 million tonnes;
- **Waste Rock Dumps**: three waste rock dumps which have a footprint area of approximately 180 ha;
- **Processing Facilities:** comprising conventional CIL and dump leach facilities to treat high and low grade ore respectively; and
- **Power Supply:** a power plant with three 2.7 MW HFO generator sets and with eight 1.0 MW diesel generators in reserve (with additional, approved units (Scott Wilson 2010a) being installed later in 2011 (4 MW)) provides power for the Mine site. Power to supply the Mines water requirements is supplied by a 450 kW/560 kVA diesel generator located at the borefield and a small mobile unit at the new intermediary pumping station. Fuel is transported to the Mine site overland by truck and is stored on-site in bunded tanks (.
- **Ancillary facilities**, including:
    - Workshops;
    - Warehouses/open stores;
    - Offices;
    - Laboratory;
    - Accommodation camp for approximately 2,000 workers (management and workers), which includes living quarters, catering facilities, laundry facilities, mosque, gymnasium, shop, two football fields and room for social meetings;
    - A temporary construction camp (for the West Branch facilities);
    - Waste management facilities; and
    - An airstrip, suitable for light aircraft only.

Currently the Mine operates at nominal milling rate of up to 9,000 tpd dependent upon variable ore characteristics and has an expected operating life of ten years. Ore bearing rock is mined from the open pits by explosives and hydraulic excavators. The split rock is loaded by diggers into various trucks, the largest of which are 220 tonne vehicles.

The operation utilises selective mining techniques to separate ore and waste rock. Overburden is deposited on the waste rock dumps and the ore taken to be processed. Two conventional process streams are currently utilised for gold extraction. High grade ore is crushed and treated in the CIL process plant while low grade ore is treated using the dump leach facilities. Process waste (tailings) from the CIL process is disposed into the TSF 2.

Water Supply

The daily water requirements for the current operations vary up to an approximate 14,000 m^3/day. The Environmental Impact Notice (EIN), which has been approved for Phase 1a(i) of the Project, has permitted a temporary increase of the extraction licence to 17,000 m^3/day to assist in construction improvement activities including upgrading the existing access road (URS Scott Wilson, 2011d).

Water is extracted, via boreholes, from the brackish aquifer located 60 km west of the Mine site. Water is pumped to the Mine site via two pipelines which follow the access road, from the existing borefield to the Mine site. At the Mine site, water is treated by a reverse osmosis (RO) water treatment plant for higher quality process and construction requirements as well as domestic use. The saline waste product from the treatment plant is either used as a dust suppressant on roads within the Mine site or disposed of in TSF 2.

Additional supplies of both tankered and bottled water are brought from Bennichab as necessary. Tankered water is used for mixing with RO water for the camp supply and for distribution to local communities.

Access

The Mine site is accessed from the main Nouakchott – Nouâdhibou N2 highway by a 60 km two-lane unsealed access road. This access road will be upgraded (surface grading and dust suppression) as part of the approved Phase 1a(i) of the Project and ultimately, after Project construction is complete, it will be hard surfaced.

An unsealed airstrip is located within the Mine site. A light aircraft is used for the transport of personnel to and from Nouakchott.

3.3 Project Components - Phase 1b

Phase 1b of the Project involves the development of infrastructure and preliminary upgrades of "on-site" ancillary infrastructure to enable the expansion of the Mine. In summary these upgrades comprise the following.

Certain activies such as borrow material development areas and, temporary crushing and screening operations that were approved in Phase 1a(i) for the Project will be ongoing to support construction and development of the Phase 1b Project components.

- **TSF 3 starter cell**: construction of the starter cell (sub-section) of a third TSF.
- **Commencement works**: construction of foundation works for proposed Phase 2 CIL process plant, mill and power plant;
- **Concrete batching plant**; construction of a new temporary concrete batching plant for the commencement and other concrete works.
- **New power plant and fuel farm**: development of a new HFO power plant (30 MW) and associated fuel farm;
- **Expansion of water treatment systems**: to support the expanded accommodation camp.
- **New waste management facilities**: to support the Project and increased workforce in construction and operational phases.
- **Accommodation camp**: for approximately 6,000 workers for Project construction activities; certain camp sections may be retained for the duration of the Projects operation.
- **New Airstrip**: proposed construction of a new airstrip and ancillary facilities;
- **Borefield expansion**: Temporary increase in water abstraction from the existing borefield for up to 30,000 m^3/ day (based upon monthly average abstraction rates) for approximately four years, pending installation of a new suitable sea water extraction, pumping and pipeline solution that will substantially replace the abstraction of groundwater from the existing borefield.

Sections 3.3.1 through to 3.3.11 outline the components included in Phase 1b. Figure 3-2 illustrates the location of the footprint areas within which the relevant Phase 1b Project components will be constructed and Figure 3-3 illustrates the proposed construction timeframes.

The terminology to be used in the assessment of Phase 1b Project components is summarised in Table 3-1 below.

Table 3-1: Terminology for the Project

Terminology	Components
Access Road	60 km existing two-lane unsealed road, which connects the main Nouakchott–Nouâdhibou road to the Mine.
Borefield	The borefield, located 60 km to the west of the Mine site and is connected to the Mine site via two pipelines which supply the Mine's operational and potable water requirements.
Mine site	The area where all mining and processing operations take place together with the associated infrastructure such as equipment, maintenance workshops, power supply, office buildings, and other supporting facilities such as, but not limited to,

Terminology	Components
	accommodation facilities and the air strip.
Mine	The Mine site, access road and borefield.
Access road and water pipeline corridor	The area of the existing access road and adjacent water pipelines.
On-site	Within the Mine (which comprises the areas of the Mine site, access road and borefield).
Off-site	Outside of the Mine.

3.3.1 TSF 3 Starter Cell

As agreed with the Mauritanian Minsitries, it is proposed to cease the use of the existing TSF 2 through the accelerated construction of the first phase of the Project's new tailings storage facility, TSF 3 starter cell, which is located within the Project TSF 3 footprint. This new TSF 3 starter cell will be constructed as part of Phase 1b, and will have the overall capacity for the storage of approximately 8 million tonnes of tailings from the existing CIL process plant (approximately 9,000 tpd) and a life of approximately 2.5 years. Water reclaimed from the TSF 3 starter cell will be recycled for process use. Once TSF 3 starter cell is operational, TSF 2 will be decomissioned. The remainder of TSF 3 will be permitted in Phase 2 of the Project.

The Phase 2 EIA will deal with compliance to the requirements of the Cyanide Code . The new CIL process plant will include a thickener and cyanide deteoxification circuit which will be used to effectively reduce cyanide levels in the tailings discharge from both the exisiting CIL and new CIL process plants in early 2014. Accordingly, it will be necessary to review the TSF 3 starter cell assessment during the Phase 2 EIA studies as both management and monitoring measures are likely to change once the full Phase 2 solution circuit becomes operational. The proposed TSF 3 starter cell will be located to the north west of the existing and proposed processing plants, within the fenced Mine site area. The TSF 3 starter cell will be constructed in the north east section of TSF 3 cell 1 (see Figure 3-4).

Facility

TSF 3 starter cell will be constructed as a ring dyke facility, approximately square in shape and sharing common sides. The perimeter dykes (embankments) will predominantly utilise waste rock in their construction, and the waste rock will generally be placed in the dykes directly from the open pit. For the purposes of this assessment, and as supported by available waste rock characterization data, non-acid generating waste rock will be available for construction purposes. Waste rock characterisation is on-going and will be reported in the Phase 2 EIA report.

To ensure seepage from the TSF 3 starter cell is contained, the facility will be fully lined with a geomembrane (1.5 mm thick HDPE). Along those perimeter dykes forming the eastern side of the facility the geomembrane will be placed beneath the dyke. Along the remaining perimeter dykes the geomembrane liner will be placed on the upstream face of the embankments.

Seepage will be collected through underdrains located above the geomembrane liner along the upstream toe of the perimeter dykes. These perimeter drains will discharge into a drain running along the eastern downstream toe of the facility.

A seepage collection pond is planned on the east side, adjacent to the TSF 3 starter cell. The collected flows will either be returned to the decant pond for recovery or directed to the dump leach facility. The dimensions of the base of the ponds have been set at approximately 95 m by 95 m, and the side slopes are set at approximate 3 h to 1 v.

An access road will be constructed around the perimeter of the TSF 3 starter cell to enable routine monitoring and maintenance.

See Figure 3-4 for TSF 3 starter cell general arrangement.

Construction

Construction of the TSF 3 starter cell will be initially built to accommodate one year of tailings storage. The following 18 months of tailings production will be contained by a single raise to the facility. Geomembrane liner requirements amount to approximately 750,000 m^2.

Site preparation works prior to liner installation will include site stripping, proof rolling and placement of screened bedding material where required. It is anticipated the site preparation works (site stripping, dam foundation excavation and proof roll compaction) will take place on a continuous basis during an initial 6 month period. Vegetation and surficial soils will be stripped and pushed into stockpiles for loading and haulage to soils stockpiles to the east and west of the facility. The material in these stockpiles will potentially be re-used during reclamation works. Proof rolling of the basin foundations will follow on close behind the stripping activities.

Operation

Tailings disposal into the TSF 3 starter cell will be by means of a series of discharge points (spigots) distributed around the perimeter. Several adjacent discharge points will be in operation at any one time and the operational discharge points will be rotated in sequence around the facility.

Supernatant solution will be reclaimed from the TSF starter cell using a floating barge mounted pump and returned by an overland pipeline to the process plant for reuse.

Monitoring

Monitoring of the facility will be undertaken in accordance with an Operating, Maintenance and Surveillance (OMS) manual which will be prepared prior to commissioning of the facility, and then updated periodically during the facility operation. The OMS manual will be developed in general accordance with the Mining Association of Canada's Guidelines on tailing facilities.

Performance monitoring of the facility is expected to include daily inspections by the Mine operational personnel responsible for the tailings facility, weekly inspections by Mine Environmental Department, quarterly audits of monitoring data, and annual dam safety inspections by a qualified engineer. During the commissioning period the frequency of inspections may be increased.

Rehabilitation and Closure

The TSF 3 starter cell will be constructed within the proposed footprint area of the larger TSF 3 cell 1, to be permitted in Phase 2, rehabilitation and closure of the TSF 3 starter cell will be performed concurrent with subsequent closure of TSF 3 cells 1 and cell 2, later in the mine life and as part of the final Mine rehabilitation and closure. Upon closure of the TSF 3, deposition of the tailings into this area of the facility will have ceased and the tailings will be allowed to de-saturate through a combination of seepage and evaporation. A 0.6 m cap of previously stripped

overburden will be applied to the tailings surface once the tailings surface is accessible by equipment.

3.3.2 Crusher, CIL Process Plant, Mill and Power Plant Foundations

Foundations are to be developed for the proposed Phase 2 crusher, CIL process plant, mill, power plant and their associated facilities. Note that it is only the earthworks and foundations which are being prepared. The installations themselves will be fully assessed in the Phase 2 EIA and the preparatory works can be easily reversed or adjusted if required.

The concrete foundation footprint will be constructed to support the following facilities:

- Primary crusher;
- Ore stockpile;
- Grinding facility;
- SAG Mill pebble crusher;
- CIL process plant, including leaching and settling tanks;
- Phase 2 power plant;
- Utility and off-load service facilities to service the power plant; and
- Other related ancillary facilities.

Commencement works will comprise only earthworks and foundations works for the above mentioned equipment. Earthworks and foundation activities will include excavation for shallow foundations, or to the rock level where additional bearing capacity is required. Heavy foundations will require excavation into rock. Following the excavation, reinforcing bars will be placed, formwork and finally cast in place concrete. Upon completion of the concrete work the area will be backfilled as required to bring it back to nominal grade.

The area, over which construction for the earthworks and foundations will take place, is approximately 1,200,000 m^2.

Fill operations and grading will be necessary to prevent flooding of the plant facilities during storm events. Excavations on both soil and rock will also be required for the construction of the raw water pond and the primary crusher.

3.3.3 Concrete Batching Plant

To support the preparatory works on foundations for the Phase 2 crusher, CIL process plant, mill and power plant and further construction activities; a temporary concrete batching plant will be installed in close proximity to the proposed CIL process plant. Approximately 50,000 to 100,000 m^3 of concrete will be required for foundation works. The Phase 1a(i) EIN assessed the impact of the borrow pits and mobile crusher which will be utilised in this process.

The concrete batching plant will include the following equipment:

- Loaders and forklifts;
- Cement sand and aggregate silos;
- Debagging machines and blowers;
- Water tank, water pumps and water treatment plant;

- Office; and
- Warehouse.

Design and layout of the batching plant and associated facilities will consider the following:

- Dust control and limitation;
- Implementation of a dedicated area for the cleaning of the truck mixers;
- Drainage and treatment of water used for cleaning of the batching plant and the truck mixers; and
- Implementation of specific measures for the disposal of rejected or surplus concrete.

Following the constructions phase, the concrete batch plant will be removed from the Mine site.

3.3.4 Power Plant

To supply operational power requirements for the Project, it is proposed to construct a new power plant in Phase 2 (approximately 150MW to 170 MW). To facilitate this, an interim power plant is to be constructed in Phase 1b. Following finalisation of the Project feasibility study and the Phase 2 power configuration, a decision will be made as to the ongoing utilisation of both the existing HFO power plant (Photograph 3-5) and the Phase 1b HFO power plant.

In Phase 1b, it is therefore proposed that a new HFO power plant will be developed to provide power for continuing Mine operations, Project construction activities and initial increased Project mining activities.

This plant will provide 30 MW of power and will consist of six 5 MW HFO generators (medium speed engine). The power plant will be connected to the existing power distribution system on-site.

Included within the new power plant system will be a HFO handling-storage system, comprising two HFO storage tanks with a capacity 3,300 m^3 each. In addition a new light fuel oil (LFO) handling-storage system will also be installed and will include one LFO storage tank with a capacity of about 600 m^3. The tanks will be installed in a bunded area and unloading station spillage will be recovered by the oily water system.

The Phase 1b power plant will be developed on the west side of the open pit series (see Figure 3-2) in close proximity to the future CIL process plant, new ancillary facilities and the site of the future larger Phase 2 power plant.

3.3.5 Fuel Farm

A new fuel farm will be developed, in close proximity to the Phase 2 mill and process plant, to support both the Phase 1 and Phase 2 power plant developments.

The fuel farm will include multiple HFO and diesel storage tanks, which will be contained and include a truck off-loading facility. Each tank will have a capacity between 400 m^3 and 13,000 m^3 with the total tank capacity of approximately 60,000 m^3. The HFO storage tanks will be heated with a hot oil closed loop; the heat will be generated by a diesel fire heater.

The fuel farm will be bunded to contain any spillages and will include secondary containment with a geosynthetic liner or equivalent. Secondary containment will be designed for 110% of the largest tank. Fire prevention and control systems shall also be installed.

3.3.6 Water Treatment Facilities

3.3.6.1 Potable Water Supply

Two new Reverse Osmosis (RO) water treatment systems will be developed that will be capable of the following:

- Treatment of raw water from either a seawater or saline groundwater source;
- Production of desalinated water to meet process and construction requirements for higher quality water; and
- Production of potable water compliant with World Health Organisation (WHO) guidelines for domestic/camp use and personal consumption by the increased construction and operations workforce.

The potable water treatment capacity is anticipated to be provided by two separate RO plant modules, one sized for approximately 100 m^3/hour and the other sized for approximately 50 m^3/hour.

The potable water treatment systems will be installed in two locations. A treatment system of approximately 100 m^3/hour capacity is to be installed adjacent to a new raw water pond (which will be developed in Phase 2). This plant will service the new process facilities and construction demand. The second treatment system of approximately 50 m^3/hour capacity is to be installed at the existing plant to connect with existing potable water production facilities. This smaller potable water treatment system will supply the existing and new accommodation camps. Potable water will be distributed from these locations to other consumption centres such as the airstrip.

The potable water treatment system will be based on packaged vendor technology. The core technology used for production of desalinated and potable water is expected to be RO membrane filtration. Post-chlorination of the membrane filtrate will be required for the potable water. Storage tanks will be added for the product water.

3.3.6.2 Sewage Treatment System

Two sewage treatment systems will be installed to treat domestic wastewater arising from the new accommodation camp, office and CIL process plant facilities.

Domestic wastewater includes wastewater from laundry and kitchen facilities in addition to toilets, sinks and showers. Effluent from the sewage treatment plant is to be collected and used to offset raw water use by using the treated effluent for:

- Road dust suppression and/or;
- In the CIL process plant;
- Watering of on-site vegetation test plots.

It is anticipated that after dewatering the biosolid residue from the sewage treatment system will be disposed of by incineration. The other option for biosolids disposal is land filling in an appropriately designed facility.

Raw sewage is expected to be generated at a rate of approximately 200 L per worker per day. Capacity of the sewage treatment systems is approximately 1000 m^3/day for the accommodation camp, and 200 m^3/day for the CIL process plant.

The sewage treatment systems will be installed in two locations; the first in close proximity to the Phase 1a(ii) and Phase 1b accommodation/construction camp and the second in close proximity to the new CIL process plant.

Sewage treatment system technology will include extended aeration, sequencing batch reactors, membrane bioreactors and rotating biological contactors. An equalization tank will be required to receive incoming raw sewage in order to balance the rate of flow delivered to the treatment system.

The sewage treatment requirements in other locations, such as the proposed airstrip and power plant, will be satisfied either by hauling raw sewage from these locations to the proposed new facilities or by installing local septic systems at such locations.

3.3.7 Waste Management Facilities

A new waste management facility is required to manage both domestic and industrial solid waste generated during construction and operation of the Project.

The waste management facility will be fenced and occupy a footprint of approximately 3 ha. It will include a building for the waste management facility operators, a sorting area, an incinerator section, a landfill area and storage for hazardous waste. The staff facilities will include an office, eating area and separate sanitary facilities. Electrical power will be supplied by a local generator, and a water tank will also be installled.

The sorting area will be an open-sided, roofed structure with a concrete floor (approximately 2,400 m^2). Included within the facility will be a 200 L drum compactor, concrete sorting bays with space for skips and weighting facilities. From the sorting area, sorted waste will be assigned it to one of the following waste streams:

- **Recycling**: Where recycling programs exist in Mauritania, and it is economically practical, is possible, materials for recycling will be sorted and stored on-site prior to being transported offsite;
- **Landfill**: The landfill area has been designed to accept both non-hazardous construction and operation waste, to an allowance of approximately 10,000 m^2. The landfill area will be divided into cells for the safe disposal of different, non-compatible wastes. Each cell will be approximately 4 m deep (excavation depth of 2 m based and construction 2 m high berms around the excavation). In addition a 2 m high fence will surround the landfill to prevent material being blown around by wind. The base of the landfill will have a slope of 1-2 % to allow for drainage. The excavation will be filled from the upstream end allowing runoff to drain by gravity to the downstream end and evaporate.
- **Incineration**: The incinerators will be housed in a separate facility with diesel fuel tank and electrical power. Two incinerators capable of handling a range of waste such as; workshop solid waste, used oil filters, oily rags & absorbents, food waste from dining room and kitchen, dewatered sewage sludge and medical waste will be installed. Segregated organic waste will be delivered directly to the incinerator facility. The incinerators will be batch incineration (operating temperature of 600 to 850 C, with a capacity of approximately of 5 - 9 tonnes per day) designed to comply with IFC air emissions standards without air pollution control systems or scrubbers. Both incenerators will be required during construiction and during operations one incinerator will operate while the other is used as back-up.
- **Hazardous waste storage**: The hazardous waste storage facility (HWSF) will be an approximately 450 m^2, securely fenced open sided building with a concrete floor. Hazardous material will be temporarily stored (for up to 5 years) in a secure contained area with

separation between material types until it can be sent to an appropriate licensed facility for final treatment and/or disposal. The HWSF will temporarily store the following types of materials: light vehicle batteries, electronic wastes and chemicals.

See Figure 3-5 for waste management facility general layout.

3.3.8 Accommodation Camp (Construction Camp)

Accommodation facilities for workers during construction and operation of the Project will be developed sequentially (in stages) across three of the Project Phases namely; Phase 1a(ii), Phase 1b and Phase 2. All accommodation will be located on the east side of the Mine site within the overall accommodation area indicated in Figure 3-2.

In addition to the existing accommodation camp (approximately 2,000 beds) (Photograph 3-8) and the proposed Phase 1a(ii) construction camp (500 beds), the accommodation facilities will be further expanded to accommodate approximately 6,000 beds. This construction camp will house workers during the Project's construction phase. Once the Project is operational, sections of the accommodation camp will be refurbished and the supporting facilities required for operations will be retained as a permanent accommodation camp.

The construction camp will comprise approximately 6,000 beds and housing will be composed of single storey modular elements. Washrooms and toilets will be provided and will either be for individual or collective use.

Ancillary facilities will include:

- Recreational facilities such as; dining rooms, prayer room, outdoor sport facilities, and recreational buildings.
- Management and operation facilities such as; laundry and catering facilities, camp administration offices, workshop, maintenance facilities, fire fighting depot, electrical switchyards, emergency diesel generator, power distribution, telephone and TV network.
- Water treatment facilities such as; potable water distribution system, buffer tank and pumps, drainage and sewage systems.

The accommodation camp will be accessed via a service road and parking space will be provided. The accommodation camp will be fenced and access will be controlled by a guard and appropriate security monitoring systems.

3.3.9 Airstrip

Due to the height and location of the proposed new waste rock dump along the flight approach path, it may be necessary the develop a new airstrip and associated ancillary facilities at some point within the Project mine life.

The proposed airstrip will be located approximately 7 km north east of the Mine site; it will have an approximate footprint of 1.3 km^2 and will be secured by a fence (see Figure 3-2).

The following facilities will be included within the secured airstrip footprint:

- **Runway**: The runway will be hard sealed with asphalt and will be approximately 3,000m in length and 45m wide. The runway will provide sufficient take off and landing distance in both directions (2,500m), runway end safety areas (150m) at each runway end and a clearway of 300m will be provided.

- **Taxiway**: The taxiway, which connects the runway with the hanger, apron and terminal, will be hard sealed with asphalt (20 m width) and will have an overall width of 50 m.
- **Apron**: The apron provides an area for aircrafts to be loaded and unloaded, fuelled and boarded. The asphalt paved apron will be approximately 50 m by 125 m wide.
- **Helipad**: The helipad, which will provide an area for helicopters to land and take off will be approximately 38 m X 38 m and will have a 6.5 m safety area around the pad.
- **Fuelling Facility**: The fuelling facility will incorporate a 38 m by 51 m bunded (5 cm high) concrete pad for containment. Fuel tanks will be double walled, and the fuelling area and pipeline from the fuel tank will be contained within the bunded area.
- **Terminal**: The terminal is approximately 41 m by 30 m in dimension. The terminal building shall consist of a stand-alone masonry block facility and will contain; a passenger/baggage security screening facility, immigration/customs offices and security area, lockable room for bonded freight packages and forklift, departure lounge, baggage room, arrivals lounge, airport personnel office, VIP lounge, and washroom facilities.
- **Hangar**: The hangar bay has an approximate gross dimension of 47 m by 48 m with a gross area of 2260 m^2. An Equipment Storage facility is attached to the Hangar. The hangar building will consist of a structural steel system in combination with concrete where appropriate.
- **Vehicle Parking Area**: The granular surfaced vehicle parking area will accommodate approximately 20 vehicles, 3 buses and other vehicles.

  For the purposes of this assessment, it is assumed that the usage of the proposed airstrip will remain unchanged compared to the existing airstrip.

3.3.10 Borefield

In order to supply the additional water requirement for Project construction and additional dump leach material that is planned to be processed by ongoing operations, it is proposed to temporarily increase the water supply from the existing borefield to 30,000 m^3/day (monthly average basis). It is proposed that this level of abstraction will continue for a period of approximately four years, thereafter it shall be utilised as an emergency back-up supply for the proposed new sea water extraction system. It is proposed that the borefield will only be used for back supply for approximately 20 days per year with a maximum abstraction of 30,000 m^3/day.

Historically TMLSA was licensed to abstract 14,000 m^3/day. However, a recent EIN submission (Phase 1ai), which was approved in June 2011, increased the abstraction rate to 17,000 m^3/day.

To facilitate the temporary increase from the borefield, from 17,000 m^3/day to 30,000 m^3/day, it is proposed that approximately 30 additional water supply wells and additional observation boreholes be constructed primarily to the south east of the existing borefield, however a few boreholes may also be located to the north of the existing borefield (see Figure 6-5). The boreholes will be drilled approximately 500 to 600 m apart from each other and the boreholes will extend to a depth of approximately 100 m and into the gravel aquifer. Equipment, piping, a new pumping station with power supply driven by diesel generator, and electrical instalments, including overhead and underground power line, will also be installed as required.

An upgrade to the water supply pipelines used to carry groundwater from the borefield to the Mine site was presented in Phase 1a(i) EIN report (URS Scott Wilson, 2011d). As part of

Phase 1a(i) the existing 400 mm pipeline was taken out of service for repairs. Repairs to this 400 mm pipeline have been undertaken and it is proposed to bring the pipeline into service for Phase 1b.

3.3.11 Connection to Raw Water Delivery System

To support the temporary expansion of the borefield a new pipeline is required to connect the new Phase 1b boreholes to the existing raw water supply pipelines which run from the borefield, along the access road, to the Mine site.

The new pipeline will be approximately 500 mm in diameter, approximately 10 – 15 km in length and will be constructed of high density polyethylene or other suitable materials. The maximum capacity of the pipeline will be approximately 12,000 m^3/day.

See Figure 3-6 for raw water delivery system general layout.

4 Project Setting

4.1 Mining in Mauritania

Mauritania has significant mineral deposits and is one of the world's largest ranked iron ore producers. Mauritania has also produced modest quantities of cement, copper, gold, gypsum, and salt from its abundant mineral deposits, which also include cobalt, diamond, phosphate rock, sulphur, and uranium (USGS, 2010).

The mining sector continues to be Mauritania's largest foreign-exchange earner, accounting for between 9% and 10% of gross domestic product, in 2008, and Mauritania's total exports were valued at about $1,751 million (USGS, 2010). Iron ore exports accounted for 42%, crude oil exports accounted for 19%, gold exports accounted for 10% and copper exports accounted for 10% of total exports.

The MPEM is the government agency responsible for regulating the mineral industry in Mauritania and has been supported by several international projects (with the World Bank and the Extractive Industries Transparency Initiative (EITI)) aimed at "accelerating the growth of the mining sector by creating favourable conditions through the removal of obstacles which constrain private sector development". This includes:

- Rationalising the role of the State by reducing its involvement in mining exploration and development activities;
- Promoting private sector investment in the mining sector;
- Building the capacity of agencies involved in regulating mining activities; and
- Developing the environmental and 'social management' aspects of mining, Ref. World Bank, Project, Project Summary, Mining Sector Capacity Building Project ID P057875.

Such initiatives have resulted in foreign investment in Mauritania increasing. Between 1995 and 2005, over 20 international companies took up licences to explore Mauritania's mining potential (Mining Journal, 2006). Demand for exploration permits has focused on copper, gold, diamonds, iron ore, phosphates and oil (Mining Journal, 2006).

4.2 Location

Mauritania is situated in northwest Africa and is bordered by Western Sahara and Algeria to the north, Mali to the east, Senegal to the south and Atlantic Ocean to the west. The Mine is situated in the Inchiri Wilaya of north western Mauritania, approximately 300 km north of Nouakchott, 250 km south east of Nouâdhibou and 65 km east of the border of the PNBA (see Figure 1-1).

The nearest industries are at Boulanouar (water bottling), Akjoujt (Guelb Moghrein Copper/Gold Mine) and Bennichab (water bottling), which are 120 km north west, 150 km east south east and 130 km south east respectively.

The Mine site is accessed from the main Nouakchott–Nouâdhibou N2 highway by a 60 km two-lane unsealed access road. In addition an airstrip is located at the Mine site; this airstrip is used to fly personnel to and from Nouakchott.

4.3 Physical Environment

The climate is classified as an arid - desert climate with an average annual high temperature of above 45°C between May and August. Minimum temperatures can reach below 10°C in December to January. The on-site area is dominated by north east winds. Average annual precipitation at the Mine site is around 84 mm and average monthly evaporation is approximately 320 mm/month (3840 mm per year). Rainfall usually occurs during the hivernage which lasts from July to September.

As a result of the high rate of evaporation and low rainfall means that there are no permanent watercourses on-site but storms can produce ephemeral floods in wadis and across open ground (URS Scott Wilson 2011b).

Air quality on-site is dominated by concentrations of both coarse dust particles and respirable particles (PM_{10}) as a result of natural desert conditions and existing mining operations. Due to the Mines remote location, air quality is not affected by surrounding industries; however sources of emission on-site include exhaust emissions from the power plant, mobile plant, road vehicles and airstrip operations.

The Mine area is generally flat, and is affected by sand dune movements. Hence most of the area is covered by skeletal soils, generally comprised of hard rock overlain with sand. The soils are predominantly sand and gravel, comprising transported sediments with low agricultural potential.

The Mine lies within the Archean age Aouèounat greenstone belt, which is a north-south trending belt of mostly supracrustal rocks situated within the south-west sector of the Reguibat Shield. Deposit types that occur consist primarily of gold-bearing Banded Iron Formation deposits. The Aouèounat belt comprises metavolcanic and meta sedimentary sequences. These include mafic to ultramafic metavolcanics, dacite and epiclastic rocks interbedded with Banded Iron Formation, Banded Iron Magnetite and schists.

At the Mine site the primary permeability of the rock is low, boreholes drilled at the Mine site yield little or no water. Groundwater levels at the Mine site are generally around 35 to 40 m below ground level, but depths as great as 85 m are recorded in some boreholes. In some cases monitoring boreholes are found to be dry. The groundwater is saline with high concentrations of chlorides and sulphates and contains heavy metals such as lead, chromium and nickel making it unsuitable for industrial or potable use.

The Mine site borefield is approximately 60km from the Mine site. It is currently permitted to abstract 17,000 m^3/day. The boreholes draw groundwater from the overlying Continental Terminal aquifer. This aquifer is formed of sedimentary deposits of variable permeability. The main aquifer zone is at a depth of around 90 m, where transmissivity has been found to be as high as 1400 m^2/d and individual borehole yields are good at around 500 m^3/d. Groundwater levels range between depths of 45 to 50 m below ground level at the borefield. There appears to be little infiltration of rain to replenish groundwater, with monitoring boreholes at the Mine site and the borefield showing no measurable response to storm events. The quality of groundwater at the borefield is highly saline, indicative of fossil water and/or low rainfall recharge. Recharge of groundwater is therefore assumed to be negligible and abstraction taken from storage.

4.4 Biological Environment

The habitat present within the site is of a gravelly regs[2] type, the typical habitat of much of the middle, north and north-east of Mauritania.

Vegetation cover is typically low and comprises of relatively few widespread plant species. Three nationally protected tree species have been recorded on-site. The fauna recorded was similarly of relatively low diversity and none of the species recorded are officially classed as rare, threatened or protected.

4.5 Social-Economic Conditions

The Mine is based in Inchiri Wilaya, a region covering 41,700 km^2 (SNC Lavalin, 2004). The region consists of a very low population density, with approximately 20,000 inhabitants (approximately 0.3% of the total population of Mauritania) (ONS, 2009). The Wilaya is made up of the administrative capital, Akjoujt, where the majority of Inchiri's population live.

The nomadic way of life is a feature of Mauritanian culture, whilst this way of life is in decline there are a number of nomadic/semi-nomadic people who transit or are temporary residents within the vicinity of the Mine for at least part of the year.

A number of isolated families have set up structures and reside within an area of 30 km diameter surrounding the Mine. They practice animal limited husbandry and other subsistence forms of livelihood. Similarly, approximately 1 km east of the borefield, four families have set up structures and provide a range of services (inn, restaurant, shop) for travellers at the junction of the Mine access road and the main Nouakchott-Nouâdhibou N2 highway.

4.6 Archaeology and Cultural Heritage

The Mine area is characterised by three key types of archaeological sites: Neolithic settlements on old ogolian dunes, protohistoric tombs clustered on gravels and rocky ridges, and historic Muslim tombs. Muslim tombs are protected by national/Islamic law and customary practice.

A total of 55 sites were identified on-site. These sites comprise Neolithic burials and occupation sites (*c.*6,000 – 2,800 Before Present), Protohistoric tombs (*c.*2500 BP – 1000 AD) and Muslim tombs (*c.*700AD to present) and prehistoric stray finds.

All of the cultural heritage sites identified at the Mine are considered to be normal and typical of the region. None have been designated according to local, national or international standards in terms of their outstanding aesthetic, artistic, documentary, environmental, historic, scientific, social, or spiritual value.

[2] Regs are desert landform defined as broad plains covered with sand and gravel. Regs are the dominant landform in most of the Sahara.

5 Environmental Impact Assessment

5.1 Introduction

This Section presents the methodology and terminology used to determine environmental and social baseline conditions and to assess the impacts of Phase 1b Project components. Methodologies adopted for the technical assessment of specific environmental and social disciplines are discussed in Sections 6 to 16 respectively.

The EIA has involved the following two stages; Terms of Reference (ToR) and Environmental Impact Assessment (EIA).

5.2 Terms of Reference

The Terms of Reference (ToR) process involved a preliminary review of the potential environmental and social impacts of the proposed Project components for Phase 1b, including a site visit and review of existing data.

The ToR report, which presented the proposed approach for the EIA was submitted to the authorities in May 2011, and was approved in May 2011. A copy of the approved ToR report for Phase 1b is presented in Appendix 1.

5.3 Environmental Impact Assessment

The overall methodology adopted for undertaking this EIA is based on the requirements of Mauritanian legislation as set out in Decree No. 2004-094 and its amendment No. 2007-105, together with the Guide for Undertaking an Environmental Impact Assessment in the Mining Sector (RIM, November 2006).

The EIA also takes into consideration international best practice, in particular, IFC Performance Standards, the World Bank's Operational Policy 4.01 on Environmental Assessment and the EU EIA Directive 85/337/EEC, and relevant other international protocols/agreements/treaties applicable to Mauritania (see Section 2).

With regard to terminology used in the EIA, specific technical terms specific to each environmental or social discipline are explained in Sections 6 to 16 respectively. However, in the interests of clarity and consistency, a number of generic Project terms are defined in Table 3-1. A listing of abbreviations used in the EIA is also presented at the front of this report.

The overall methodology adopted for undertaking the EIA and preparation of this report has included the following key stages outlined in Section 5.3.1 to 5.3.7.

5.3.1 Consultation

Consultation is being undertaken throughout the development of the Project to ensure that all interested parties are aware and informed of the Project and that any potential issues are addressed appropriately. Such consultations include:

- **Ministry**: As outlined in Sections 1 and 20 regular consultation meetings have been held with the relevant Mauritanian authorities, including MPEM, MESD and MWS. In addition, a Project Cordiantion Committee has been established between TMLSA/Kinross and several key Ministries to facilitate Project implementation;
- **Stakeholders**: As outlined in Section 20, a public consultation meeting for Phase 1b was held with stakeholders and their comments have been addressed in this EIA report;

- **Project team**: Regular meetings (weekly teleconferences and quarterly meetings) are held with representatives from the Mine, project management, engineering, environmental and social specialist teams.

In addition, consultation occurs throughout the EIA process through interaction with authorities and stakeholders in the collection of baseline data.

5.3.2 Baseline Conditions

An important component of the EIA process is the definition of the baseline conditions, i.e. the prevailing environmental and social conditions, against which the potential impacts of Phase 1b Project components are assessed. The establishment of the baseline conditions facilitates identification of potentially sensitive receptors (such as, ecosystems, local communities) and an evaluation of their level of sensitivity to the impacts.

On-site baseline conditions are dominated by on-going mining operations; Phase 1b Project components are located on-site. Baseline conditions were identified through three key stages and the results are presented on a discipline basis in Sections 6 to 15.

- **Existing Baseline Data**: Review of relevant published data, including previous EIAs for the Mine (SNC Lavalin, 2004, Scott Wilson, 2008a,b,c,d, 2009 a, b and 2010a). Sources of baseline data and all key documents, which have been used for this EIA, are listed in Section 22;
- **Baseline Surveys**: Where baseline data was considered to be potentially insufficient (such as, out of date, lack of seasonality considerations, too narrow scope) for the current EIA process, new baseline surveys were conducted and additional primary data collected. Phase 1b baseline surveys were undertaken from February 2011 through May 2011 and included: air quality, ecology, groundwater, archaeology and cultural heritage and socio-economics. The methodologies and results of the baseline surveys, together with information gathered in the data review, are presented in Sections 6 to 15 of this report; and
- **Geographic Information System (GIS)**: Development of a GIS incorporating remotely sensed data (satellite imagery and aerial photography), topographical maps, secondary spatial data, engineering drawings and field visit Geographical Positioning System (GPS) data. The GIS was used to generate figures for the Phase 1b EIA.

5.3.3 Identification and Assessment of Impacts

Potential impacts (both beneficial and adverse) have been identified through a technical assessment of the Phase 1b Project components upon the environmental and social baseline conditions. The assessment draws on baseline data (both primary and secondary data); national and international design guidelines (Hatch, 2011) and on the technical expertise of the URS Scott Wilson team. The results are presented in Sections 6 to 16. Terminology used to describe the impacts is presented in Table 5-1 and Table 5-2.

The relative 'significance' of an impact is considered to reflect the relationship between two factors:

- The magnitude of the impact (i.e. the actual change taking place to the environment); and
- The sensitivity of the affected resource or receptor.

Phase 1b potential impacts have been assessed for the lifetime of the relevant Project components; this includes:

- **Construction**: Period during which Phase 1b Project components will be delivered to the Mine, erected and installed;
- **Operation**: Period during which the relevant Phase 1b Project components will be in-use at the Mine;
- **Closure**: period when relevant Phase 1b Project components are decommissioned, and the area is rehabilitated in line with an agreed plan (see Section 19). Post closure no operations are undertaken, however monitoring will be continued until such time as necessary.

Within this EIA, the following generic matrix (see Table 5-1) is used has been applied to define the level of and significance of impacts.

Table 5-1: Level and Significance of Impacts

		Impact Magnitude		
		High	**Medium**	**Low**
Receptor sensitivity	**High**	High	High/Moderate	Moderate
	Medium	High / Moderate	Moderate	Moderate/Low
	Low	Moderate	Moderate/Low	Low/Negligible

The 'residual impact', i.e. the impact remaining after mitigation, has been assessed using the terminology presented in Table 5-2.

Table 5-2: Assessment Terminology

Nature of predicted impacts	
Neutral	No overall environmental impact.
Adverse	Negative environmental impact.
Beneficial	Positive environmental impact.
Significance of predicted impacts	
High	An impact that is capable of causing sufficient change in the environment and fundamentally affect the status, potential productivity or usage of the environment.
Moderate	An impact that is capable of causing change in the environment but does not fundamentally affect the status, potential productivity or usage of the Environment
Low	An impact which is either too small to be measured or, even if quantifiable, Does not give rise to any material change in the environment
Negligible	No effect, not significant. Irrespective of other effects.
Duration of predicted impacts	
Short term	An impact that persists for 36 months or less (i.e. during construction period).
Medium term	An impact that persists for between 36 months and 16 years (i.e. during the Mine's Operational lifetime).
Long term	An impact that persists for longer than 16 years (i.e. Post Closure).

Where possible, the rating of impact significance, nature and duration is based upon quantitative criteria (such as, Environmental, Health and Safety (EHS) Guideline values), together with the use of value judgements and expert interpretations to establish to what extent an impact is environmentally significant. In addition, performance against environmental quality

standards or pollution control thresholds and compatibility with environmental policies is taken into account where appropriate.

5.3.4 Cumulative Impacts

The potential for significant cumulative impacts arising from the project phases is considered limited. As discussed in Section 1.3, the Project phasing has been developed to minimise the overlapping of construction activities such that each of the project components within each Phase are either carried out sequentially on Site (e.g the Phase 1 supporting infrastructure and preliminary upgrades are carried out ahead of the main infrastructure developments to be constructed in Phase 2); or they are spatially separated, i.e the Phase 3 Project components are located off-Site. This will be confirmed and presented in the Phase 2 EIA, and where cumulative issues do potentially arise, recommendations for management will be presented in the overarching EMP for the Project as discussed in Section 5.3.6, below.

5.3.5 Mitigation

Mitigation measures are proposed to ensure that beneficial impacts are enhanced and adverse impacts are either avoided, reduced, remediated (restored) or compensated or offset. Mitigation includes preventative engineering implemented during the design phase of the proposed Project, ongoing and planned programmes to eliminate or minimise the effects of impacts during the life time of the Project and monitoring plans to evaluate the success or otherwise of the mitigation measures.

An evaluation of the level of predicted impacts that are anticipated to remain after the implementation of all proposed mitigation measures (residual impact) has also been undertaken. The nature of the predicted impact is described and its significance determined by reference to appropriate standards or guidelines.

5.3.6 Environmental and Social Management

The EIA includes an Environmental Management Plan (EMP) which integrates all aspects of mitigation, management, monitoring and institutional measures into a framework management plan for Phase 1b.

Each successive phase of the Project will be subject to distinct EIA processes and any cumulative impacts will be fully assessed at each phase. All proposed mitigation actions will be incorporated into and implemented via the Mine's Environmental Management System (EMS) (Scott Wilson, 2010b) and/or its other Corporate Responsibility management programs.

5.3.7 Rehabilitation and Closure Plan

The EIA includes a preliminary plan for rehabilitation and closure of Phase 1b Project components including plans for removal or re-use of infrastructure, rehabilitation plans and potential approaches to alternative economic development (see Section 19).

6 Surface Water and Groundwater

6.1 Introduction

This Section presents the methodology and baseline conditions used to assess the potential impacts on surface water and groundwater resulting from Phase 1b. In addition, mitigation measures which aim to reduce, remediate or avoid potential impacts are proposed and the residual impacts (impacts after mitigation measures implemented) assessed.

6.2 Scope of Assessment

The main potential impacts on hydrology from the works proposed in Phase 1b relate to groundwater abstraction from the Mine's existing brackish borefield located approximately 60 km west of the Mine site. In 2010 the West Branch EIA authorised abstraction of 14,000 m^3/day. Subsequently in June 2011, the Phase 1a(i) EIN authorised abstraction of 17,000 m^3/day (14,000 m^3/day for operations and 3,000 m^3/day for road upgrade construction purposes).

In order to supply the Project's construction and production water requirements, it is proposed to temporarily increase the existing borefield water usage to 30,000 m^3/day on a monthly average basis, for approximately 4 years. To achieve this abstraction it is proposed to construct up to 30 new water supply wells and additional observation boreholes as an extension to the existing borefield. Abstraction boreholes will primarily be located to the south of the existing borefield; however a few abstraction boreholes may also be located to the north of the existing borefield. The water will be used for construction and operation for approximately 4 years (commencing upon permitting of the EIA), after which the borefield will be used for emergency backup purposes. Total water extracted over the 4 year period will be slightly less than current abstraction predictions based on a permitted abstraction of 14,000 m^3/day over 10 years. After approximately 4 years the existing borefield will be utilised as emergency backup for the operation for a maximum of 20 days per year.

Within the Mine site, construction and operation of Phase 1b Project components, including the TSF 3 starter cell, has potential effects on surface water drainage, storm water management and groundwater quality.

Since water is such a precious resource in Mauritania, it is considered to be of inherently high value and therefore is a receptor of high sensitivity. Exceptions to this are where groundwater is unusable due to the presence of low permeability rock, in which case the sensitivity is defined as low; and where the water quality is brackish or saline and therefore considered to be of medium sensitivity. (For the purpose of this assessment, brackish water is defined by total dissolved solids of between 2000 mg/l (the limit for agriculture irrigation) and 30,000 mg/l; saline water from 30,000 to 50,000 mg/l; and brine > 50,000 mg/l)[3].

6.3 Methodology

As referred to in Section 2, this assessment takes into consideration national legislation, international guidance and Kinross standards.

The approach to both surface water and groundwater hydrological impacts is to evaluate the baseline in terms of flows and water quality; assess the value of the resource and the vulnerability of any users; and determine impacts in terms of flow and water quality.

[3] http://www.engineeringtoolbox.com/water-salinity-d_1251.html

With regards to surface water the following data have been used in this assessment:

- Geological maps have been used to determine the surface water catchment area;
- Meteorological data; and
- Storm water management plan.

With regards to groundwater, the following data have been used in this assessment:

- Mine site borehole monitoring results. In addition to six existing monitoring boreholes, an additional nine monitoring boreholes have recently been drilled (in 2011) at the Mine site to expand the Mine's groundwater monitoring programme. Groundwater levels and quality are monitored at the Mine site (URS Scott Wilson 2011b); and
- Hydrogeological modelling of the borefield has been undertaken to determine the impact of increased temporary abstraction. Numerical modelling has been carried out to assess the impact of abstraction (cone of depression) and to ensure that there is no encroachment on surrounding fresh water aquifers (Bennichab and Boulanouar) and their users.

The regional nature of groundwater and surface water flow means that the impacts are assessed not only at the development site but in the water basin. For example interruption of surface water flow may affect downstream grazing, and abstraction of groundwater may have an impact throughout the cone of influence which spreads beyond the borefield.

6.3.1.1 Adopted Standards Influencing Methodology and Design

The IFC EHS Guidelines for Mining form the basis for design, assessment and mitigation approach. There will be a Stormwater Management Plan and a Water Use, Discharge and Conservation Management Plan. The key elements of these in relation to surface water and groundwater are as follows:

IFC EHS Guidelines for Mining

- Develop a plan to minimise impact to natural systems by managing water use, avoiding depletion of aquifers, and minimizing impacts to water users;
- Minimise the amount of make-up water to the extent practical;
- Consider the potential impact to the water balance prior to commencing any dewatering activities; and
- Consult with key stakeholders (such as, government, civil society, and potentially affected communities) to understand any conflicting water use demands and the communities' dependency on water resources and/or conservation requirements that may exist in the area.

Regarding water quality:

- The quality and quantity of mine effluent streams discharged to the environment, including storm water that contacts Mine site components should be managed and treated to meet the applicable effluent discharge guideline values and baseline (background) water quality targets.
- Receiving water-body use and assimilative capacity, including the impact of other sources of discharges to the receiving water, should be considered with respect to acceptable contaminant loadings and effluent discharge quality.

Specific stormwater/runoff control strategies include:

- Separate stormwater from process and sanitary wastewater streams in order to reduce the volume of wastewater to be treated prior to discharge;
- Prevent surface runoff from process areas or potential sources of contamination. Where this approach is not practical, runoff from process and storage areas should be segregated from potentially less contaminated runoff; and
- Minimise runoff from areas without potential sources of contamination to reduce the peak discharge rate.

Other management strategies include:

- Water used for dust control must not reach surface waters; and
- Divert storm water around active mine areas to avoid contact with disturbed areas.

The Stormwater Management Plan sets out the drainage strategy for external drainage, plant site drainage and road drainage. The underlying principles are:

- To prevent clean runoff water from external areas from entering plant site facilities, thus reducing both the risk of flooding plant areas and the amount of water that needs to be collected, retained or treated. This will be achieved by diverting external drainage back to nature via interceptor ditches;
- To safely convey the stormwater resulting from rainfall on general plant site areas out of the plant site through ditches, swales, culverts (or fords) and, where necessary, stormwater management ponds, to eliminate the risk of flooding; and
- To contain runoff from areas with potential contamination in stormwater retention ponds. From these ponds, water will either be recycled through the process plant (if practicable); left to evaporate; or pass through oil separators or other treatment, thus minimising the risk of plant site flooding and environmental pollution.

Water Use, Discharge and Conservation Management Plan

This plan covers:

- Borefield abstraction volume and flow rate monitoring and compliance with abstraction license conditions, potentially involving improved leak detection patrols;
- Borefield quality monitoring;
- Borefield water level monitoring;
- Monitoring of groundwater levels and groundwater quality in designated monitoring boreholes in and around the Mine site and borefield;
- Analysis of groundwater samples by independent laboratory, as per EMS programme, to standards/methods approved by TMLSA (such as, ISO/TS 17924, Dutch Intervention Values and World Bank EHS Guidelines for Mining, Table 1 - Effluent Guidelines, 2007) if groundwater is discharged at surface.
- Potable water sampling, analysis and review;
- Sanitary effluent treatment and disposal systems;
- Water utilization and management audits; and
- Mine Water Balance to ensure optimum water use and re-use.

6.4 Baseline Conditions

6.4.1 Mine Site

6.4.1.1 Climate

The climate is classified as an arid - desert climate with an average annual high temperature of above 45°C between May and August. Minimum temperatures can reach below 10°C in December to January.

The area experiences very low rainfall with an annual precipitation of 84 mm. Rainfall usually occurs during the hivernage which lasts from July to September. Average recorded monthly evaporation is approximately 320 mm/month (3840 mm per year) at ATAR station, which is located approximately 265 km to the east of the Mine.

Meteorological data for the EIA were obtained from previous EIAs and meteorological stations.

6.4.1.2 Surface Water Courses

The high rate of evaporation and low rainfall means that there are no permanent watercourses but storms can produce ephemeral floods in wadis and across open ground.

The topography of the region is shown on the geological map (Republique Islamique de Mauritanie, Carte Geologique a 1/200,000, Chami 2015), reproduced in Figure 6-1. The geological map datum differs from local datum but can still be used to assess general directions of flow and catchment boundaries. The Mine site lies at an elevation of around 120 m Reduced level (RL) which is approximately 120 m above sea level.

On the basis of the regional mapping, drainage is towards the Mine site from the catchment beyond the Mine to the north east and, to a lesser extent, the south west. The catchment boundary, including the Mine site, is shown in Figure 6-1 and covers an area of approximately 194 km^2. The proposed Mine pits and plant site occupy an area of approximately 133 km^2.

The Mine site catchment is approximately coincident with the Mine site so impacts as a result of changes in runoff will tend to be within the Mine site. The exception is the area towards the south into which runoff could flow from the site. The area beyond the southern flow boundary has low sensitivity as a result of its occasional use for grazing land.

Drainage patterns give an indication of the permeability of the ground and likelihood of infiltration of rainfall. Where there are more drainage routes the permeability is likely to be lower. The majority of rainfall runs off and evaporates. At the Mine site there is little evidence of infiltration as discussed in subsequent sections.

As there is no permanent surface water at the Mine site, the sensitivity of surface water is considered to be medium. Flows are ephemeral but runoff from the Mine site feeds into a larger catchment which may be affected by changes.

6.4.1.3 Geology

Two principal mineralised zones have been identified within the MLA; the Piment Zone and the West Branch prospect which lies 1 km south west of the current southern limit of the Piment Zone.

The Piment Zone is situated along the east limb of an interpreted broad, regional antiform that is cored by a felsic volcanics, approximately 200 m wide at the present surface elevation. The West Branch is located on the reverse limb of this antiform.

The stratigraphic sequence for these zones comprises:

- Epiclastic sediments, greywacke (SVC);
- Oxide-silicate facies ferruginous magnetite quartzite (BIM or BIF) ± grunerite-cummingtonite;
- Garnetiferous green schist (GST);
- Biotite green schist; locally contains garnet crystals and grades into the garnetiferous green schist (GST);
- Intercalated BIF-GST, with varying proportions of the two components occurring in centimetre or decimetre-size beds;
- Dacite; fine to medium grained; overlain by an aphanitic, pyrite/pyrrhotite-rich interval at the upper contact, interpreted as a chert by previous operators; and
- Late cross-cutting mafic (dolerite-gabbro) dykes (MGO-MDO).

Quaternary sand deposits outcrop to the south east.

The dominant feature is a north south trending fault with quartzite to the west. To the east of the fault the ore host deposit dips to the east at approximately 40 degrees and consists of banded iron formations with felsic volcanics. The deposits are of Mezoarchaean age.

More recent dykes cross cut in a dominant west north-west, east south-east direction.

Most of the Mine is covered by skeletal soils underlain by weathered basement rock with unweathered (fresh) rock below. The elevation of the fresh rock interface undulates across the study area but, at West Branch, averages about 50 m below ground surface in the west, and 45 m and 46 m in the centre and west respectively.

6.4.1.4 Groundwater levels

Groundwater levels have been recorded at the Mine site since early 2010. Six monitoring boreholes were drilled initially and a further nine were drilled in April through June 2011. The boreholes are drilled to depths of approximately 100 m and completed with standpipes. The locations of the boreholes are shown in Figure 6-2. Three additional monitoring boreholes are proposed for construction.

Groundwater levels at the Mine site are around 35 m to 40 m below ground level. Levels at borehole 15 are at a depth of 55 m due to higher ground surface elevations. Depths as great as 85 m below ground level were recorded in some boreholes soon after they were drilled. Boreholes drilled in 2011, for example, were found to be dry initially with water levels recovering slowly. Earlier boreholes also show a slow rise in level and may still be stabilising. This slow response is attributed to low permeability. There is no evidence of confined conditions. Preliminary readings from piezometers at different depths show close to hydrostatic conditions.

Water level hydrographs are shown in Figure 6-3. The method of measuring water levels changed in November 2010, with reporting accuracy of 1 m replaced by accuracy of 1 cm. Significant fluctuations in the data shown at around this time, should therefore be treated with

caution. There were major rainfall events in September and October 2010. There does not appear to be a measurable response to those events.

On the basis of existing monitoring borehole data there is a fall in groundwater levels of approximately 15 m from West Branch Pit to the process plant, with a hydraulic gradient of between 0.003 and 0.005 to the north. Some of the existing Piment pits appear to intercept groundwater and contain water in the base at between 10 m to 25 m lower than surrounding groundwater levels and may be a controlling factor in the apparent groundwater flow direction.

6.4.1.5 Groundwater quality

A groundwater monitoring programme has been in place at the Mine since 2010 and was extended to include new wells in 2011.

Ambient groundwater samples are collected from monitoring boreholes around the Mine site. A summary is included in Table 6-1 for monitoring boreholes MBH2, MBH3, MBH4, MBH5 and MBH6 between March 2010 and November 2010. Comparison with some WHO guidelines for drinking water quality shows that the water is high in total dissolved solids and is brackish to saline. The dominant ion is chloride which is in excess of 12,000 mg/l, with an average of around 17000 mg/l and maximum in excess of 33,000 mg/l. The WHO drinking water standard is 400 mg/l. Sulphate concentrations are also high, averaging around 3000 mg/l compared to a drinking water standard of 500mg/l.

There have been some occurrences of metals exceeding drinking water standards as shown by the maximum values in Table 6-1 but average values do not, to date, indicate high concentrations of most metals in samples taken from boreholes beyond the zone of mineralisation. The comparison with drinking water quality does not imply that groundwater should meet drinking water standards, but is a useful comparison standard.

With respect to IFC EHS Guidelines for Mining, no substances have been recorded consistently at above guideline values. The data excludes occasional high values that are believed to be outliers, and also excludes data for which the limit of detection exceeded the guideline value. Further sampling is underway. Total suspended solids are also high but this is as a result of sampling difficulties in low permeability rock and slow recovery after purging.

Monitoring is ongoing and at least one year of quarterly sampling will be used to define the baseline for the expanded Mine operations in Phase 2.

Table 6-1: Mine Site Baseline Water Quality Analyses

Determinants	Units	Limit of Detection	WHO Guidelines for Drinking Water Quality	IFC EHS Guidelines for Mining	Maximum	Minimum	Average	No. of Samples
pH	pH Units	<1		6 to 9	8.18	6.71	7.47	40
Redox potential	mV				492.00	86.00	208.09	35
Conductivity @ 20 deg.C	µS/cm	<0.014			55500	35100	42805	40
Hardness, Total as CaCO3	mg/l	<1			20322	1	9994	35
Dissolved solids, Total	mg/l	<5	1500**		475156	13312	48217	35

Determinants	Units	Limit of Detection	WHO Guidelines for Drinking Water Quality	IFC EHS Guidelines for Mining	Maximum	Minimum	Average	No. of Samples
Suspended solids, Volatile	mg/l	<6			185.00	6.00	33.81	15
Total Suspended Solids	mg/l			50	286.00	173.00	229.40	5
Aluminium (dissolved)	µg/l	<2.9			10.00	2.90	7.97	35
Arsenic (dissolved)	µg/l	<0.12	10	100	14.00	0.12	5.10	35
Calcium (dissolved)	mg/l	<0.012			7390	0	2693	35
Cadmium (dissolved)	µg/l	<0.1	3	50	10.00	0.10	2.29	30
Chromium (dissolved)	µg/l	<0.22	50* Total	100	24.00	2.77	7.75	30
Copper (dissolved)	µg/l	<0.85	2000	300	27.50	5.00	9.23	35
Iron (total)	mg/l	<0.024		2	3.03	0.02	1.05	15
Iron (dissolved)	µg/l				78.69	10.00	17.38	25
Lead (dissolved)	µg/l	<0.02	10	200	10.00	0.25	2.63	35
Magnesium (dissolved)	mg/l	<0.036			1685.00	0.04	793.43	35
Manganese (dissolved)	µg/l	<0.04	400		355.40	0.16	51.85	35
Mercury (dissolved)	µg/l	<0.01	6	2	1.00	0.01	0.19	40
Nickel (dissolved)	µg/l	<0.15	70	500	74.90	1.80	20.42	35
Potassium (dissolved)	mg/l	<2.335			392.50	2.34	140.59	35
Sodium (dissolved)	mg/l	<0.076			21900	0	11813	35
Zinc (dissolved)	µg/l	<0.41		500	67.00	2.88	8.89	35
Alkalinity, Total as CaCO3	mg/l	<2			310.00	20.00	155.89	35
Alkalinity, Carbonate as $CaCO_3$	mg/l	<2			60.00	2.00	11.60	35
Chloride	mg/l	<2	400**		33355	12254	17388	35
Sulphate	mg/l	<3	500**		5206	1166	3612	35
Organic Carbon, Total	mg/l	<3			6.89	2.20	3.72	30
DOC (w)	mg/l				16.00	3.00	8.68	5
Ammoniacal Nitrogen as N	mg/l(N)	<0.2			2.36	0.20	0.98	35
Ammoniacal Nitrogen (NH_3	mg/l	<0.2			2.87	0.20	1.17	35

Determinants	Units	Limit of Detection	WHO Guidelines for Drinking Water Quality	IFC EHS Guidelines for Mining	Maximum	Minimum	Average	No. of Samples
Nitrite as N	mg/l	<0.0677	50		0.07	0.07	0.07	12
Nitrate as N	mg/l	<0.01	50		130.68	0.50	17.56	23
Acidity as HCl	mg/l	<4			11.00	5.48	8.54	15
Acidity (w) $CaCO_3$	mg/l				40.00	15.00	24.00	5
Cyanide, Total *	mg/l	<0.05	0.07	1	0.05	0.01	0.04	20
Cyanide, Free *	mg/l	<0.05		0.1	0.07	0.00	0.04	20

** Maximum Limits for Organoleptic Parameters in Drinking Water

* Excludes outliers and data where limit of detection exceeds guideline

Parameter exceeds the WHO guidelines for drinking water quality

Parameter exceeds the International Finance Corporation (IFC) EHS Guidelines for Mining

Parameter exceeds both WHO and IFC EHS guidelines

The following assessment uses field parameters of electrical conductivity and pH. The electrical conductivity of groundwater has ranged from around 25,000 to 65,000 µS/cm as shown in Figure 6-4. An approximate conversion factor of 0.6 between electrical conductivity and total dissolved solids gives salinity in the range 15,000 to 39,000 mg/l. It is concluded that groundwater at the Mine site is brackish to saline.

Samples taken from existing pits show a wide range of electrical conductivity from approximately 5000 µS/cm at Piment sud nord, to more than 70,000 µS/cm at Piment nord. Different pits are exposed to different conditions such as inflow of surface water which results in dilution, and evaporation which results in increased concentrations. Pit water samples are included in the monitoring regime when the pits are accessible.

Water quality logging was undertaken during drilling of borehole HG400A (Easting 47075, Northing 71450) located in West Branch area as summarised in Table 6-2. The results also confirm the brackish nature of the groundwater at these depths. However there was evidence of fresher water (7 mS/cm) in the top 150 m.

Table 6-2: Borehole Water Quality Logging

Borehole: HG400A					
Depth	Date	Temp (deg C)	pH	EC (20) mS/cm	EC (25) mS/cm
265	08/04/2011	40.3	7.6	-	31.5
267	08/04/2011	39.5	7.64	-	33.9
291	09/04/2011	29.3	7.62	26.3	30
295	09/04/2011	29.3	7.65	28	31.2
320	09/04/2011	-	7.59	27.5	31.4
360	10/04/2011	37.9	7.41	27.5	30.6

Borehole: HG400A					
373	11/04/2011	38.7	7.74	28.6	32.2
380	11/04/2011	38.9	7.64	29.6	33
390	11/04/2011	36.6	7.83	27.7	31
400	11/04/2011	36.9	7.85	28.4	31.7

The pH of groundwater at borehole HG400A indicates slightly alkaline conditions. Samples from the environmental boreholes gave similar results with a range of pH from 6.9 to 8.0. Routine sampling and analysis of water samples is ongoing to extend the dataset.

6.4.1.6 Hydrogeology

Hydrogeological investigations were carried out at the Mine site as part of the geotechnical investigations for pit slope design. The primary permeability of the rock was found to be low and any groundwater flow that does occur will be primarily through fractures. Most boreholes drilled at the Mine site yielded little or no water. Packer tests and falling and rising head tests (between near surface and depths of up to 700 m) indicated permeability values of less than 10^{-9} m/s at depths below approximately 75 m. Above this, permeability was calculated to lie in the range 10^{-5} m/s to 10^{-8} m/s with a median value of around 10^{-7} m/s. The higher values in some boreholes were restricted to fracture zones and shown by nearby boreholes to be localised features.

There is no aquifer at the Mine site. Aquifers are saturated regions of the subsurface that produce an economically feasible quantity of water. The Mine site is underlain by formations with low hydraulic conductivity and very low yields. Therefore, although groundwater is present in pores and fractures, the volumes of water are very small and difficult to extract and the groundwater is not usable.

Since there is no aquifer at the Mine site, the sensitivity of groundwater is considered to be low. There is little evidence of infiltration; the water table is at a depth of around 35 m to 40 m; the water quality is brackish; and permeability and yields are very low.

6.4.2 Borefield

6.4.2.1 Background

Development of the existing borefield commenced in 2005/2006 for Rio Narcea Gold Mine. The positions and layout of the original eight boreholes were based on a water supply demand of 4,000 m^3/day. The drilling of these boreholes was completed in 2005 under the supervision of GCS (Pty) Ltd and the supply system was successfully commissioned in 2006/7 by the Aster Company, Spain.

A follow up well-field review was undertaken by GCS (Pty) Ltd, at the request of the Red Back Mining Inc., in January 2008. During this period an average of only 2,500 m^3/day was abstracted and the supply gradually increased as the demand from the mine increased. It was found that the aquifer system performed as anticipated.

As part of the Mine's 2008/9 development the original 4,000 m^3/day water demand was increased to approximately 10,000 m^3 day. Twelve additional supply boreholes were

subsequently drilled and constructed, and completed in April 2009; giving a design capacity of around 10,000 m^3/day.

An additional ten production boreholes were drilled in 2010/2011 to increase the number of boreholes to 28 and the borefield capacity to 14 000 m^3/day by April 2011. (Two production boreholes were lost due to collapse and flooding.) Each borehole yields on average around 500 m^3/day (between 350 and 750 m^3/day).

A total of 10 observation/monitoring boreholes were also drilled during the different phases of borefield development; these are measured for groundwater levels on a regular basis by Tasiast. GCS (Pty) Ltd continue to oversee the operation and development of the borefield and receive water level data, pump and other data on a monthly basis for feedback and monthly internal reporting.

The borefield was permitted for 14,000 m^3/day in 2010 upon approval of the West Branch EIA (Scott Wilson, 2010a). Subsequently, as part of Phase 1a(i) EIN for the Project, abstraction to 17,000 m3/day (14,000 m3/day for operations and 3,000 m3/day for road upgrade construction activities) was approved in June 2011. To facilitate this incremental increase from the borefield it was proposed that approximately 17 additional water supply boreholes be constructed within and to the south of the existing borefield (see Figure 6-5). Ten of these boreholes were designated as water supply wells and the remaining seven for back up water supply purposes when other boreholes require maintenance, rehabilitation, or replacement.

This Phase 1b EIA addresses the proposed abstraction of 30,000 m^3/day. This will commence upon approval for approximately 4 years. The proposed development includes drilling and commissioning of an additional 30 boreholes. The location of the 30 boreholes will be finalised as drilling progresses.

6.4.2.2 Climate

Baseline climate conditions are essentially similar to those at the Mine site, although influenced by sea breezes.

There appears to be little infiltration of rain to replenish groundwater, with monitoring boreholes at the borefield showing no measurable response to storm events.

6.4.2.3 Surface Water Courses

There are no permanent water courses in the borefield area. Surface water drainage is predominantly from north east to south west and three wadis are marked crossing the area (see Figure 6-5). There is evidence of significant surface water flows across the borefield following high rainfall, and two boreholes have been lost during flood events. Future boreholes will be placed away from drainage channels where possible.

There is no permanent water course at the borefield but when rainfall and runoff do occur potential grazing land is receives water. The sensitivity of surface water at the borefield is therefore considered to be medium.

6.4.2.4 Geology

The existing water supply borefield is underlain by Precambrian basement rocks at a depth of around 100 m, increasing in depth towards the coast. The boreholes draw groundwater from the overlying Continental Terminal aquifer. This aquifer is formed of sedimentary deposits of

variable permeability. Refer to Figure 6-6 for a Schematic representation of the Tasiast Well-field aquifer system.

6.4.2.5 Groundwater Levels and Quality

Groundwater levels range between depths of 45 m to 50 m below ground level at the borefield. Levels have been monitored at observation boreholes since 2008 and a gradual decline in levels of between 1 to 4 metres can be seen, as illustrated in Figure 6-7. The Figure also illustrates the borefield groundwater abstraction and water quality (electrical conductivity).

The quality of groundwater at the borefield is brackish, indicative of fossil water and/or low rainfall recharge. Recharge of groundwater is therefore assumed to be negligible and abstraction taken from storage.

6.4.2.6 Hydrogeology

The Mine borefield as well as the borefields further afield at Bennichab and Boulanour all form part of the Continental Terminal aquifer as identified by the World Wide Hydrogeological Mapping and Assessment Programme (WHYMAP, 2008) and are part of the major Senegalo-Mauritanian groundwater basin.

The main aquifer zone at the Mine borefield is at a depth of around 90 m, where transmissivity has been found to be as high as 1,400 m^2/day and individual borehole yields are good at around 500 m^3/day (see Table 6-3).

Table 6-3: Borefield Aquifer Characteristics

Layer	Aquifer	Transmissivity (m^2/day)	Hydraulic Conductivity (m/day)	Specific Yield	Storage Coefficient
1	Unconfined	5	0.1 to 0.0066	0.1	
2	Confined (leaky)	450 to 1400	45 to 140	0.25 – 0.3	3.06E-04 - 2.9E-05
3	Confined	1	0.01		

The sensitivity of groundwater at the borefield is considered to be medium because of its brackish quality. Fresh water has a high sensitivity as discussed in the subsequent section.

Monitoring boreholes are positioned in and around the borefield and, together with numerical modeling, are used to assess the impact of abstraction and to ensure that there is no encroachment on fresh water aquifers.

6.4.3 Water Users/Receptors

The Continental Terminal aquifer is part of the major Senegalo-Mauritanian groundwater basin. The World Wide Hydrogeological Mapping and Assessment Programme (WHYMAP, 2008) identifies the area of poor quality water within which the borefield is located. The extent of fresh water was delineated by IWACO (1995) as shown on Figure 6-8. Water quality contours were also provided as part of a U.S. Geological Survey study (Friedel, 2008) and are shown on Figure 6-9. There is some difference between the different sources of information but it is clear that the borefield is within the poor water quality zone.

The aquifer at the borefield is of medium sensitivity. The fresh water aquifer is a high sensitivity receptor.

There are also specific groundwater users which are high sensitivity receptors. These include high sensitivity groundwater receptors are the fresh water borefields at Bennichab and Boulanouar, approximately 100 km to the south and north respectively. Water quality at the Mine borefield and these borefields is shown by the contours on Figure 6-9 which illustrate the saline to highly brackish groundwater at the borefield compared to the fresh water at Boulanouar and Bennichab. The Bennichab resource is of sufficiently high quality to be used as a source for bottled drinking water.

A survey of water users at the borefield and along the access track was conducted. Only five households were identified in the area. Each household was asked where they obtained water for potable, domestic and livestock use and how much is consumed. No water is abstracted locally because of its brackish nature. All the users reported that they obtain their water from a borehole known as Ouad Echibke, located approximately 27 km north west on the road to Nouâdhibou at wadi Chebka, or from a borehole at Bouamatou at KP 234 located on the route between Nouakchott and Nouâdhibou approximately 40 km to the south at R'Gueittat. The locations of the boreholes are shown on Figure 6-9.

Further surveys of these boreholes were completed in July 2011, details held by the Ministry indicate that Ouad Echibke (at wadi Chebka) is fitted with an electrical pump and has a date in the borehole survey database of 1999 and electrical conductivity record of 246 µS/cm. The records for borehole Bouamatou indicate a well depth of 110 m, an electrical pump and water electrical conductivity of 762 µS/cm. During a visit in July 2011 it was confirmed that there are three separate boreholes and a new large diameter well at Bouamatou.

Figure 6-8 illustrates the location of the monitoring and abstraction wells, in and around the borefield. Observation boreholes were drilled in 2011 between the borefield and fresh water aquifers, and are marked as REG 1 and REG 2 on Figure 6-8.

The boundary of the PNBA lies approximately 5 km to the west of the borefield. The ecology and habitats of the PNBA are not dependent on groundwater.

6.5 Potential Impacts

6.5.1 Construction

6.5.1.1 Mine Site

Surface Water

Proposed Phase 1b Project components are infrastructure upgrades which will support the expansion of the Mine. These components are being constructed in accordance with good practice to minimise the effects of potential pollution or accidental spillage on water quality. Consideration has also been given to minimising seepage and runoff from the facilities, with the aim of maintaining surface water flow quality, magnitude and direction as much as practically possible in its pre development state.

The Stormwater Management Plan sets out the drainage strategy for external drainage, plant site drainage and road drainage. The underlying principles are:

- To prevent clean runoff water from external areas from entering plant site facilities, thus reducing both the risk of flooding plant areas and the amount of water that needs to be collected, retained or treated. This will be achieved by diverting external drainage back to nature via interceptor ditches.

- To safely convey the stormwater resulting from rainfall on general plant site areas out of the plant site through ditches, swales, culverts (or fords) and, where necessary, stormwater management ponds, to eliminate the risk of flooding.
- To contain runoff from areas with potential contamination in stormwater retention ponds. From these ponds, water will either be recycled through the process plant (if practicable); left to evaporate; or pass through oil separators or other treatment, thus minimising the risk of plant site flooding and environmental pollution.

The criteria for storm water management are set out in Table 6-4.

Table 6-4: Stormwater Management Infrastructure Sizing Criteria

Item Description	Sizing Criteria
Stormwater management pond(s) for general plant site areas	24-hour, 25 year return storm event
General plant site ditches, swales, culvert	24-hour, 25 year return storm event
External drainage diversion ditches	24-hour, 100 year return storm event
Containment pond for environmentally sensitive areas	24-hour, 100 year return storm event

The magnitude of potential impacts on surface water at the Mine site during construction is adverse, low to medium. The sensitivity of surface water at the Mine site is medium. The significance of potential impacts on surface water at the Mine site during construction is therefore adverse, low to moderate, based on implementation of the Stormwater Management Plan.

Groundwater

There are no excavations or other activities during construction which will extend to the watertable; therefore the magnitude of potential impacts on groundwater at the Mine site during construction is low as discussed in Section 6.4.1.6. The sensitivity of groundwater at the Mine site is considered to be low. The significance of potential impacts on groundwater at the Mine site during construction is therefore negligible.

6.5.1.2 Borefield

Surface Water

The drilling of the boreholes at the borefield will not significantly affect surface water flows; therefore the magnitude of potential impacts on surface water at the borefield during construction is low. The sensitivity of surface water at the borefield is medium as discussed in Section 6.4.2.3. The significance of potential impacts on surface water at the borefield during construction is therefore adverse and low.

Groundwater

The construction phase of the borefield will include drilling additional production and monitoring boreholes. Good practice will be adopted to ensure that the aquifer is not contaminated during drilling. During construction there are no or very minor pumping effects and therefore no impacts on receptors beyond the borefield. Test pumping will follow construction and is covered in the operation section of this assessment.

The magnitude of potential impacts on groundwater at the borefield during construction is adverse, low. The sensitivity of groundwater at the borefield is medium. The significance of potential impacts on groundwater at the borefield during construction is therefore adverse, low.

6.5.2 Operation

6.5.2.1 Mine Site

Surface Water

The main potential impacts on surface water will occur following rainfall events, as the development may result in changes to the quality of and flow of runoff. A Stormwater Management Plan has been developed and will be used to inform the layout of the Mine and supporting infrastructure so as to avoid inundation and to allow runoff to flow, as much as practically possible, uninterrupted.

The potential impact of change in runoff quality and quantity is on downstream users. The land to the south (in the direction of flow) is occasionally used for grazing so change in runoff may have an indirect, but limited impact on land use.

The Stormwater Management Plan developed during the construction phase will be adopted and follow the same principles during operation. The generic control measures in the plan are considered to be sufficient to ensure low to negligible impacts on surface water during operation of the concrete batch plant, shops, warehouses, accommodation camp and borefield. Particular design measures for the facilities to be operated under Phase 1b are as follows:

- **TSF 3 starter cell:** The TSF 3 starter cell will become operational before the remainder of TSF 3 is fully constructed and is therefore considered in this Phase 1b EIA. The Cyanide Management Plan and Tailings Dam Operations, Maintenance and Surveillance Plan will be developed and implemented. The TSF 3 starter cell will be lined and is a zero discharge facility with seepage management and monitoring. Based upon current acid generation test work, non-acid generating waste rock will be used in the construction of the facility. In the event of seepage, rates are likely to be negligible given the climatic regime, low initial moisture content of the waste rock and low permeability observed in testwork to date at the Mine site. There will be seepage management throughout the tailings facility lifecycle, which is likely to include a piezometer-based monitoring system for seepage water levels within and downstream of the structure wall. The facility itself is being designed to have zero discharge and will be lined with a synthetic liner. Diversion channels will divert water from surrounding catchment areas away from the tailings structure. A full water balance and risk assessment for the mine process circuit including storage reservoirs and tailings dams will be completed. Synthetic liners will be used to minimise risks.
- **HFO power plant and fuel farm:** The runoff from potentially hydrocarbon-contaminated stormwater (such as, containing residues of oil and grease) will pass through oil separators before release to the environment.
- **Potable and waste water treatment plant:** Use of brine for dust suppression. Water used for dust control must not reach surface waters.
- **Landfill:** The waste management facility comprises a landfill for non-hazardous solid waste. The drainage plan for the landfill is limited to an external drainage diversion which will be achieved through interceptor ditches. Rainfall over the landfill will be allowed to evaporate. The material going to the landfill is assumed to be inert and free of contaminants. No leachate collection is required.

Potentially polluting water will be contained, and discharges will meet environmental discharge criteria.

Given the proposed design measures for stormwater management as summarised above, and the low rainfall and scope for runoff the magnitude of potential impacts on surface water at the Mine site during operation is adverse, medium to low. The sensitivity of surface water at the Mine site is medium. The significance of potential impacts on surface water at the Mine site during operation is therefore adverse, moderate to low, based upon implementation of the Stormwater Management Plan.

Groundwater

The groundwater resources on the Mine site are limited and of poor quality. Nevertheless monitoring boreholes are in place and will be used to ensure that potential pollution from activities and facilities at the Mine site are not having an adverse impact on groundwater quality.

The operation of the pit, process plant, TSF and other facilities will be covered in the Phase 2 EIA. Pit closure and pit sump water levels are also considered in future phases of the Project.

The TSF 3 starter cell will become operational before the remainder of TSF 3 is fully constructed and is therefore considered in this Phase 1b EIA. The Cyanide Management Plan and Tailings Dam Operations, Maintenance and Surveillance Plan will be applied. The TSF will be lined and is a zero discharge facility with seepage management and monitoring.

The magnitude of potential impacts on groundwater at the Mine site during operation of the Phase 1b facilities is adverse medium to low. The sensitivity of groundwater at the Mine site is low. The significance of potential impacts on groundwater at the Mine site during operation is therefore low to negligible.

6.5.2.2 Borefield

Surface Water

The magnitude of potential impacts on surface water at the borefield during operation is low since there is very little surface infrastructure or interference with drainage routes. The sensitivity of surface water at the borefield is medium as discussed in Section 6.4.2.3. The significance of potential impacts on surface water at the borefield during operation is therefore low.

Groundwater

Potential impacts associated with the existing borefield include partial removal of aquifer storage and lowering of groundwater levels.

The water table lies well below surface at the PNBA and there is no hydraulic interconnectivity between the borefield and the PNBA. There is therefore no impact on the PNBA from abstraction, as illustrated in Figure 6-10.

Expanded groundwater monitoring and modeling assessments were undertaken to determine the impact of proposed abstractions on groundwater resources. Groundwater modeling to simulate abstraction of 30,000 m^3/day for 4 years was completed to support this assessment.

The West Branch EIA (Scott Wilson, 2010a) authorised abstraction from the existing borefield of 14,000 m^3/day for 10 years (51.1 Mm^3 in total). In June 2011, the Phase 1a(i) authorised

abstraction of 17,000 m^3/day (based upon six months represented an incremental 3.1 Mm^3 of water abstraction).

Abstraction from the borefield has been recorded. Between September 2006 and January 2011, 7.9 Mm^3 had been abstracted. From February 2011 to June 2011 an additional estimated 2.0 Mm^3 was abstracted. Proposed future abstraction is for 6 months at 17,000 m^3/day and 4 years at 30,000 m^3/day (46.9 Mm^3 in total) and thereafter to have the provision to abstract water for emergency purposes for 15 years at a rate of 30,000 m^3/day for a maximum of 20 days per year (9 Mm^3). The total abstraction is therefore anticipated to be approximately 65.8 Mm^3, compared to the permitted 54.2 Mm^3; an increase of approximately 21 per cent.

Based upon volume extracted at the existing borefield, the proposed increase to 30,000 m^3/day for approximately 4 years represents a high potential impact. As discussed previously, because of the relatively poor quality of existing groundwater, the sensitivity of groundwater at the borefield is medium. The significance of potential impacts on groundwater at the borefield during operation is therefore high to moderate (which is comparable to the significance of the existing permitted abstraction).

The impacts of abstraction will be confined to the cone of depression around the borefield so that there is no direct impact on fresh water borefields at Bennichab and Boulanouar. Figure 6-9 illustrates the borefield radius of influence and Figure 6-10 provides a cross section of the borefield.

The closest boreholes for potable and domestic use are located at around 27 km from the borefield to the north (Ouad Echibke) and 40 km to the south (Bouamatou). These are also beyond the predicted cone of depression of the borefield so the significance of impacts is negligible.

It is possible that the effects of abstraction may start to encroach along the edge of the fresh water aquifer at its closest point to the borefield (Figure 6-9). The impact magnitude is predicted to be low. Whilst there are no groundwater users in this area, given the high sensitivity of the fresh water aquifer, the significance of potential impacts is moderate.

6.5.3 Closure

6.5.3.1 Mine Site

Surface Water

The magnitude of potential impacts on surface water at the Mine site during closure are anticipated to be the same as those experienced during construction and operation, and therefore is adverse, low to medium. The sensitivity of surface water at the Mine site is medium. The significance of potential impacts on surface water at the Mine site during closure are therefore adverse, low to moderate, based on implementation of the Stormwater Management Plan.

Groundwater

The groundwater resources on the Mine site are limited and of poor quality. During and post closure, monitoring of boreholes are in place and will continue to ensure that groundwater resources are not impacted by pollution.

The magnitude of potential impacts on groundwater at the Mine site during closure of the Phase1b facilities is low. The sensitivity of groundwater at the Mine site is low. The significance of potential impacts on groundwater at the Mine site during operation is therefore negligible.

6.5.3.2 Borefield

Surface Water

The magnitude of potential impacts on surface water at the borefield during closure is adverse, low. The sensitivity of surface water at the borefield is medium. The significance of potential impacts on surface water at the borefield during construction is therefore adverse and low.

Groundwater

During closure, abstraction of water from the existing borefield for the Mines operations will cease. Water will have been removed from storage, whilst water levels in the aquifer are expected to recover this will be to a lower level than before abstraction. The magnitude of potential impacts on the borefield during closure is moderate to high.

The magnitude of potential impacts on the borefields at Bennichab and Boulanouar, and on users at Ouad Echibke and Bouamatou, during closure, will continue to be negligible.

As the cone of depression recovers, the potential for an impact on the fresh water aquifer at its closest point continues to be low and the significance of potential impacts is moderate.

Post closure of the Mine, the borefield and associated infrastructure may be handed over to the Government. This will however be addressed during the life of Mine and development of the detailed Rehabilitation and Closure Plan.

6.6 Mitigation and Monitoring Measures

6.6.1 Construction

6.6.1.1 Mine Site

Surface Water

If monitoring shows that pollution is detected in potential discharges to the environment which exceeds applicable effluent discharge guideline values or baseline (background) water quality, additional measures will be taken to recirculate or treat discharges. The Stormwater Management Plan may possibly extend to run-off sampling and analysis and/or emergency spill response.

Groundwater

No mitigation is required.

6.6.1.2 Borefield

Surface Water

No mitigation is proposed.

Groundwater

No mitigation is proposed.

6.6.2 Operation

6.6.2.1 Mine Site

Surface Water

If monitoring shows that pollution is detected in discharges to the environment which could affect background water quality, additional measures will be taken to recirculate or treat discharges. The Stormwater Management Plan will define checks on key systems and facilities. The same mitigation measures as for construction will be adopted.

Groundwater

Potentially polluting water will be contained, and discharges managed so that there is no long term deterioration of background water quality. With the proposed controls and management plans in place, and given the low sensitivity of groundwater at the Mine site, no further mitigation is required.

6.6.2.2 Borefield

Surface Water

No mitigation is proposed.

Groundwater

No specific mitigation measures are deemed necessary. However to ensure that there are no significant impacts to groundwater receptors identified, as part of the overall procedures for groundwater management, monitoring will be used to confirm the cone of depression predicted in the modeling exercise and any changes in abstracted groundwater quality. Operating procedures will be reviewed regularly and used to update the model and its predictions. Production boreholes that show a marked improvement in water quality will be decommissioned and abstraction will be from more brackish areas.

6.6.3 Closure

6.6.3.1 Mine Site

Surface Water

No mitigation is proposed following closure.

Groundwater

No mitigation is proposed following closure, but monitoring during the life of the mine will be used to confirm groundwater quality and to identify any additional mitigation measures.

6.6.3.2 Borefield

Surface Water

No mitigation is proposed following closure.

Groundwater

No mitigation is proposed following closure.

6.6.4 Monitoring

6.6.4.1 Mine Site

Surface Water

Surface water flows are ephemeral. Monitoring will therefore be at the point of discharge to ensure targets are met, and no routine surface water environmental monitoring is proposed. However, when practical surface water flows in major wadis following rainfall events will be sampled and flood levels will be surveyed where possible.

Groundwater

The environmental monitoring boreholes installed in 2010 and 2011 will be used to monitor in and around the Mine site. Monitoring of Mine site groundwater will be undertaken as per the Mine Site groundwater monitoring plan (URS Scott Wilson, 2011b) to ensure groundwater is not impacted by pollution.

At the Mine site, water levels will be recorded monthly and water level data loggers, where installed, will be downloaded quarterly. Groundwater samples will also be collected quarterly and the results compared with background water quality and WHO and IFC EHS guidelines presented in Table 6-1.

Because of the low permeability and absence of an aquifer at the Mine site, some of the monitoring boreholes have a very slow response time and are therefore not well suited to purging and water quality sampling. Borehole recovery tests are proposed and only those with recovery in a reasonable time will be used for sampling. Groundwater from these boreholes will be sent for analysis. Others that have yields which are too low to give even the small quantities required for laboratory analysis will continue to be used for water level monitoring.

6.6.4.2 Borefield

Surface Water

No monitoring is required.

Groundwater

Routine monitoring of the borefield and surrounding observation wells will be carried out as part of routine management, as discussed in Section 6.6.2.2. At the borefield, groundwater levels will be recorded manually monthly and loggers downloaded monthly to check for any unexpected changes. Water quality sampling will take place quarterly but electrical conductivity will be recorded monthly so that any trends in water quality can be detected quickly. The combined abstraction rate from the borefield and individual production boreholes will be recorded by means of flow meters and total volume meters. Monthly reports will continue to be produced.

6.7 Evaluation of Mitigated Impacts

6.7.1 Construction

6.7.1.1 Mine Site

Surface Water

With mitigation measures the significance of impacts on surface water at the Mine site during construction are low.

Residual surface water impacts during constructions are assessed to be adverse, long term and of low significance.

Groundwater

The significance of impacts on groundwater at the Mine site during construction is negligible.

Residual groundwater impacts during operation are assessed to be neutral, long term and of negligible significance.

6.7.1.2 Borefield

Surface Water

The significance of impacts on surface water at the borefield during construction is low.

Residual surface water impacts during constructions are assessed to be neutral, long term and of low significance.

Groundwater

The significance of impacts on groundwater at the borefield during construction is low.

Residual groundwater impacts during construction are assessed to be adverse, short term and of low significance.

6.7.2 Operation

6.7.2.1 Mine Site

Surface Water

With mitigation measures the significance of impacts on surface water at the Mine site during operation is low.

Residual surface water impacts during operation are assessed to be adverse, long term and of low significance.

Groundwater

The significance of impacts on groundwater at the Mine site during operation is negligible.

Residual groundwater impacts during operation are assessed to be neutral, long term and of negligible significance.

6.7.2.2 Borefield

Surface Water

The significance of impacts on surface water at the borefield during operation is low.

Residual surface water impacts during operation are assessed to be neutral, long term and of low significance.

Groundwater

Residual impacts on the brackish aquifer at the borefield during operation are assessed to be adverse, medium term and of moderate to high significance.

The residual impact on the fresh water aquifer is assessed to be adverse, medium term and moderate in the zone closest to the borefield. Fresh groundwater users at Bennichab, Boulanouar, Ouad Ebichke and Bouamatou are beyond the radius of influence and the residual impacts on these users are therefore negligible.

Abstractions at the borefield will be managed to minimise the potential for groundwater to be drawn from fresh areas towards brackish areas. The predicted impact is low and therefore, the significance of impact on fresh water aquifers will be moderate.

6.7.3 Closure

6.7.3.1 Mine Site

Surface Water

The significance of impacts on surface water at the Mine site during operation is low.

Residual surface water impacts post closure are assessed to be adverse, long term and of low significance.

Groundwater

Residual groundwater impacts at the Mine site post closure are assessed to be neutral, long term and of negligible significance.

6.7.3.2 Borefield

Surface Water

Residual surface water impacts post closure are assessed to be neutral, long term and of low significance.

Groundwater

Abstraction of water from the borefield will cease following closure of the Mine and water levels will be allowed to recover. However as water is abstracted from storage, water levels will recover to a lower level than before abstraction. Residual groundwater impacts post closure are assessed to be adverse, long term and of moderate to high significance as recharge is negligible.

Residual groundwater impacts on the fresh water aquifer abstractors at Bennichab, Boulanouar, Ouad Echibke and Bouamatou are assessed to be negligible as they are beyond the radius of influence of abstraction and recovery.

The potential for impacts on the edge of the fresh water aquifer, closest to the borefield, is assessed to be moderate and medium term once abstraction has ceased as water levels are able to recover.

6.8 Summary

A summary of the potential impacts of the proposed Phase 1b following the implementation of mitigation measures with respect to hydrology are presented in Table 6-5.

Table 6-5: Summary of potential residual impacts[1] - Surface Water and Groundwater

Location	Nature of Impacts	Mitigation Measure	Project Phase[2]	Nature[3]	Duration[3]	Significance[3]
Mine site	Change in surface water runoff and quality	Storm water management, monitoring and emergency response	C, O, D	Adverse	Long term	Low
	Change in groundwater quantity and quality	Monitoring boreholes on site to be routinely checked for water levels and water quality	C, O, D	Neutral	Long term	Negligible
Borefield	Change in surface water runoff and quality	Storm water management, monitoring and emergency response especially around key facilities and installations	C, O, D	Neutral	Long term	Low
	Change in groundwater quantity and quality	Good practice during drilling process and test pumping prior to use	C	Adverse	Short term	Low
	Removal of groundwater storage	Good management practice and monitoring of quantity abstracted and water levels	O, D	Adverse	Long Term	High/Moderate
	Effects on fresh water users	Monitoring and remedial works such as lowering pumps	O, D	Neutral	Long Term	Negligible
	Effects on fresh water resources (edge of fresh water aquifer)	Monitoring and borefield management	O, D	Adverse	Medium Term	Moderate

[1]Following implementation of proposed Mitigation Measures

[2]Project Phase: C = Construction, O = Operation, D = Closure

[3] Duration and significance refer to the predicted impact after the implementation of proposed mitigation measures and are based on the ratings provided in Table 5-2.

7 Air Quality

7.1 Introduction

This Section presents the methodology and baseline conditions used to assess the potential impacts on air quality resulting from Phase 1b. In addition mitigation measures which aim to avoid, reduce, remediate or compensate potential impacts are proposed and the residual impacts (impacts after mitigation measures implemented) assessed.

7.2 Scope of Assessment

During the construction phase, the works included within Phase 1b of the Project have the potential to increase fugitive emissions of particulate matter and particulate deposition beyond that which is experienced at sensitive locations under baseline conditions.

In this assessment, the effects of construction activities on local air quality have been considered in a qualitative fashion. The same qualitative approach is used to evaluate the potential for fugitive emissions of particulate matter from the proposed new TSF 3 starter cell and the concrete batching facility to potentially affect sensitive receptors.

During the operational phase, the proposal to increase the existing power plant capacity on-site has the potential to affect local air quality. The proposal is to introduce an additional six 5 MW (additional 30 MW total) engines fuelled by HFO. The Phase 1b power plant will operate whilst the proposed Phase 2 power plant is constructed in a subsequent phase. Following finalizing the Project feasibility study and the Phase 2 power configuration, a decision will be made as to the ongoing utilization of both the existing HFO power plant and the Phase 1b HFO power plant. For the purposes of evaluating this EIA, the Phase 1b power plant was assumed to operate for 18 to 24 months, before being retained as an emergency generation plant. Emissions from power plant were assessed on the basis that <2.5% sulphur HFO will be utilised. The Phase 2 EIA will assess necessary changes resulting from the feasibility study for the operating duration of the Phase 1b power plant. The magnitude of proposed emission rates will be compared with small combustion facility emission guidelines and a qualitative assessment of significance will also consider the proposed duration of the plants operation, the available mitigation options and the baseline standard of air quality in the study area.

The operation of the proposed Phase 1b power plant will have the potential to increase ground level concentrations of sulphur dioxide (SO_2), oxides of nitrogen (NO_X), particulate matter (PM_{10}) and carbon monoxide (CO) in the vicinity of the Mine. This assessment has quantified operational concentrations at locations where there is relevant exposure, including the proposed accommodation camp, which will be located to the east of the Mine's working areas. The magnitude of impacts at locations near to the Mine site boundary have also been calculated, to enable the assessment of the potential for significant effects at off-site locations, including sensitive ecological sites.

The remaining operational aspects of Phase 1b, including the operation of the proposed airstrip, expansion to the existing borefield and the expansion and upgrade of the waste management facilities are also considered qualitatively in this assessment.

7.3 Methodology

As referred to in Section 2, this assessment takes into consideration national legislation, international guidance and Kinross standards.

In the absence of specific national guidance, the assessment employs methodologies for the estimation of construction and operational impacts, based on guidance from the World Bank Group and from the United Kingdom (UK). The assessment of resultant pollutant concentrations at sensitive receptor locations is based on the criteria provided in Directives of the European Union (Council of European Communities, 1996 & 2008) and in IFC EHS Environmental Guidelines (International Finance Corporation, 2007).

7.3.1 Construction

7.3.1.1 Overview

Dust is a generic term but is defined in BS 6069:1994 (BSI, 1994) as particulate matter with a diameter in the size range 1-75µm (microns), and is primarily composed of mineral materials and soil particles.

Particulate matter (PM_{10}), and fine particulate matter ($PM_{2.5}$), is composed of particles with an aerodynamic diameter of less than 10 and 2.5 micrometers (µm) respectively, and include the size fractions of greatest concern to impacts on human health. The majority of dusts generated by construction activities are larger than 10 µm in diameter and, therefore, increased levels of dust in the air do not necessarily equate to an increase in levels of PM_{10} and $PM_{2.5}$. In general dust emissions associated with construction operations rarely represent an adverse risk to human health and are more typically associated with causing annoyance to the public through the visible deposits soiling property.

The EHS Guidelines contain a series of standards relating to ambient concentrations of airborne pollutants. Included in the guidelines are prescribed health-based standards for concentrations of both PM_{10} and $PM_{2.5}$ (see Table 7-4).

In this assessment it is the smaller size fractions of particulates (PM_{10} and $PM_{2.5}$) that are of concern, due to the risk they pose on human health. The larger particles (> 10 µg/m^3), which are typically associated with increased rates of soiling to fabrics and glossy surfaces. As rates of surface soiling are very high in desert environments and public tolerance of this effect is very high, the assessment focuses on the impact on ambient concentrations of PM_{10} and $PM_{2.5}$.

7.3.1.2 Assessment Criteria

Whilst there are no statutory UK or International standards relating to nuisance dust, there are standards relating to concentrations of PM_{10} and $PM_{2.5}$ (Table 7-4).

Although there are a number of ways in which emissions of particulate matter and its deposition can be quantified, it is difficult to relate the amount of potential emissions to significant effects at specific areas. Instead, it is considered more practical to assess sensitive receptors on the basis of their relative risk of exposure.

In this instance, the emphasis of the regulation and control of particulate emissions from construction activities at the site should be the adoption of best working practices. A qualitative assessment methodology has been adopted. The approach to this study has been to:

- Assess the sensitivity of the surrounding areas and identify dust sensitive locations;
- Evaluate prevailing meteorology and the risk of particulate dispersal;
- Assess the potential of the site and its activities to generate dust;

- Assess the potential effect of the site on local air quality, based on existing baseline conditions, including meteorology and the proximity of receptors to the site; and
- Propose recommendations to reduce potential dust emissions from the site.

Whilst research undertaken to date is not conclusive, studies in the UK have shown an indication of the distance within which particulate matter is dispersed by the wind, before being deposited. These studies have focused on the mining industry, although the transportation of particulate via the wind applies to all dust generating activities, including those of construction and also natural weather processes (sand/dust storms).

Large particles (> 30 µg/m^3), which make up the greatest proportion of particulate matter generated by mining activities (such as use of unsurfaced haul roads, crushing, and stockpiles, etc.), will usually be airborne within 100 m of the source. Smaller particles (10 – 30 µg/m^3) can be carried further by the wind and are likely to travel between 250 – 500 m from the source. Fine particulate (< 10 µg/m^3), which is the least common size of particle generated from mining activity, can travel up to 1 km from the source (Arup Environmental Ove Arup & Partners, 1995). It is this fine particulate matter that is of greatest risk to human health.

Therefore, receptors within 1,000 m of a dust generating activity at the Mine site are at risk of experiencing an increase in exposure to PM_{10}, and should be considered in this impact assessment. At the Mine site, the only sensitive receptor matching the criteria is the existing accommodation camp, which is located within 1,000 m of the proposed new accommodation camp. All other proposed Phase 1b facilities will be more than 1,000 m from the accommodation camp, and can therefore be discounted during the construction phase.

The generation of particulates during the proposed Phase 1b construction phase will be dependent on the sources of particulate matter inherent within the activities undertaken. The best control of particulates will be obtained using a combination of the established best practice techniques commonly used at construction sites. The assessment will review the likely controls to be included within the EMP and examine the likelihood of fugitive releases occurring. A consideration of working practices will identify how particulate emissions can be minimised and controlled effectively.

7.3.2 Operation

7.3.2.1 Assessment methodology for Fugitive Emissions from TSF 3 Starter Cell and Concrete Batching Plant

Overview

The main type of emission from the proposed TSF 3 starter cell and concrete batching facility will be fugitive emissions of particulate matter. As such, the assessment of effects from the operation of these items follows the same methodology as that of construction phase emissions.

Assessment Criteria

The same assessment criteria will also be used.

The TSF 3 starter cell will be located in the north west of the Mine site and is in excess of 1,000 m from any sensitive receptors.

Whilst the exact location of the concrete batching plant has not been decided, it will not be located in a location that will increase the risk of sensitive receptors on site being exposed to elevated concentrations of PM_{10} and $PM_{2.5}$.

7.3.2.2 Assessment methodology for Additional Power Plant Capacity

Dispersion Model Selection

The air quality impacts of the proposed power plant are best evaluated using a refined, near field (less than 50 km from the emission source) Gaussian Plume Dispersion Model, which is able to calculate maximum ground level concentrations at receptors both within and beyond the Mine site boundary. Gaussian models assume that pollutants do not decompose in the atmosphere, and therefore do not account for the long-range transport of atmospherically reactive pollutants. They are designed to produce results that are close to monitored values.

The assessment has been undertaken using the US EPA preferred model AERMOD, developed by the American Meteorological Society and U.S. Environmental Protection Agency Regulatory Model Improvement Committee (AERMIC). AERMOD is an advanced plume model that incorporates the latest understanding of the atmospheric boundary layer, and includes the PRIME downwash algorithm for the assessment of structure effects.

In addition to AERMOD, there are two input data processors that make up the regulatory components of the modelling system. AERMET is a meteorological data pre-processor that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, while AERMAP is a terrain data pre-processor that allows the incorporation of complex terrain effects within the model. During its development, AERMOD has undergone a number of validation studies, the most recent of which was published in 2003. Comparisons with the previous ISC-PRIME model show similar results for most databases, with some notable improvements.

This assessment has used version 6.8.6 of the software package ISC-AERMOD View, produced by Lakes Environmental Software.

Power Plant Configuration

The assessment of the proposed Phase 1b power plant is based on a configuration consisting of six Wartsila 12V32 reciprocating engines. Discharge to atmosphere from the power plant occurs via six stacks, with one stack per engine.

The exact location of the power plant stacks has not yet been finalised. In this assessment, the positions of the stacks have been located to represent a row of separate stacks, and no enhanced dispersion has been assumed for grouping stacks into a cluster. The indicative location of each source are listed in Table 7-1 and illustrated in Figure 7-1.

Table 7-1: List of Stack Locations

Stack Number	X Coordinate	Y Coordinate	Stack Number	X Coordinate	Y Coordinate
1	444650	2271440	4	444680	2271440
2	444660	2271440	5	444690	2271440
3	444670	2271440	6	444700	2271440

Modelled Scenarios

For the purposes of evaluating this EIA, the Phase 1b power plant was assumed to operate for 18 to 24 months, before being retained as an emergency generation plant. This assessment assumes that the Phase 1b power plant will operate at constant full load, although, in reality, it is likely that a maximum of five of the six engines will be operating at any one time.

The modelled scenario considers the impact of the process contribution of emissions associated with the additional engines. The contribution from background sources and all existing on-site sources of nitrogen dioxide and sulphur dioxide to baseline pollutant concentrations is being quantified by measurements that are currently being undertaken. The baseline measurement based survey will be sufficiently complete to allow the reporting of this information in the Phase 2 EIA.

Table 7-2 provides a summary of the emission data used in the modelling of this scenario, along with some of the model conditions. Further model conditions are discussed in detail below.

Table 7-2: Summary of emission rates from each engine (when operating at full load)

Variable	100 % Load, HFO [1]
Stack Internal Diameter (m)	0.9
Exit Volume of Flue Gas (Nm^3/s)	8.4
Stack Exit Temperature (ºC)	355
SO_2 Emission Rate (g/s)[1]	16.6
NO_X Emission Rate (g/s)[1]	16.2
PM_{10} Emission Rate (g/s)[1]	1.15
CO Emission Rate (g/s)[1]	1.15

[1] *Emission rate per engine.*

Terrain Data

The land between the stacks and the receptors does not slope sufficiently to justify the consideration of terrain effects in the model within the time scales of the assessment. For the purposes of this assessment the terrain has been regarded as flat or simple.

Building Downwash Effects

Nearby buildings and structures have the potential to effect the dispersion of emissions from the plant's stacks. As the wind blows over and around these buildings the airflow will be disrupted and pollutants may become entrained within the eddy (cavity) near to the building or within the associated zone of turbulent air (wake), resulting in higher near-field ground level concentrations.

Due to the distance between source and receptors, building downwash has not been considered in this assessment.

Meteorological Data

The minimum required parameters in a meteorological data set for AERMOD modelling must contain (1) temperature, (2) wind speed, (3) wind direction, (4) a vertical temperature gradient, and (5) one of sky cloud cover, solar radiation or net radiation during the daytime.

Automatic weather station data were obtained for the Tasiast Mine Site between 29 February and 25 September for 2008 and between 19 April and 30 September for 2009. There were observations of solar radiation, but only for 2009. A constant cloud cover of one tenth of the sky has been assumed for both 2008 and 2009. There were no observations on vertical temperature gradient.

For dispersion modelling, the most important meteorological parameters are wind speed and wind direction. Wind roses have been used to compare the year-by-year variations of meteorological parameters at Tasiast. Figure 7-2 shows the wind rose for Tasiast between 29 February and 25 September 2008 and 19 April and 30 September 2009. North and northeast winds were dominating at Tasiast. They were the surface component of trade winds, slowing down due to the surface drag forces and baring to the left in the Northern Hemisphere.

Under the meteorological conditions experienced at the Mine site in 2009, emissions will be dispersed from the proposed power plant in the direction of the nearest relevant receptors to the north east, more frequently than under the conditions observed in 2008. The meteorological conditions for 2009 have therefore been used as the basis for this assessment.

AERMOD uses the Gaussian plume equation, which assumes that concentration is inversely proportional to wind speed. The Gaussian plume equation does not properly calculate concentrations for wind speeds less than 1 m/s. AERMOD counts those hours when wind speeds are less than 1 m/s as calm hours. Between 29 February and 25 September 2008, there were 652 hours of calms. Between 19 April and 30 September 2009, there were 1091 hours of calms.

During calms, the dispersion of emissions is adversely effected and as they are a common feature of the local climate, methods recommended by the U.S. E.P.A Office of Air Quality Planning and Standards have been adapted to manually adjust the calms to very light wind conditions that can be modelled. When measured wind speeds were less than 1 m/s but higher than the response threshold of the instrument, wind speeds have been adjusted to 1 m/s and the measured wind directions have been used. Remaining hours with wind speeds below the response threshold of the instrument (calms) account for more than 10 % of the period that site based data is available for. For the purposes of this assessment wind speeds during calms have been assigned a value of 1 m/s and a randomised wind directions value between 1 and 360 degrees, so that the hours are included within the model run. The use of randomised wind directions when wind speeds are below the response threshold of the instrument is necessary to avoid introducing an asymmetrical bias towards any specific direction.

Meteorological data has been gathered from two sources, including surface data from a meteorological station operating at the Mine site. Where data is missing from this source, gaps have been patched with surface data from the MM5 (5^{th} generation Mesoscale Model) model. Upper atmosphere data was also sourced from the MM5 model. The data gathered from the MM5 model was centred over the peninsular town of Nouâdhibou, which is approximately 160 km to the west of the Mine site.

The meteorological data was converted to SAMSON format using the built in converter within AERMET. The dataset illustrated in windrose in Figure 7-2 was pre-processed in AERMET to generate the surface file used in AERMOD.

Receptors

Ground level concentrations of the pollutants modelled have been calculated at eight discrete receptors located within the Mine site. The location of these receptors was chosen from mapping of the Mine site. They represent areas just within the Mine site boundary (B1 to B4), the existing accommodation camp (R1), the proposed new accommodation camp (R2 and R3) and the welcome centre (R4). Receptors R1 to R4 represents the impact that will also be experienced at relevant receptor location within the site boundary. Receptors B1 to B4 provide an indication of the maximum process contributions at any sensitive receptor located beyond the site boundary. The location of the selected discrete receptors is illustrated in Figure 7-1, and listed in Table 7-3. The concentration of pollutants at each receptor was modelled at near ground level (z = 1.5 m).

Table 7-3: List of Discrete Receptors

Receptor	Description	X Coordinate	Y Coordinate	Z Coordinate
R1	Existing Accommodation Camp	448500	2274000	1.5
R2	New Camp Northern Edge	448076	2274615	1.5
R3	New Camp Southern Edge	448350	2274194	1.5
R4	Welcome Centre	449308	2275415	1.5
B1	Boundary (South West)	442000	2267000	1.5
B2	Boundary (West)	442000	2271000	1.5
B3	Boundary (North West)	442000	2275500	1.5
B4	Boundary (North)	445000	2278000	1.5

NO_X to NO_2 Conversion

NO_X emissions from the power plant will consist of both NO and NO_2, however NO_2 is of the most concern regarding health effects. At the point of emission into the atmosphere NO will be the predominant chemical form, around 95% of NO_X produced by combustion is NO. In rural areas, with abundant ozone, oxidation to NO_2 will rapidly occur.

Within the rural assessment area is likely that background ozone concentrations will be high (< 100 µg/m^3 as is this is typical of rural locations at this latitude. It can be assumed, therefore, that the conversion of NO to NO_2 will not be O_3 limited and complete conversion of NOx emissions into NO_2 will take place. While this approach is likely to result in an over prediction of impact within a few hundreds of metres from the point of emission, it is considered a reasonable and robust approach to the assessment of impacts at relevant receptors.

7.3.2.3 Assessment of Significance

EHS Environmental Guidelines provide guidance on acceptable pollutant concentrations at sensitive receptors. These Guidelines state that emissions from proposed plant should not

'result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines or other internationally recognised sources'. Table 7-4 lists the WHO Ambient Air Quality Guidelines referred to above.

Table 7-4: WHO Ambient Air Quality Guidelines

Pollutant	Averaging Period	Guideline Value (µg/m^3)
Sulphur dioxide (SO_2)	24 hour	125 (Interim target 1)
		50 (interim target 2)
		20 (Guideline)
	10 minute	500 (Guideline)
Nitrogen dioxide (NO_2)	1 year	40 (Guideline)
	1 hour	200 (Guideline)
Particulate matter (PM_{10})	1 Year	70 (Interim target 1)
		50 (Interim target 2)
		30 (Interim target 3)
		20 (Guideline)
	24 hour	150 (Interim target 1)
		100 (Interim target 2)
		75 (Interim target 3)
		50 (Guideline)
Particulate matter ($PM_{2.5}$)	1 Year	35 (Interim target 1)
		25 (Interim target 2)
		15 (Interim target 3)
		10 (Guideline)
	24 hour	75 (Interim target 1)
		50 (Interim target 2)
		37.5 (Interim target 3)
		25 (Guideline)

The General EHS Guidelines also state that emissions from the proposed plant should not 'contribute a significant proportion to the attainment of relevant ambient air quality guidelines or standards. As a general rule, this guideline suggests 25 % of the applicable air quality standards to allow additional, future sustainable development in the same airshed'.

Within the EU economic area, limit values (Council of European Communities, 2008) have been adopted that relate to specific WHO guideline or interim target values. In adopting limit values for these pollutants, the EU considered the evidence for adverse effects on human health associated with the broad range of levels of economic development present across the EU economic area. This assessment uses Environmental Assessment Levels (EAL) that are consistent with the WHO guideline and interim target values adopted by the EU. This assessment also considers the magnitude of the process contribution relative to 25 % of the EAL value (see Table 7-5).

Table 7-5: Assessment Criteria

Pollutant	Averaging Period	EU Limit Value (µg/m^3)	EAL (µg/m^3) (25 % of EU Limit Value)
Sulphur dioxide (SO2)	24 hour	125	31.2
Nitrogen dioxide (NO2)	1 year	40	10
	1 hour	200	50
Particulate Matter (PM_{10})	1 year	40	10
	24 hour	50	12.5

7.3.3 Sensitive Receptors

The construction and operation of Phase 1b has the potential to affect air quality at existing on-site sensitive receptors, such as those located at the existing accommodation camp and those located at the proposed Phase 1b accommodation camp.

A small number of people (22 families) occupy various non-permanent locations within 30 km of the Mine site and are also potential receptors. A small temporary community is located at the junction of the access road with the Nouakchott–Nouâdhibou N2 highway, approximately 1 km from the existing borefield and approximately 60 km from the Mine site. There is also a national park (Banc D'Arguin) located approximately 65 km to the west of the Mine site and within 5 km of the borefield.

7.4 Baseline Conditions

7.4.1 Air Quality

The Mine is located in a remote area where the nearest industries to the Mine site are at Boulanouar (water bottling), Akjoujt (Guelb Moghrein Copper/Gold Mine) and Bennichab (water bottling), which are 120 km northwest, 150 km east southeast and 130 km southeast respectively (see Figure 1-1). Due to the remoteness of the Mines location, and the associated distance from the Mine to these industries, air quality at the Mine is not affected by these industries.

Current sources of emissions of oxides of nitrogen, sulphur dioxide, carbon monoxide and carbon dioxide at the Mine include exhaust emissions from mobile power plant, the 19 MW power plant, mobile plant, road vehicles and airstrip operations (daily light aircraft). Potential sources of odour exist at facilities for the management of waste and waste water.

The existing dump leach facility and process plant are also a potential source of emissions of cyanide gas. These facilities and emissions are subject to stringent controls to meet specific guidelines, protecting the health of mine workers and the wider environment.

7.4.1.1 Baseline Air Quality Survey

To quantify baseline conditions with regard to concentrations of nitrogen dioxide, oxides of nitrogen, sulphur dioxide and ozone, a passive sampling survey is currently being undertaken at the Mine site. Diffusion tubes for each pollutant have been positioned at five locations at the site and will be exposed for periods of one calendar month per sample.

Other than the high levels of ozone identified, there is an insufficient quantity of data from which any reasonable conclusions can be drawn on baseline air quality, at this time.

7.4.2 Dust and Particulate

Respirable particles and larger particles are generated from the existing operations at the Mine site (such as crushing, vehicle movements, on the currently unsurfaced access road, unsurfaced haul roads, blasting, etc). These are subject to controls as required by the Occupational Health and Safety system for the Mine. Baseline levels of exposure of these receptors to particulates at the Mine site are determined by the combined contributions from both background sources and emissions from activities already undertaken at the Mine. Unconsolidated sand and dust particles may be re-suspended locally by both mining activities and by natural processes.

Atmospheric concentrations of both coarse dust particles and respirable particles (PM_{10}) are high as a result of the desert conditions (SNC Lavalin, 2004), particularly during windy periods. Due to the nature of the terrain such as, loose and semi-consolidated sediments with sparse vegetation and windy conditions, it is common for sand storms and dust storms to occur. These storms are natural phenomena, which can be prolonged and cover vast areas.

7.5 Potential Impacts

7.5.1 Construction

Construction activities have the potential to generate emissions of airborne particulates that could result in short-lived episodes of elevated particulate matter (PM_{10} and $PM_{2.5}$) concentrations. During such times, sufficient quantities of particulate matter could be transported via air to residential areas of the Mine site.

The proposed construction activities within the Phase 1b footprint are considered to only have the potential to result in changes to airborne concentrations of particulate matter at distances of less than 1,000 m from the source of the emission. Therefore, impacts are only likely to affect receptors located within the existing accommodation area, which is located within 1,000 m of the proposed new accommodation camp.

Impacts at this location will be infrequent and limited to the time period within which the construction works on the proposed accommodation camp will be undertaken. The majority of particulates generated by construction related activities are larger than 10 µm in diameter and, therefore, are not usually associated with an increase in concentrations of PM_{10} and $PM_{2.5}$.

Particulate controls at source, such as those employed at the operational Mine works, including use of water to dampen down materials and dust generating activities, the minimisation of drop heights and speed limits on haul routes, will be capable of delivering the required level of mitigation to minimise impacts.

Due to the proposed location of the Phase 1b construction sites, the nature of particulate likely to be generated by construction activities, and the control measures to be used on site, it is unlikely that any receptors will be affected by the generation of dust and particulates from construction activities.

7.5.2 Operation

7.5.2.1 Fugitive Emissions from TSF 3 Starter Cell and Concrete Batching Plant

Neither the TSF 3 nor concrete batching facility will be located within an area where they will have a significant effect on sensitive receptors.

7.5.2.2 Additional Power Plant Capacity

The predicted contribution of the temporary power plant to annual mean concentrations of NO_2, PM_{10}, SO_2 and CO at the selected discrete receptors is displayed in Table 7-6.

Table 7-6: Predicted Magnitude of Impacts from Proposed Power Plant Emissions[4]

Receptor	Annual Mean NO_2 ($\mu g/m^3$)	98th %ile of Hourly Maximum NO_2 ($\mu g/m^3$)	Annual Mean PM_{10} ($\mu g/m^3$)[a]	24 Hour Mean PM_{10} ($\mu g/m^3$)[a]	24 Hour Mean SO_2 ($\mu g/m^3$)
R1	0.9	4.3	0.1	2.5	36.8 (+29%)
R2	1.0	3.9	0.1	3.0	44.0 (+35%)
R3	1.0	4.3	0.1	3.1	44.5 (+36%)
R4	0.9	3.1	0.1	2.5	35.9 (+29%)
B1	2.3	20.9	0.2	0.8	10.9 (+9%)
B2	1.9	19.4	0.1	3.0	43.9 (+35%)
B3	0.3	2.4	<0.1	0.6	8.4 (+7%)
B4	0.2	1.7	<0.1	0.4	5.4 (+4%)
Assessment Criteria	**10** (25% of 40)	**50** (25% of 200)	**10** (25% of 40)	**12.5** (25% of 50)	**31.2** (25% of 125)

[a] Modelled PM_{10} process contributions also represent the magnitude of $PM_{2.5}$ process contributions as almost all of the PM_{10} will be present as $PM_{2.5}$ sized particulate.

Predicted impacts on ambient concentrations of nitrogen dioxide and particulate matter due to the operation of the proposed power plant will result in an increase in mean concentrations of considerably less than the 25% of environmental assessment level at any relevant receptor. Impacts on some workplace areas of the Mine site will be higher, but workers will be exposed to air of good quality when at the accommodation camp or off-site.

With the use of available HFO fuel, the emissions of sulphur dioxide are higher than will have been the case had a lower sulphur fuel been available. The power plant will contribute an additional 36 $\mu g/m^3$ to 45 $\mu g/m^3$ to 24 hour mean SO_2 concentrations at relevant on-site receptors and throughout the area near to the site boundary (B2) closest to the power plant. At this time there is no evidence to indicate that background 24 hour mean concentrations of sulphur dioxide in the wider study area surrounding the Mine site are elevated. An increase in 24 hour mean concentrations of the magnitude predicted (Table 7-6) will not be large enough to raise ambient concentrations to the 125 $\mu g/m^3$ adopted by the European Union for the protection of human health.

At greater distances, including the Mine site boundary (B1 and B3-4), the power plants contribution to ambient concentrations will decrease with distance to a value that is less than the assessment criteria applied. The impact of the power plant for Phase 1b will be limited to

the duration of its operation and as such does not represent a permanent impact and air pollutant concentrations will return to their current values when the plant becomes an emergency generation facility.

Overall the predicted magnitude of the impact of the power plant emissions to air quality during Phase 1b of the expansion project do not represent a significant effect on local air quality at any on-site or off-site receptor.

7.5.2.3 Airstrip, Borefield Site and Waste Management Facility

The proposals included within Phase 1b of the Mine expansion include the upgrade and relocation of the Mine's airstrip. The proposed airstrip will be larger and hard-surfaced, to accommodate the scope of the Project, and will include new facilities, such as a hanger, fuel farm, staging building and offices. The schedule for the proposed airstrip construction is under assessment and may occur later in the mine life.

The proposed site of the airstrip is envisioned to be located beyond the perimeter fence of the existing Mine site and will therefore be substantially further away from the sensitive receptors considered in this assessment. Whilst the airstrip may accommodate an increase in air traffic, the effect of any additional emissions on ground level pollutant concentrations is likely to be negligible.

The proposals include the relocation and expansion to the existing landfill facility of the Mine site, to accommodate domestic waste, provide a permanent long-term location for the storage of other regulated waste, and temporary storage space for wastes that will be shipped off-site.

Whilst the landfill facility will be a source of odour and particulate matter, the proposed location of it is to the far south of the Mine site, over 7 km away from the nearest sensitive receptor (existing accommodation camp). As such, the proposed landfill facility will not have a significant effect on air quality, where there is relevant exposure.

The incineration plant proposed as part of the new waste management facility is currently being designed in detail. The supplier of the plant will be required to supply and commission plant that meets the daily average emission limit values set by Annex V of the EU Waste Incineration Directive (Council of European Communities, 2000), which are listed in Table 7-7.

Table 7-7: Daily Averaged Emission Limit Values in the EU

Pollutant	Emission Limit Value ($\mu g/m^3$)	Averaging Period
Total Dust	10	Daily mean
Gaseous and vaporous organic substances, expressed as total organic carbon	10	Daily mean
Hydrogen Chloride (HCl)	10	Daily mean
Hydrogen Fluoride (HF)	1	Daily mean
Sulphur Dioxide (SO2)	50	Daily mean
Nitrogen monoxide (NO) and nitrogen dioxide (NO2), expressed as nitrogen dioxide for existing incineration plants with a nominal capacity exceeding 6 tonnes per hour or new incineration plants	200	Daily mean

[4] Emissions from power plant were assessed on the basis that <2.5% sulphur HFO will be utilised

Pollutant	Emission Limit Value ($\mu g/m^3$)	Averaging Period
Carbon Monoxide (CO)	50	Daily mean
Cadmium (Cd) and Thallium (Tl)	Total 0.05	All average values over the sampling period 30 minutes to 8 hours
Mercury (Hg)	0.05	
Antimony (Sb), Arsenic (As), Lead (Pb), Chromium (Cr), Cobalt (Co), Copper (Cu), Manganese (Mn), Nickel (Ni) and Vanadium (V)	Total 0.5	
Dioxins	0.1 ng I-TEQ/Nm^3	CEN method, sample period 6 to 8 hours

The supplier of the incineration plant will be required to demonstrate by extractive sampling, prior to the completion of plant commissioning, that emission rates associated with the waste materials being incinerated result in emission rates that are within the respective emission limit values.

The proposals also include the expansion of the borefield site, which is located approximately 60 km to the west of the Mine site. The expansion will see an expansion to and an increase in the water extracted from the borefield, from 17,000 m^3/day to 30,000 m^3/day, for a period of approximately four years (2011 through 2015). To facilitate the temporary increase, additional wells will be added to the existing and the increase in raw water production will require a suitable mobile power supply.

Whilst the mobile power supply for the proposed borefield expansion will be a new source of NO_X, PM_{10}, SO_2 and CO emissions, the scale of the plant required will mean that the quantity of emissions will not have a significant effect on local air quality, including that within the PNBA.

7.5.3 Closure

During Mine closure, operations at the Mine will cease and, where appropriate, all infrastructure will be formally closed, dismantled and/or removed as appropriate. Impacts related to dust during this period will be similar to those experienced during construction (see Section 7.5.1) and emissions from plant and the power station will continue until such time as they are removed.

Post closure, impacts related to emissions will be negligible and dust impacts will be as a result of normal land use condition.

7.6 Mitigation and Monitoring Measures

7.6.1 Construction

Workers at the Mine are currently protected by controls and measures defined in the Occupational Health and Safety management system for the Mine. These controls and measures will be applied to Phase 1b works and will provide all workers at the Mine with a consistent level of protection from the potential impact of airborne pollutants.

The potential for particulate generation from the movement of vehicles over the upgraded base of haul roads and construction areas will be minimised by the application of water suppressant during the construction period. On completion, hard-standing surfaces will significantly reduce

the potential for vehicle movements to re-suspend particulate matter (dust and PM_{10}) throughout the construction programme.

Particulate controls that are already employed at the Mine, including the use of water to damp down materials if necessary, the minimisation of drop heights and speed limits on haul and mine roads are capable of delivering the required level of mitigation.

The use of well maintained vehicles, mobile plant and power generators will ensure that exhaust emissions of nitrogen dioxide, sulphur dioxide are negligible adverse impacts over the short to medium term.

Monitoring of total inhalable and respirable particulate should be extended to include the sites of the additional construction works.

7.6.2 Operational

7.6.2.1 Fugitive Emissions from TSF 3 Starter Cell and Concrete Batching Plant

The locating of the proposed TSF 3 starter cell and concrete batching plant has taken into account the location of sensitive receptors within and beyond the site boundary. The locations have been chosen to reduce any potential impact as a result of particulate emissions and no specific mitigation measures, above good standard design practices, are proposed.

7.6.2.2 Additional Power Plant Capacity

Due to the emissions from the temporary Phase 1b power plant, the location of the proposed accommodation camp is near the existing accommodation camp on the east side of the Mine's process area, upwind and allowing for a greater distance between emission source and receptor. An alternative location on the west side of the Mine's process area and in closure proximity to the Phase 1b power plant was initially considered but dismissed after initial emissions and air quality model results were reviewed.

The power plant was located on the western side of the Mine's process area to allow for a suitable distance between the emissions and the existing and new proposed accommodation camp.

7.6.2.3 Airstrip, Borefield Site and Waste Management Facility

The locating of the proposed airstrip and waste management facility has taken into account the position of sensitive receptors in and around the Mine site. Both have been positioned to minimise any potential impacts on sensitive receptors.

The proposed waste management facility is still in the detailed design phase. It is recommended that combustion emissions from waste management plant are confirmed by a programme of emissions monitoring prior to the completion of plant commissioning and that dispersion modelling of cumulative effects of incineration and other energy sources is undertaken at that time.

7.6.3 Closure

During closure mitigation measures proposed for the construction phase will be applied where necessary. No mitigation measures are required post closure of the Mine and its operations for activities proposed under Phase 1b.

7.6.4 Monitoring

Ongoing surveys for nitrogen dioxide, oxides of nitrogen, sulphur dioxide and ozone should be continued throughout the construction period of Phase 1b (see Section 19).

7.7 Evaluation of Mitigated Impacts

7.7.1 Construction

The implementation of standard control measures, which will reduce emissions of particulate at source, will ensure that any effects associated with the construction Phase of 1b will have a negligible impact on air quality.

Residual air quality impact during construction are assessed to be adverse, short term and of negligible to low significance.

7.7.2 Operational

The careful positioning of the proposed elements of Phase 1b and the implementation of standard control measures, where applicable, will be sufficient in minimising any effects during the operation of the phase so that any impacts at sensitive receptors (including the PNBA) are negligible.

Residual air quality impact during operation are assessed to be adverse, medium term and of negligible to low significance.

7.7.3 Closure

The impacts of closure are likely to be similar to those that will occur during the construction phase.

Residual air quality impact post closure are assessed to be neutral, long term and of negligible significance.

7.8 Summary

A summary of the potential impacts of the proposed Phase 1b following the implementation of mitigation measures with respect to air quality are presented in Table 7-8.

Table 7-8: Summary of potential residual impacts1 - Air Quality

Location	Nature of Impacts	Mitigation Measure	Project Phase[2]	Nature[3]	Duration[3]	Significance[3]
Mine site	Particulate emissions during construction, operation and closure	Best Practicable Means	C O D	Adverse	Short term	Low/Negligible
	Process emissions from power plant	Locate plant away from sensitive receptors	O	Adverse	Medium term	Low/Negligible
	Process emissions from Waste Management Facility	Locate plant away from sensitive receptors and control emissions to below EU WID limit values	O	Adverse	Long term	Low/Negligible
Borefield	Particulate	Best Practicable	C O D	Adverse	Short	Low/Negligible

Location	Nature of Impacts	Mitigation Measure	Project Phase[2]	Nature[3]	Duration[3]	Significance[3]
	emissions during construction, operation and closure	Means			term	
	Operational power	None	O	Adverse	Medium term	Negligible

[1]Following implementation of proposed Mitigation Measures

[2]Project Phase: C = Construction, O = Operation, D = Closure

[3] Duration and significance refer to the predicted impact after the implementation of proposed mitigation measures and is based on the ratings provided in Table 5-2.

This assessment has considered the effect of the construction and operation of Phase 1b of the proposed Tasiast expansion project.

During the construction phase, the proposed elements of Phase 1b have the potential to increase concentrations of particulate matter at sensitive receptors located within 1,000 m of construction activities. Of the items included within Phase 1b, only the construction of the new accommodation camp will occur within 1,000 m of a sensitive receptor.

The nature of construction activities results in the generation of particulate matter, which is then dispersed by the wind. The majority of particulates generated by these activities is greater than 10 µm in diameter, and do not pose a risk to human health. Whilst some smaller particles are generated form construction activities, which do pose a risk to human health, standard control measures will be able to reduce emissions so the concentrations of particulate matter are not significantly higher at sensitive locations. As such, the effect of Phase 1b during its construction phase will be negligible.

During the operational phase, Phase 1b includes the expansion of the Mine site's power supply. This will see the installation of a power plant based on an 18-24 month operating duration. The emissions from this plant have been modelled using ISC-AERMOD to quantify its contribution to annual mean pollutant concentrations at sensitive locations. The results of the modelling exercise indicated that the plant will have a negligible effect on air quality where there is relevant exposure.

The assessment has also considered the impact of the operation of the Mine site's airstrip and waste management facility, and the off-site borefield site. With regards to the proposed airstrip and the waste management facility, these elements have located away from sensitive receptors so that that any potential impact will be negligible. With regard the borefield expansion, the mobile power plant will be of a scale that will lead to emissions that will be undetectable in the surrounding area, including the PNBA.

Therefore, the effect of Phase 1b during its operational phase will also be negligible. The proposals will not have a significant detrimental effect on local air quality.

8 Noise and Vibration

8.1 Introduction

This Section presents the methodology and baseline conditions used to assess the potential impacts on noise and vibration use resulting from Phase 1b. In addition mitigation measures which aim to avoid, reduce, remediate or compensate potential impacts are proposed and the residual impacts (impacts after mitigation measures implemented) assessed.

8.2 Methodology

As referred to in Section 2, this assessment takes into consideration national legislation, international guidance and Kinross standards.

In be absence of national guidance, Section 8.2.1 to Section 8.2.3 outline the international guidance which has been utilised.

8.2.1 Construction

Construction noise levels have been predicted using the methodology provided in British Standard BS 5228: 2009 'Control of noise and vibration from construction and open sites'.

The assumed plant to be used during each construction activity and their 'on-times' (the percentage of time that an item of plant is operational per hour) are provided in Table 8-1: Sound power levels for each piece of equipment have been sourced from BS 5228.

Table 8-1: Assumed Construction Plant

Construction Activity	Plant	Sound Power Level L_{WA} dB	No. of Plant	Overall L_{WA} dB	On-time (% of hour)	Reference
Site Clearance	Chainsaw	114	1	114	10	BS 5228 Table D.2 no. 14
	Dozer	108	1	108	50	BS 5228 Table C.2 ave no.'s 10-13
	Dumper	111	1	111	50	BS 5228 Table C.2 ave no.'s 30-31
	Scraper	110	1	110	50	BS 5228 Table D.9 no. 14
	Loading lorries	106	1	106	83	BS 5228 Table C.2 ave no.'s 26-28
Earthworks	Excavator (tracked)	110	1	110	83	BS 5228 Table D.3 ave no.'s 34-40
	Dumper	111	1	111	50	BS 5228 Table C.2 ave no.'s 30-31
	Dozer	108	1	108	50	BS 5228 Table C.2 ave no.'s 10-13
	Lorries/hr	105	6	113	83	BS 5228 Table D.7 ave no.'s 121-122
Excavations and foundations	Excavator (tracked)	110	1	110	83	BS 5228 Table D.3 ave no.'s 34-40
	Loader (tracked)	112	1	112	50	BS 5228 Table D.3 ave no.'s 7-21

Construction Activity	Plant	Sound Power Level L_{WA} dB	No. of Plant	Overall L_{WA} dB	On-time (% of hour)	Reference
	Lorry	105	1	105	50	BS 5228 Table D.7 ave no.'s 121-122
	Cement mixer truck	105	1	105	50	BS 5228 Table C.4 ave no.'s 18 & 20
	Concrete pump	107	1	107	50	BS 5228 Table D.6 ave no.'s 34 & 36
	Compressor	104	3	109	83	BS 5228 Table D.7 ave no.'s 18-22
	Poker vibrator	98	3	104	83	BS 5228 Table D.6 no. 40
Slab Construction	Cement mixer truck	105	1	105	50	BS 5228 Table C.4 ave no.'s 18 & 20
	Concrete pump	107	1	107	50	BS 5228 Table D.6 ave no.'s 34 & 36
	Compressor	104	3	109	83	BS 5228 Table D.7 ave no.'s 18-22
	Poker vibrator	98	3	104	83	BS 5228 Table D.6 no. 40
Steelwork Construction	Crane	106	1	106	50	BS 5228 Table C.4 no. 38
	Generator	102	1	102	50	BS 5228 Table C.4 no. 32
	Electric drills	104	2	107	33	BS 5228 Table D.6 no. 54
	Metal cutter	107	2	110	33	BS 5228 Table C.1 no. 18
	Electric bolter	104	2	107	33	BS 5228 Table D.6 no. 54
	Lorries/hr	105	6	113	50	BS 5228 Table D.7 ave no.'s 121-122
Finishing and Fitting	Generator	94	6	102	33	BS 5228 Table C.4 no. 85
	Welding plant	102	1	102	33	BS 5228 Table C.3 no. 31
	Electric drills	104	2	107	33	BS 5228 Table D.6 no. 54
	Lorries/hr	105	6	113	33	BS 5228 Table D.7 ave no.'s 121-122
Road Construction	Road roller	108	1	108	83	BS 5228 Table C.5 no. 19
	Excavator (tracked)	110	1	110	83	BS 5228 Table D.3 ave no.'s 34-40
	Dumper	101	1	101	83	BS 5228 Table D.7 ave no.'s 81-92
	Asphalt spreader	110	1	110	83	BS 5228 Table D.8 no. 21
Aggregates Crusher	Dozer	113	1	113	83	BS 5228 Table D.3 ave no.'s 65-67
	Crusher	115	1	115	83	Scott Wilson Internal

8.2.2 Operational

The existing noise climate across the Mine site is dominated by noise emanating from the ongoing excavation and processing activities. Noise levels at the accommodation camp resulting from these operations (processing, power generation, and airstrip) are negligible.

No quantitative data relating to operational equipment schedule and associated acoustic emission levels are available. However, a robust assessment of the operation of the Phase 1b infrastructure is possible, based on the proposed operations, likely equipment to be employed and representative noise emission levels, the distances to sensitive receptors and the existing noise climate.

Estimates of noise propagation from source to receptor have been based on the methodology provided in ISO 9613-2: 1996 Attenuation of Sound during Propagation Outdoors.

8.2.3 Closure

Closure will involve comparable activities to some of those employed in the construction of Phase 1b, in particular excavation works and steelwork.

An assessment of noise and vibration impacts during closure has been carried out based on the results of the Phase 1b construction works.

8.2.4 Assessment of Significance

The IFC's General EHS Guidelines provide guidance on acceptable noise levels to residential and other sensitive receptors (see section 1.7. The values are based upon the Guidelines for Community Noise, issued by the World Health Organisation in 1999). Table 8-2 presents these noise levels.

Table 8-2: IFC Noise Level Guidelines

Receptor	One Hour L_{Aeq} (dB)	
	Daytime (07:00 to 22:00)	Night-time (22:00 to 07:00)
Residential; Institutional; Educational	55	45
Industrial; Commercial	70	70

The daytime limit of 55 B LAeq,1h is a free-field level. The night-time limit of 45 dB LAeq,1h is a façade level, meaning the noise level at the wall of a property (such as, just outside a bedroom window). A façade noise level of 45 dB LAeq is equivalent to an internal noise level of approximately 30 dB LAeq, assuming small open areas to the building. This will ensure no disturbance to sleep.

The Mine operates 24 hours per day and workers will be resting and sleeping during daytime and night-time. Therefore the 45 dB LAeq limit applies for daytime and night-time at the accommodation camp.

An external free-field noise level of 70 dB(A) will allow for a good internal noise climate to office accommodation, assuming a reasonable façade construction. Thus, the daytime and night-time noise limit of 70 dB LAeq for commercial receptors is applicable for offices on the Mine site

Due to the large distances between any significant sources of vibration (such as, blasting, crushing equipment) and any sensitive receptors, no calculations of likely vibration levels have

been carried out. Ground borne vibration for both construction and operation are thus scoped out of the assessment.

Where noise levels resulting from construction or operational activities exceed the limits provided in Table 8-2, a significance of effect is assigned. Construction noise impacts are generally classified as short term (persist for 36 months or less) and operational noise impacts as medium term (persist for between 36 months and 16 years (the life of the mine). There will be no long term noise impacts that persist longer than 16 years (post closure).

Due to the large distances between any significant sources of vibration (such as, blasting, crushing equipment) and any sensitive receptors, no calculations of likely vibration levels have been carried out. Ground borne vibration for both construction and operation are thus scoped out of the assessment.

8.3 Baseline Conditions

The Mine is located in a remote region with no formal settlements in the vicinity. Baseline noise levels in the vicinity of the Mine site will be dominated by the operation of the existing Mine. Away from the Mine site it is anticipated that the baseline noise levels are low.

Baseline conditions at the location of the borefield are again likely to be low, with the dominant noise being from traffic on the Nouakchott - Nouâdhibou N2 highway, with minimal contributions from borefield pump station located along the access road.

A site visit, in February 2011 confirmed that noise levels at the accommodation camp resulting from existing mining operations (blasting, excavation, processing) are negligible.

As will be expected, noise levels at office accommodation in the existing process area are dominated by noise from the process buildings and external plant.

8.3.1 Sensitive Receptors

The sensitive receptors closest to the Mine are the employees located at the Mine site itself. There is an existing accommodation camp located to the east of the existing Mine operation.

Further sensitive receptors are nomadic/semi-nomadic communities, which are located within 30 km of the Mine site. A small temporary community is located at the junction of the access road with the Nouakchott–Nouâdhibou N2 highway, approximately 1 km from the existing borefield and approximately 60 km from the Mine site.

8.4 Potential Impacts

8.4.1 Construction

Typical construction noise levels have been predicted for a number of distances from typical construction activities associated with Phase 1b Project components.

Noise levels generated by construction works and experienced by sensitive receptors depend upon a number of variables, the most significant of which are:

- The noise generated by plant or equipment used on site, road traffic and other sources, generally expressed as sound power levels (Lw);
- The periods of operation of the plant on-site, known as its on-time;
- The distance between the noise source and the receptor;

- The attenuation due to ground absorption, air absorption and barrier effects; and
- In some instances, the reflection of noise due to the presence of hard surfaces such as the sides of buildings.

Due to the distances between sources of vibration and sensitive receptors, no prediction of vibration has been carried out.

Specific details of construction works were not available at the time of assessment and therefore representative construction activities have been assumed using experience of similar projects/constructions.

The following construction activities have been assumed during the Phase 1b construction works:

- Site clearance and earthworks;
- Excavations and foundations;
- Slab construction;
- Steelwork construction;
- Finishing and fitting; and
- Aggregates crusher.

Table 8-3 shows the predicted noise level for each construction activity at various distances from the activity. These predicted levels assume that there is direct line-of-sight between the noise source and receptor.

Table 8-3: Predicted Façade Noise Levels

Distance (m)	Noise Level $L_{Aeq,1h}$ (dB)							
	Site Clearance	Earthworks	Excavations and Foundations	Slab Construction	Steelwork Construction	Finishing and Fitting	Road Construction	Aggregates crusher
50	73	75	75	72	73	70	73	77
100	68	70	72	66	67	65	69	71
150	65	67	66	63	64	61	65	68
200	62	64	64	60	61	59	63	65
300	59	61	60	57	58	55	59	62
400	56	58	58	54	56	53	57	59
500	54	56	58	52	53	51	55	57
750	51	53	52	49	50	47	51	54
1,000	48	50	50	46	47	45	49	51
1,500	45	47	46	43	44	41	45	48

Distance (m)	Noise Level $L_{Aeq,1h}$ (dB)							
	Site Clearance	Earthworks	Excavations and Foundations	Slab Construction	Steelwork Construction	Finishing and Fitting	Road Construction	Aggregates crusher
2,000	42	44	44	40	42	39	43	45
3,000	39	41	42	37	38	35	39	42
4,000	36	38	38	34	35	33	37	39
5,000	34	36	36	32	33	31	35	37

For most of the construction period, noise levels will be significantly lower than those given in Table 8-3, with high noise levels for short periods only. It should be noted that construction noise impacts are only temporary by their very nature.

Appendix 2 contains detailed analysis of noise impacts upon sensitive receptors resulting from construction of each Phase 1b Project components.

With the exception of the accommodation camp construction, noise impacts, upon sensitive receptors, resulting from construction of Phase 1b Project components is assessed as being within WHO guidelines and therefore is of negligible to low significance.

With regards to the construction of the accommodation camp, sections of the new accommodation camp are located within 100 m of the existing accommodation camp. The noisiest activities are likely to arise from excavation works, including earthworks, and resulting unmitigated noise levels may exceed the night-time WHO guideline criteria of 30 dB within rooms to be used for resting and sleeping for some periods of the works. Overall, without taking into account any noise shielding provided by erected buildings as the work progresses the significance of the effect is therefore assessed as moderate.

8.4.2 Operation

The existing noise climate across the Mine site is dominated by noise from the ongoing excavation and processing activities. However, as stated in Section 8.3, noise levels at the accommodation camp resulting from these mining operations (blasting, excavation, processing) are negligible.

No quantitative data relating to operational equipment schedule and associated acoustic emission levels are available. However, a robust assessment of the operation of the Phase 1b infrastructure is possible, based on the proposed operations, the distances to sensitive receptors and the existing noise climate.

Appendix 2 contains detailed analysis of noise impacts upon sensitive receptors resulting from operation of each Phase 1b Project components.

With the exception of the operation of the airstrip, noise impacts, upon sensitive receptors, resulting from operation of Phase 1b Project components is assessed as being within WHO guidelines and therefore is of negligible significance.

The proposed airstrip and associated buildings are envisioned to be located approximately 5,800 m from the existing accommodating camp and approximately 4,500 m from the Phase 1b accommodation camp. Noise impacts to the accommodation camps will be dependent on a number of factors including frequency of flights, times of flights and direction of flight paths. Optimisation of these factors will result in minimal disturbance to workers resting and sleeping.

8.4.3 Closure

Closure will involve comparable activities to some of those employed in the construction of Phase 1b, in particular excavation works and steelwork. Noise and vibration impacts will be comparable to those for the construction works.

However, it is likely that, as plant is closed and dismantled, some office receptors will also be removed. Additionally, the number of occupants in the accommodation camps will be to be much reduced from operational numbers. Hence, the significance of these impacts during closure will be less than during construction.

Post closure, no significant noise and vibration impacts are anticipated for on-going monitoring activities.

8.5 Mitigation and Monitoring Measures

8.5.1 Construction

Best practicable means should be followed to further reduce the noise impact upon the nearest sensitive receptors. Best practicable means should include the following:

- All construction plant and equipment should comply with EU, or comparable, noise emission limits;
- Proper use of plant with respect to minimising noise emissions and regular maintenance. Vehicles and mechanical plant used for the purpose of the works should be fitted with effective exhaust silencers and should be maintained in good efficient working order;
- Selection of inherently quiet plant where appropriate. Major compressors should be 'sound reduced' models fitted with properly lined and sealed acoustic covers which should be kept closed whenever the machines are in use and all ancillary pneumatic percussive tools should be fitted with mufflers or silencers of the type recommended by the manufacturers;
- Machines in intermittent use should be shut down in the intervening periods between work or throttled down to a minimum;
- Plant and equipment such as flat bed lorries, skips and chutes should be lined with noise attenuating materials. Materials should be handled with care and be placed, not dropped. Materials should be delivered during normal working hours; and
- All ancillary plant such as generators, compressors and pumps should be positioned so as to cause minimum noise disturbance, i.e. furthest from receptors or behind noise barriers. If necessary, acoustic enclosures should be provided and/or acoustic shielding.

Many activities, although resulting in high noise levels, are expected to be short-term for any one receptor. Therefore the significance of the noise impact from on-site activities is regarded as low.

Localised noise barriers could be provided to screen the noise sources at areas of construction. It may be possible to provide mitigation for certain items of fixed or semi-fixed plant using

partial or full enclosures. However these should be assessed on a case by case basis at detailed design stage once construction methods and plant types have been finalised.

The use of white noise reversing alarms can considerably reduce the noise impact of mobile plant items. Background noise sensing alarms work by adjusting the level of the alarm to be audible above the background noise level, without being unnecessarily loud. Another type of reversing alarm sounds only when the sensors detect persons in the vicinity of the vehicle.

The greatest noise impact is predicted to occur at the existing accommodation camp while the Phase 1b accommodation camp is being constructed. It is recommended that the nearest new accommodation buildings to the existing camp be constructed first so that these can then provide shielding to the existing camp as the works commence. With this phasing of the construction of the new camp to provide shielding, providing approximately 10 dB(A) reduction, internal noise levels with closed windows will generally be less than 35 dB LAeq. With the use of these mitigation measures, providing reasonable resting and sleeping conditions, the significance of the effect is assessed as low.

Although noise impacts upon sensitive receptors are anticipated to be of negligible to low significance, monitoring of noise levels during construction is best practice. A monitoring program should be designed to ensure that noise levels during both peak construction periods and at resting times are captured at points where sensitive receptors are located.

8.5.2 Operation

No specific measures for noise mitigation are required to ensure negligible effects at office and accommodation buildings. However, the following techniques and good site management practices should be employed to minimise operational noise and vibration levels to the workplace and workforce in general:

- Acoustic enclosure and cladding of processing plant;
- Employment of earth berms as noise barriers at facility boundaries;
- Optimization of internal traffic routing to maximize distances to sensitive receptors and to minimise need for reversing (reducing noise from reversing alarms);
- Proper use of plant with respect to minimising noise emissions and regular maintenance. All vehicles and mechanical plant should be fitted with effective exhaust silencers and should be maintained in good efficient working order;
- Selection of inherently quiet plant where appropriate;
- Machines in intermittent use should be shut down in the intervening periods between work or throttled down to a minimum;
- All ancillary plant such as generators, compressors and pumps should be positioned so as to cause minimal noise disturbance;
- Minimise, to the extent practical, the use of blasting;
- Implementation of ground vibration and air overpressure control with appropriate drilling grids; and
- Proper design of foundations to crushers and other significant vibration sources.

As with construction, noise impacts upon sensitive receptors is anticipated to be of negligible significance, however regular monitoring of noise levels during operation is best practice. A monitoring program should be designed to ensure that noise levels during both peak

construction periods and at resting times are captured at points where sensitive receptors are located.

8.5.3 Closure

The mitigation and monitoring measures recommended for the construction (Section 8.5.1) will apply to the closure activities. Post closure, no mitigation measures are required.

8.5.4 Monitoring

The Environmental Department shall devise a suitable monitoring programme commensurate with the anticipated impacts, acquire appropriate sound level metering equipment and acoustic calibrator, and provide training for technicians.

The monitoring programme shall cover the full construction period and extend into the operational phase of the Project. Frequency of monitoring shall be determined by the Environmental Department on the basis of the programme of works and will be adjusted as necessary based upon the measurement results.

A range of suitable survey points shall be selected close to the aforementioned sensitive receptors (i.e. current and proposed accommodation camps and offices). Measurements at all locations should be 'free field' (i.e. no vertical reflective surfaces within 3m of the microphone) at a height of 1.2 metres above ground level, with microphones fitted with all-weather kits to protect them from dusts and distortion from wind. The monitoring procedure shall be generally based upon BS 7445:1991 & 2003 Description and Measurement of Environmental Noise, Parts 1 to 3, and be defined within the Mine's EMS. Records of instrument calibration, noise measurements and any consequential actions shall be kept.

8.6 Evaluation of Mitigated Impacts

8.6.1 Construction

With the exception of the Phase 1b accommodation camp, and power plant the significance of noise impacts from the construction, without mitigation, is assessed as being negligible; and therefore no further mitigation measures will be required.

The significance of effect from the expansion of the power plant, without mitigation, is assessed as low. Therefore no further mitigation measures will be required.

To reduce the impact of the construction of the new accommodation camp on the existing camp is recommended that the nearest new accommodation buildings to the existing camp be constructed first so that these can then provide shielding to the existing camp as the works commence. With the use of these mitigation measures the significance of the effect is assessed as low.

Residual noise impacts during construction are assessed to be adverse, short term and of negligible to low significance.

8.6.2 Operation

The significance of the noise impact from the operation of the following Phase 1b Project components is assessed as negligible:

- TSF 3 starter cell;
- Borefield Expansion;

- New Accommodation Camp;
- Water Treatment Systems Expansion;
- Waste Management Facilities Upgrade and Expansion;
- Fuel Farm; and
- Commencement Works.

Airstrip

Careful attention to frequency of flights, times of flights and direction of flight paths should ensure that the significance of effect due to operation of the proposed airstrip will be negligible.

Concrete Batch Plant

An aggregate crusher and batching plant will be temporarily employed during construction for foundation and other concrete works. As such, the noise and vibration impacts are dealt with in the construction assessment. There are no operational noise and vibration impacts and the significance of the effect is assessed as negligible.

Power Plant

With appropriate mitigation (choice of plant, enclosure where necessary, structure of building fabric) there is no reason why operational noise levels to the new operations office and the accommodation camps should increase. The significance of effect is assessed as negligible.

Residual noise impacts during operation are assessed to be adverse, short term and of negligible to low significance.

8.6.3 Closure

The significance of impacts during closure will be less than those during construction. Post closure impacts will be negligible.

Residual noise impacts post closure are assessed to be neutral, long term and of negligible significance.

8.7 Summary

A summary of the potential impacts of the proposed Phase 1b following the implementation of mitigation measures with respect to noise and vibration are presented in Table 8-4.

Table 8-4: Summary of potential residual impacts[1] - Noise and Vibration

Location	Nature of Impacts	Mitigation Measure	Project Phase[2]	Nature[3]	Duration[3]	Significance[3]
Mine site and Borefield	Construction and Closure Noise	Best Practicable Means	C D	Adverse	Short Term	Low/Negligible
	Construction and Closure Vibration	Best Practicable Means	C D	Adverse	Short Term	Negligible
	Operational Noise	Control techniques and Site Management Practices	O	Adverse	Medium Term	Negligible
	Operational Vibration	Best Practicable Means	O	Adverse	Medium Term	Negligible

[1]Following implementation of proposed Mitigation Measures

[2]Project Phase: C = Construction, O = Operation, D = Closure

[3] Duration and significance refer to the predicted impact after the implementation of proposed mitigation measures and is based on the ratings provided in Table 5-2.

9 Soils and Land Use

9.1 Introduction

This Section presents the methodology and baseline conditions used to assess the potential impacts on soils and land use resulting from Phase 1b. In addition mitigation measures which aim to avoid, reduce, remediate or compensate potential impacts are proposed and the residual impacts (impacts after mitigation measures implemented) assessed.

9.2 Methodology

As referred to in Section 2, this assessment takes into consideration national legislation, international guidance and Kinross internal standards.

The soil conditions at the Mine site were determined by:

- Reviewing of existing data (SNC Lavalin 2004, Scott Wilson 2008a,b,c,d, 2009a,b, 2010a); and
- Soil surveys and analysis undertaken as part of the Mine's environmental monitoring programme (Scott Wilson 2010b).

Land use across the Mine was surveyed during previous site visits in March 2010 by members of the EIA team and confirmed during consultation undertaken throughout the EIA process.

9.3 Baseline Conditions

The proposed Phase 1b development is located within the existing footprint of the Mine; and therefore the surrounding soils and land use have already been impacted by mining related activities.

9.3.1 Soil

The Mine site is generally flat, affected by sand dune movements and hence most of the area is covered by skeletal soils.

The soils of the Project area are predominantly sand and gravel, comprising of transported sediments with low agricultural potential. The majority of on-site soil is dry, weakly cemented, generally degraded, unproductive and easily eroded. Within wadi channels unconsolidated alluvial sediments comprising fine silt and sand can be found.

Baseline soil sampling at the Mine site was undertaken in March 2010 as part of the Mine's environmental monitoring programme (Scott Wilson, 2010b) and the results were analysed for a range of geochemical parameters, in particular those elements typically associated with gold mining activities. In the absence of any RIM equivalent, the Dutch Intervention Guidelines (DIV), which provide reference values used for environmental assessment, remediation and cleanup purposes, have been adopted to determine threshold levels for contaminants that require action for remediation, regardless of the final use of the land.

Table 9-1 presents a summary of the results of the soil analysis with the full data set provided at Appendix 3. The data indicates that there is no evidence of soil contamination resulting from the ongoing mining and associated activities at the site. Only one sample marginally exceeded any of the DIV levels (for Barium) and this was attributed to the natural geochemistry of the soil (Scott Wilson, 2010b).

Table 9-1: Summary of soils analysis

Sampling Location	Parameter								
	As	Cd	Cu	Co	Cr	Hg	Ni	Pb	Zn
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	Ppm
TSF 1 Centre Line	4.2	0.1	22.5	11.3	106.9	<0.01	32.3	10.3	42.0
TSF 1 South West Corner	5.0	0.1	26.8	12.1	97.4	0.01	34.8	10.2	47.3
DLF South West	5.3	0.0	23.2	10.7	78.4	0.01	29.7	8.9	42.4
West Branch	4.2	0.1	23.0	11.6	77.9	0.01	30.3	9.7	41.4
TSF II South East	2.7	0.1	17.6	10.8	78.9	0.01	20.0	8.1	34.8
Accommodation Camp	12.0	0.1	14.2	7.3	89.8	0.01	21.1	8.2	23.8
	Ag	Al	Ba	Be	Bi	Ca	Ce	Cs	
	ppm	%	ppm	ppm	ppm	%	ppm	ppm	
TSF 1 Centre Line	0.1	5.0	442.5	1.2	0.2	1.2	47.0	2.5	
TSF 1 South West Corner	0.1	5.6	505.0	1.1	0.1	1.3	44.7	2.5	
DLF South West	0.0	5.3	488.8	0.9	0.1	1.4	40.8	2.4	
West Branch	0.0	5.1	448.8	1.0	0.1	1.5	49.1	2.1	
TSF II South East	0.0	4.1	386.3	0.8	0.1	2.0	40.9	1.5	
Accommodation Camp	0.1	3.5	351.3	0.7	0.1	1.4	39.5	1.1	
	Fe	Ga	Ge	Hf	In	K	La	Li	
	%	ppm	ppm	ppm	ppm	%	ppm	ppm	
TSF 1 Centre Line	3.2	13.7	0.1	2.0	0.0	1.2	24.4	19.6	
TSF 1 South West Corner	3.5	15.1	0.1	2.0	0.0	1.2	24.8	20.2	
DLF South West	3.4	13.8	0.2	1.9	0.0	1.1	22.9	16.1	
West Branch	3.8	14.0	0.2	2.5	0.0	1.2	26.2	17.4	
TSF II South East	2.9	11.1	0.1	2.5	0.0	0.9	21.7	13.7	
Accommodation Camp	2.1	8.9	0.1	2.3	0.0	0.9	19.9	13.3	
	Mg	Mn	Mo	Na	Nb	P	Rb	Re	
	%	ppm	ppm	%	ppm	ppm	ppm	ppm	
TSF 1 Centre Line	0.8	459.6	1.1	0.9	6.8	275.0	58.3	0.0	
TSF 1 South West Corner	0.8	478.4	0.9	0.9	6.5	253.8	54.9	0.0	
DLF South West	0.7	513.4	0.7	0.8	6.1	215.0	52.9	0.0	
West Branch	0.8	542.6	0.8	0.7	7.4	286.3	52.1	0.0	
TSF II South East	0.7	494.0	0.8	0.7	6.7	346.3	39.9	0.0	
Accommodation Camp	0.5	340.8	0.8	0.8	6.4	255.0	37.9	0.0	
	S	Sb	Sc	Se	Sn	Sr	Ta	Te	
	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	
TSF 1 Centre Line	0.1	0.3	8.6	1.4	1.0	182.6	0.5	0.1	
TSF 1 South West Corner	0.0	0.4	9.1	1.0	0.9	214.8	0.5	0.1	
DLF South West	0.2	0.3	8.2	1.5	0.8	185.5	0.4	0.1	
West Branch	0.0	0.3	9.2	1.3	1.0	166.2	0.6	0.1	
TSF II South East	0.0	0.3	8.9	1.3	0.8	139.3	0.5	0.1	
Accommodation Camp	0.0	0.4	6.0	1.3	0.8	140.9	0.5	0.1	

Sampling Location	Parameter							
	Th	Ti	Tl	U	V	W	Y	Zr
	ppm	%	ppm	ppm	ppm	ppm	ppm	Ppm
TSF 1 Centre Line	7.0	0.3	0.3	1.4	52.9	1.4	12.4	68.9
TSF 1 South West Corner	6.6	0.3	0.3	1.5	63.4	1.3	12.1	64.4
DLF South West	6.5	0.3	0.3	1.3	55.0	1.3	11.5	59.4
West Branch	7.5	0.3	0.2	1.5	59.5	2.2	13.7	75.4
TSF II South East	6.5	0.4	0.2	1.3	57.6	1.0	13.9	79.8
Accommodation Camp	6.9	0.3	0.2	1.1	48.3	0.7	10.3	75.8

In addition, as part the environmental monitoring programme, samples of tailings material were also tested in March 2010 as this material is considered to represent the largest potential source of windblown dust on the mine, and therefore a potential source of soil contamination. The results of this analysis are presented in Table 9-2.

Table 9-2: TSF soil sample analysis results

Parameter	Units	Dutch Intervention Value	Dry Tails	Semi-Wet tails	Filtered Tails
Ag	ppm	15	0.16	0.33	0.13
As	ppm	55	81.1	49.4	72
Ba	ppm	625	340	360	360
Be	ppm	30	0.72	0.66	0.65
Cd	ppm	12	0.15	0.2	0.08
Co	ppm	240	5	6.5	3.8
Cr	ppm	380	30	22	41
Cu	ppm	190	16.8	33.3	18.9
Mo	ppm	200	1.39	2.51	1.46
Ni	ppm	210	17.4	20.1	17.3
Pb	ppm	530	7.3	4.8	6.9
Se	ppm	100	1	2	2
Sn	ppm	900	0.4	0.4	0.4
Te	ppm	600	0.13	0.15	0.23
Th	ppm	15	2.3	2.3	2.3
V	ppm	250	18	14	25
Zn	ppm	720	46	55	38
Hg	ppm	10	0.02	0.01	nd

The only element in the tailings which is present at a concentration greater than the DIV threshold level is Arsenic (As). This is not considered harmful to the wider environment because the arsenic concentration only marginally exceeds the DIV threshold, and any dust deposition will be diluted by the volumes of naturally occurring dust in the vicinity (Scott Wilson, 2010b). This is supported by the data for soils around the site, including that near the TSF (Table 9-1). Ambient arsenic levels in the surrounding soils range between 0.9 ppm and 17.8 ppm (average of 5.6 ppm), meaning that a considerable proportion of tailings dust will need to be present in the soil for the DIV threshold level to be exceeded.

9.3.2 Land Use

The Project is located in a remote desert area with no permanent land uses in the surrounding area other than the existing Mine. A relatively small number of subsistence pastoralists are resident in the vicinity of the Mine site while the nearest towns are located over 100 km away. The Mine site offers very limited potential for residential, tourist or recreational development or agriculture. Land use is largely limited to grazing by small livestock herds owned by local resident families and by larger herds of camels, sheep, goats and some cattle as nomadic groups pass through the area.

Most of the proposed locations for Phase 1b infrastructure development are within the existing Mine footprint and is therefore already associated with mining-related activities, including exploration, mining, production and ancillary works.

The Mine site is secured by a perimeter fence while the borefield and the access road corridor remain generally 'open' to public access. The proposed airstrip will also have a perimeter fence for safety and security reasons. The area where the proposed airstrip is envisioned to be located has higher levels of plant diversity compared with the rest of the Mine site (refer to Section 10.3.1) however in the regional context biodiversity and soil fertility remains very low.

9.4 Potential Impacts

Phase 1b Project components are located on-site in areas which have already experienced a significant degree of disturbance as a result of mining activities, or in the case if the airstrip, are in close proximity to areas that have already experienced a large degree of disturbance. Given the sandy nature of the soil and its lack of potential to support arable land use or intensive livestock grazing, the impacts of the Project on soils are considered to be minimal.

9.4.1 Construction

9.4.1.1 Soil

Potential impacts on soil during construction of Phase 1b include:

- Loss of and disturbance to soils;
- Increased erosion of soils resulting from construction activities (including drilling) and removal of vegetation (which provides limited soil stability); and
- Soil contamination as a result of spills and/or leaks of fuels, oils or other chemicals.

9.4.1.2 Land Use

The land use within the Mine sites perimeter fence will not change from the existing use. The impact on land use during construction of Phase 1b is limited to the land-take required for the proposed airstrip and its associated facilities and the expansion of the borefield towards the south.

Any loss of land within the existing mine footprint is not considered significant since local communities are already excluded from it and it has limited biodiversity value.

The loss of land associated with the proposed airstrip and borefield expansion could impact upon existing users. The proposed land take for the airstrip (approximately 1.3 km^2) in relation the Mine site (approximately 196 km^2) and surrounding area (approximately 2,830 km^2) of influence, as defined in Section 11, represent a new land take of less than 1%. Therefore given the scale of proposed land take for the airstrip, the local and national trends of desertification and the low productivity of the land; the impact on the potential land users is considered to be low/negligible.

9.4.2 Operation

9.4.2.1 Soil

Potential impacts on soils during operation of Phase 1b are:

- Loss of soil due to the continual removal of vegetation during operations;
- Compaction of soils due to vehicle and plant movements; and
- Soil contamination as a result of spills and/or leaks of fuels, oils or other chemicals.

9.4.2.2 Land Use

There will be negligible impacts on land use within area enclosed by the Mine's perimeter fence and the borefield during operation of Phase 1b, as the affected areas are already utilised for mining and related activities.

With regards to the proposed airstrip, the impacts will be the same as those experienced during construction.

9.4.3 Closure

9.4.3.1 Soils

The main impact on soils at closure of Phase 1b will be the opportunity for the reuse of any stored topsoil to enable rehabilitation of areas following decommissioning and dismantling of infrastructure. However, it is unlikely given the arid conditions that significant, if any, volumes of topsoil will be encountered during construction.

9.4.3.2 Land Use

Impacts on land use at closure of Phase 1b infrastructure will be restricted due to the location within the overall Mine footprint. There will be limited opportunities for recolonisation of flora and fauna, but land will not be available for livestock grazing until the perimeter fence is ultimately removed which will not be until the completion of closure activities.

9.5 Mitigation and Monitoring Measures

9.5.1 Construction and Operation

9.5.1.1 Soil

Disturbance of soil during construction and operation are limited as, Phase 1b activities are located in areas which have previously been disturbed. It is unlikely that significant volumes of topsoil will be encountered during the construction; however, if sufficient topsoil material is encountered during the construction phase it will be stockpiled for use in progressive or final closure and rehabilitation works.

Erosion of soils during construction and operation will be minimised by ensuring that where practical, vehicles and pedestrians utilise the designated roads and tracks within the Mine site. The generally low rainfall in the area results in an insignificant risk of water erosion of soils and its redistribution on surrounding land, however, wind erosion and sand dune 'creep' are significant but natural features of the landscape and therefore soil erosion would occur even without mining activity. No mitigation actions are considered appropriate.

Routine monitoring may be required to ensure that sand dunes are not encroaching on Mine infrastructure and that any topsoil piles (if sufficient material is recovered) are stable and not eroded.

Any spills or leaks will be managed in accordance to the emergency response plan (see Section 18). The response plan will include methods for spill clean-up and the disposal of any contaminated materials. Spill kits will be available at key locations and all workers will be trained to prevent and respond to incidents. Routine inspection, monitoring and maintenance will take place to reduce the risks of spills and accidents.

9.5.1.2 Land Use

Phase 1b Project components will not alter the current land use within the area bordered by the Mine's perimeter fence.

Considering the low/negligible impact of land take for the proposed airstrip, no mitigation measures are proposed. The loss of access/barriers to pastureland and/or the loss viable pastureland resulting from the proposed airstrip may require some compensatory measures for stakeholders – see Section 11.

9.5.2 Closure

During closure, all Phase 1b infrastructure, except the existing and proposed borefield infrastructure will be removed and re-contouring of the land surface will take place where necessary. Natural colonisation by vegetation will help to promote soil stability and to restore the landscape to a state which is in-keeping with surrounding land uses, and to a condition which is safe and suitable for an alternative land use. Post closure, no mitigation measures are required.

9.5.3 Monitoring

No formal soil or land use monitoring programmes are considered necessary during the construction and operational phases of the Project. However, the Mines Environment Department will include a visual assessment of significant changing soil conditions, including

erosion and dune encroachment, and any changes in land use within or in proximity to the Mine site, proposed airstrip and borefield, in its routine EMS audits and inspections (i.e. add these topics to checklists). In addition to the written EMS audit and site inspection records, the Environment Department shall retain suitable photographs of any soil and land use conditions of significant interest to monitor trend.

9.6 Evaluation of Mitigated Impacts

9.6.1 Construction

Adverse impacts on soil during construction will be negligible due to the poor quality of the existing soil. Soil disturbance, compaction and erosion are likely in the short term and soil contamination is possible. However, the significance of these impacts is low, given that activities in Phase 1b are located within (or in the case of the airport and borefield, near to) existing mining activity.

Residual soil impacts during construction are assessed to be adverse, long term and of low/negligible significance.

The impacts on land use during construction are low/negligible, as potential for non-mine related land use is limited by security related exclusion and the poor soil conditions. However, land-take for the proposed airstrip and its associated facilities may result in some loss of local pasture and/or create barriers to the free movement of livestock.

Residual land use impacts during construction are assessed to be adverse, long term and of low/negligible significance.

9.6.2 Operation

Adverse impacts on soil during operation will be low and primarily caused by traffic associated with the new infrastructure operating in areas that were previously less disturbed. For example, some plant will be required for maintenance of TSF3 starter cell and air traffic will potentially increase, with takeoff and landing in a proposed airstrip location. The potential for soil contamination during operation is higher than during construction, as some of the proposed new infrastructure is associated with potentially environmentally toxic materials, for example heavy fuel oil at the new fuel farm and expanded power station, and aviation fuel at the proposed airstrip.

Residual soil impacts during operation are assessed to be adverse, long term and of low/negligible significance.

Impacts on land use during operation are generally considered to be negligible, although the potential disturbance to pastures and any to livestock movements may affect local residents.

Residual land use impacts during operation are assessed to be adverse, long term and of low/negligible significance.

9.6.3 Closure

Impacts on soil and land use at closure will be neutral or beneficial as land lost during construction will be returned to a condition and use similar to, or better than that before. The only exception to this will be any infrastructure for which, and in negotiation with stakeholders, a beneficial post mining use can be found. It is unlikely that significant volumes of topsoil will be encountered during the construction; however, if sufficient topsoil was encountered during construction to warrant stockpiling it will be used to assist in land reclamation.

Residual soil impacts post closure are assessed to be neutral, long term and of low/negligible significance.

Impacts on land use will be neutral, as land lost to mine operations will be, where practical, restored to a state which is in-keeping with surrounding land uses, and to a condition which is safe and suitable for an alternative use.

Residual land use impacts post closure are assessed to be neutral, long term and of low/negligible significance.

9.7 Summary

A summary of the potential impacts of the proposed Phase 1b following the implementation of mitigation measures with respect to air quality are presented in Table 9-3.

Table 9-3: Summary of potential residual impacts[1] - Soils and land Use

Location	Nature of Impacts	Mitigation Measure	Project Phase[2]	Nature[3]	Duration[3]	Significance[3]
Mine site and Borefield	Soil contamination	Emergency Response Plan	C O D	Adverse	Long term	Low/Negligible
	Soil disturbance	Limit disturbance; locate borrow pits within existing infrastructure area/s or close to new infrastructure area/s	C O	Adverse	Short term	Low/Negligible
	Soil compaction	Efficient movement of heavy plant	C O	Adverse	Long term	Low/Negligible
	Soil Erosion	Use designated roads and tracks around the mine site	C O D	Adverse	Long term	Low/Negligible
	Land-take/loss of pasture/ barrier to movement	No mitigation proposed	C O	Adverse	Long term	Low/Negligible
	Restoration of soil and land	Passive re-establishment of vegetation	D	Neutral	Long term	Low/Negligible

See 9.5.1.21 [1]Following implementation of proposed Mitigation Measures

[2]Project Phase: C = Construction, O = Operation, D = Closure

[3] Duration and significance refer to the predicted impact after the implementation of proposed mitigation measures and is based on the ratings provided in Table 5-2.

10 Ecology

10.1 Introduction

This Section presents the methodology and baseline conditions used to assess the potential impacts on ecology resulting from Phase 1b. In addition mitigation measures which avoid, reduce, remediate or compensate potential impacts are proposed and the residual impacts (impacts after mitigation measures implemented) assessed.

10.2 Methodology

As referred to in Section 2, this assessment takes into consideration national legislation, international guidance and Kinross standards.

Mauritania has only limited legislation and policy affording protection to flora and fauna. The relevant legislative instruments are summarised below.

- The Hunting Code (Law No. 97-006) which extends legal protection to certain fauna based on socio-economic value and not rarity.
- The Protection of Vegetation Law (Law No. 2000-042) legislates on the protection of vegetation as a natural resource and on the import and export of vegetation.
- The Forestry Code (Law No. 2007-055) regulates the exploitation of forest products, the classification of forests and forest clearance. It affords protection to certain species of tree in recognition of their socio-economic value.
- Decree 2009-104 applies the dispositions of Law No. 2007-055 (above), namely with regard to exploitation rights, the exploitation of forest products, the classification of forests, and forest clearance.

None of the above legal protocols assigns protection based on species or habitat rarity or nature conservation value, with socio-economic considerations being the primary drivers for legal protection.

While not Mauritanian policy, the Project is also being undertaken in accordance with IFC Performance Standards 6 (IFC, 2006).

The baseline conditions have been defined through a range of investigations. This included a review of existing baseline data (SNC Lavalin, 2004, Ismail & Clarke, 2009) and a specific ecology survey for the Mine. The ecology survey for the Mine was undertaken in March 2011 by a team of two national botanists and ornithologist and two international ecologists. Transect surveys to identify habitats, flora and fauna were undertaken across the Mine site (including proposed airstrip location), borefield and access road. The results of the March 2011 ecology survey have provided the majority of the data upon which this ecology assessment is based (URS Scott Wilson 2011f).

10.3 Baseline Conditions

10.3.1 Habitats, Vegetation and Flora

The Mine is located within the Saharan zone, which occupies up to three-quarters of Mauritania and is of low floristic diversity. Climatic and geomorphological conditions are the primary determinants of the Saharan flora (and fauna also), although other factors including overgrazing and other anthropogenic pressures can also be important.

The habitats present within the Mine are typical of a desert location and of much of the middle, north and north-east of Mauritania is dominated by this habitat. The predominant physical habitat type comprises a flat area of land formed mainly of gravelly regs[5] and localised superficial sand deposits. Locally there are small rock and boulder extrusions as well as lower lying wadis[6]. Vegetation cover is typically low and it is not uniformly distributed, being influenced by variations in topography and physical conditions. As such, vegetation is clustered in and around the beds of minor depressions and wadis as well as areas of sandy deposit. See Figure 10-1 for the Mine site habitat map.

A total of 56 species of plant have been recorded at the Mine site (URS Scott Wilson 2011f). The most recent survey undertaken in February 2011 coincided with the end of a period of higher than average rainfall, providing an unprecedented opportunity to identify and record the range of flora associated with the Mines location.

The most common species recorded were herbaceous plants, particularly *Fagonia oliveri*, *Aerva javanica*, *Aristida* spp., *Astragalus vogelii*, *Chrozophora brochiana*, *Citrullus colocynthys*, *Corchorus depressus*, *Farsetia ramosissima*, *Hyoscyamus muticus*, *Monsonia nivea*, *Nucularia perrinii*, *Panicum turgidum*, *Pulicaria incisa*, *Seetzenia lanata* and *Stipagrostis pungens*.

There were also four woody species (trees and shrubs) (*Acacia ehrenbergiana*, *Calotropis procera*, *Capparis decidua, Maerua crassifolia*), of which *Acacia ehrenbergiana* was the most common being widespread throughout the Mine site. Tree cover across the Mine was very low, being less than 5 trees per km^2. See Figure 10-2.

The semi-natural plant assemblages found during the survey are all typical of desert areas of Mauritania and wider North Africa. They can be categorised into three sub-types:

- A stony regs (with or without fine sand) assemblage dominated by groups such as *Fagonia, Farsetia, Heliotropium, Seetzenia, Corchorus and Aristida.* This was the most commonly distributed habitat within the vicinity of the Mine (Photograph 10-1);
- A wadis assemblage dominated by *Panicum turgidum and Citrulus colocynthys,* as well as trees and shrubs, particularly *Acacia ehrenbergiana*, *Maerua crassifolia* and *Capparis decidua* (Photograph 10-2); and
- A mobile dune assemblage typified by herbaceous species such as *Stipagrostis pungens, Cyperus conglomeratus* and *Panicum turgidum* (Photograph 10-3). Based on the available survey data there are no major dune systems within the boundary of the Project.

Figure 10-3 summarises the diversity of flora found at the survey sites, expressed as the number of species recorded there, grouped into five classes. The data indicate that although there was much local variability, certain areas were more consistently diverse than others. Overall, survey points located towards the northeast, near the proposed airstrip, and west of the Mine site appeared to have consistently higher levels of diversity compared with other areas. Areas in the south and south-east of the Mine site were generally characterised by low plant diversity. These differences are likely to reflect land use including disturbance by Mine activities and the availability of water to plants (a critical limiting factor on plant growth in the region), which is in turn regulated by flow paths and water accumulations during wet weather, along with soil and subsoil capacity for holding water.

Areas of the existing borefield exhibit effects from drilling activities and associated vehicle access. The plant communities are sparse and dominated by *Fagonia spp* with a range of other

[5] Regs are desert landform defined as broad plains covered with sand and gravel. Regs are the dominant landform in most of the Sahara.
[6] Gullies or stream beds that are predominantly dry but that collect water during rainfall events.

attendant herbaceous species. There are some wadis and these support a more varied flora including *Panicum turgidum*, *Cupresssus compactum Aerva javanica*, *Aristida* spp., and *Astragalus vogelii*. Tree cover is generally low and includes *Capparis decidua*.

None of the vegetation types and plant species identified are considered to be rare or threatened, and none have been designated by local, national or international standards. However, the trees *Acacia ehrenbergiana, Maerua crassifolia* and *Capparis decidua* are protected by national forestry legislation due to their socio-economic importance, see Section 2.2.1.

10.3.2 Birds

An overview of the bird fauna of Mauritania is provided in Shine *et al*. (2001) and this includes the identification of a number of 'Important Bird Areas'. The Mine is not located within an Important Bird Area and the results of the bird surveys do not indicate that it will merit consideration as one.

Shine *et al*. (2001) identifies that Mauritania supports no bird species of restricted range, although there are endemic subspecies of grey heron *Ardea cinerea monicae* and Eurasian spoonbill *Platalea leucorodia balsaci* which are primarily restricted to wetland habitats, particularly within the PNBA. The Mine falls within the Sahara-Sindian biome, which covers much of the north and centre of the country as well as much of north Africa and supports a biome-restricted assemblage of birds.

The ornithological survey (URS Scott Wilson, 2011f) recorded the presence of 31 species of resident and migratory (mainly over-wintering) birds within the Mine. Species diversity at survey points was mostly in the range of three to six bird species recorded, although some of the points closest to existing facilities had zero to three species. The abundance of most species was low, with the exception of singing bushlark (*Mirafra cantillans*), black-crowned sparrow-lark (*Eromopterix nigriceps*), northern wheatear (*Oenanthe oenanthe leucorhoa*) and Thekla lark (*Galerida theklae*) which were more abundant. The total (all species) bird abundance was estimated at approximately 50 to 60 individuals per km^2. Abundances at the time of survey were likely to be higher than typical due to an exceptional rainfall events over the preceding year which had promoted the growth of vegetation, supporting an increase in associated insect poplulations.

No internationally (IUCN Red List) or nationally rare or threatened bird species were recorded, but two species were recorded that were uncommon in Mauritania. These species were bronze-winged courser (*Rhinoptilus chalcopterus*) and common quail (*Coturnix coturnix*).

10.3.3 Mammals

Given the large size of the Mine and the current, disturbed habitat conditions, many of the mammal species that occur, or that might potentially occur, are expected to be present at low density or otherwise be nocturnal in occurrence (URS Scott Wilson, 2011f).

Small mammal trapping recorded the presence of a species of spiny mouse of the genus *Acomys* (Photograph 10-4). Species of this genus are superficially very similar, requiring genetic and dental studies to distinguish, but based on known distributions and habitat preferences, it was considered likely that the animals that were trapped were Chudeau's spiny mouse (*Acomys chudeaui*), a species that favours rocky areas and hot desert. This species is not threatened or rare.

One sighting was made of a fennec fox (*Vulpes zerda*) and, although not confirmed, based on the evidence observed this species is expected to breed within the Mine site. The fennec fox is not threatened or rare.

No other wild mammal species were identified but evidence of mammal activity was found throughout the Mine site (see Figure 10-4). Animal holes were regularly recorded in the stabilised faces of sand dunes and in the sandy areas within uneven hummocky ground typically found around the edges of wadis. Animal holes were not associated with the compacted areas such as the stony 'regs' formations. In addition, mammal tracks were observed at various survey points (Photographs 10-5 and 10-6).

The vegetation around the site lacks certain tree species necessary to support the presence of the threatened and nationally rare dorcas gazelle (*Endorcas rufifrons*). Coupled with the impact from the effects of disturbance from grazing and current mining activities, it is considered that this shy, species will not occur within the Mine survey area. No evidence was found to indicate its presence.

No bat species were recorded during the baseline survey.

Survey work for the West Branch Development (Scott Wilson, 2010a) recorded evidence of the presence of the following species in the vicinity of the site: Cape hare (*Lepus capensis*), gerbil (Gerbillinae), jerboa (*Jaculus jaculus*), golden jackal (*Canis aureus*) and feral domestic dog (*Canis lepus familiaris*). None of these species are threatened or rare.

10.3.4 Other Fauna

A limited number of direct observations of reptiles were made, these being of Moorish gecko (*Tarentola mauritanica*) and oscellated skink (*Chalcides ocellatus*). Neither of these species is rare, threatened or specialist in their habitat requirements.

No systematic invertebrate survey was undertaken and limited direct observations were made. Large numbers of the desert locust (*Schistocerca gregaria*) were observed across the Mine site, exploiting the vegetation that had developed as a result of the above average rainfall of the preceding year. The ant *Formica nigra* was also recorded as well as several additional species of invertebrate which were not identified.

Each of the sub-types of habitat present within the Mine site is likely to support different assemblages of invertebrates, with the scarcest niches typically supporting the most locally notable species. However, none of the habitat types present are rare or isolated in distribution and as such it is unlikely that the site will support any invertebrate species of high nature conservation importance.

10.4 Potential Impacts

Most of the proposed infrastructure is located within the existing footprint of the operational Mine site. As such, while potential impacts need to be considered, much of it can largely be screened out as the scope for impacts to occur has been markedly reduced as a result of the existing site context. New disturbance areas, both within and outside the Mine site, require greater consideration.

10.4.1 Construction and Operation

In the context of Phase 1b, while it is entirely practical to separate out construction and operational impacts, there is little merit in doing so given the nature of the established ecological baseline.

Potential Phase 1b impacts on the ecological resources of the area are:

- Habitat loss (new disturbance): this is a direct impact arising from Phase 1b. The significance of this is related to the area lost, the proportion of the total area and the ecology and nature conservation value of that habitat.
- Habitat fragmentation: new disturbance can separate habitats, leaving areas too small to support viable populations, and create physical barriers to the movement of animals or the dispersion of plant propagates between areas cut off by Phase 1b. Fragmentation can lead to reduced genetic diversity and can increase the likelihood of local populations being lost.
- Indirect effects: these impacts may affect habitats outside the boundary of the construction site. They may arise from disturbance (visual, noise or vibration), dust deposition, pollution incidents and changes in site hydrology or the flow and/or quality of watercourses.

The main sources of impacts on flora and fauna as a result of Phase 1b construction activities are likely to relate to:

- Clearance of vegetation and loss of habitat;
- Soil erosion and dust impacts on vegetation;
- Noise and dust disturbance to wildlife; and
- Involvement of wildlife in accidents with vehicles or as a result of working practices.

The main sources of impacts on flora and fauna as a result of the Phase 1b operational activities are likely to relate to:

- Ongoing soil erosion and dust impacts on vegetation;
- Ongoing disturbance to wildlife due to noise and dust;
- Involvement of wildlife in accidents with vehicles; and
- Risk of wildlife death as a result of CIL tails in TSF 3 starter cell and water ponding.

The duration of the predicted impacts will be medium term ending with the closure and restoration of the Mine site and borefield, with the exception of TSF 3 starter cell which will be permanent beyond the life of the Mine. While the final configuration of the TSF 3 (including starter cell, cell 1 and cell 2) can be restored to a state where it may become colonised by passive revegetation, it will remain a permanent artificial feature of the landscape. As such, while a biodiversity value can be reinstated, the affected land will not be restored to a state directly comparable to the baseline conditions.

10.4.1.1 Habitat

Clearance of vegetation and loss of habitat will be the main impact during construction and operation. The total land area requirement for Phase 1b is approximately 183 ha.

None of the habitats and vegetation communities that will be impacted are threatened or of limited extent (locally, nationally or internationally) or are otherwise critical habitat (as defined in IFC Performance Standard 6) for rare or threatened flora and fauna. Therefore, the precise location of infrastructure is relatively unimportant in this context and regardless of location will result in comparable effects as a result of the Project.

While none of the vegetation communities recorded were of high nature conservation value in their own right, the three tree species recorded at low density across much of the Mine site

(*Acacia ehrenbergiana, Capparis decidua* and *Maerua crassifolia*) are protected by Mauritanian law. These species are protected for their socio-economic importance and the grubbing, destruction or damage to these tree species is normally prohibited unless authorised by the Ministry responsible for Forests. Note however that an exemption from this requirement can be sought under Article 23 of the Forestry Code (2007-055) where the trees are located in 'private' property and do not form part of a significant forest body[7].

The proposed airstrip location merits specific mention as it will be located in an area of relatively high tree cover, although the tree cover is still sparse at 30 to 50 trees per km^2 and not exceptional in the wider, off-site context.

Given the above considerations, the significance of the predicted impact on habitats and vegetation, including protected trees, is assessed as adverse, medium term and moderate.

Most of the land within the Mine site is of a gravelly regs habitat type which will be relatively invulnerable to erosion (but they will still generate dust). Areas of looser sandy deposits only occur locally and while these could destabilise if disturbed this will only happen in limited areas with limited potential to spread. Because such disturbances and dust deposition are likely to be comparable with the natural and modified baselines, within the capacity of the landscape to absorb, and given the extent of the comparable un-impacted (by the Project) natural vegetation communities in northern Mauritania**,** the significance of the predicted impact on vegetation is assessed as low adverse and therefore the impact is assessed as not significant.

During construction, individual species of flora and fauna will be affected by a temporary loss of habitat. However, the total habitat resource is extensive throughout northern Mauritania and wider North Africa. The diversity of species associated with these habitats is rather limited, none are threatened or rare and all will be expected to be widely distributed wherever there is suitable habitat. Given the localised land take requirements, a proportion of which is within the existing footprint of the Mine site, the extent of available habitat directly comparable to the habitats affected and the limited suite of species present, it is considered that any effects associated with habitat loss are within the capacity of the wider landscape/ecosystem to absorb.

In addition to habitat losses, fauna may also experience disturbance (disturbance effects on flora will be the same as that for vegetation communities). The construction phase will represent the predicted peak in human activity and associated disturbance but some disturbance will continue into the operation phase as a result of people and vehicle movements and the operation and maintenance of infrastructure. Such disturbance is already experienced in the area as a result of existing mining and processing operations. Effects resulting from construction will be temporary, only occurring on those days when disturbing activities are being carried out and/or restricted to daylight hours. Effects resulting from operation are likely to be long term as mining will be a 24 hour operation. The zone of disturbance and any associated displacement will vary in size according to the sensitivity of the species involved and is unlikely to encompass the whole Mine site or all of the available habitat resource for specific species. This will mean that there will always be places of refuge for wildlife. It is also reasonable to assume that the wildlife will gradually habituate, particularly away from the footprint of the main mine infrastructure, to the presence of large machinery and people, as they have already done in the context of the existing Mine infrastructure.

Based on the relatively low densities of fauna observed it is unlikely that accidents with vehicles and machinery will be any more than a rare occurrence during Phase 1b. Many species, birds

[7] In regards to trees within the existing MLA, this exemption will be obtained through a submission of to the relevant MSED authority detailing appropriate compensatory measures.

included, are more likely to be displaced by the noise of approaching vehicles and machinery before they will be at risk of an accident. In addition, vehicle movements will be subject to specified site speed limits (see below) which will further negate any risks.

The significance of the predicted impact on fauna and flora as a result of disturbance and accidents is assessed as low adverse and is therefore not significant.

Phase 1b itself will not represent a barrier to the free movement of wildlife and gene flow between individual sub-populations. No impact is predicted in terms of wildlife movements and gene flow.

10.4.1.2 TSF 3 starter cell

Water that collects in the TSF 3 starter cell during operation will present the potential of elevated levels of cyanide, which could poison wildlife drinking the water. Until the new cyanide detoxification circuit is installed in Phase 2 of the Project, cyanide levels will be kept to the minimal level practical and breakdown will be assisted by the hot sunny climatic conditions. Additionally, the amount of standing water on the TSF surface will be minimised and audible bird deterrent devices will be employed.

The actual likelihood of impacts occurring is considered limited, on the basis of the mitigation standards already adopted at the Mine (see Section 10.5) and the following:

- Larger mammals (camels and livestock) will continue to be excluded from the Mine site by the perimeter fence;
- As reported by TMLSA to Ministry officials, it is acknowledged that there have been some limited bird mortalities.

The significance of the impact associated with elevated concentrations of cyanide in the tailings on fauna is assessed as low adverse and therefore the impact is assessed as not significant.

10.4.2 Closure

Following cessation of operations, clearance and rehabilitation activities will be undertaken as per the agreed Rehabilitation and Closure Plan. Initial impacts to habitat will be similar to those experienced during construction and may include:

- Soil erosion and dust impacts on vegetation;
- Noise and dust disturbance to wildlife; and
- Involvement of wildlife in accidents with vehicles or as a result of working practices.

Following removal of infrastructure (except for the existing and proposed borefield expansion infrastructure), a strategy for passive re-establishment of vegetation and subsequently native wildlife will be implemented. The strategy will also ensure that invasive alien plant species are not introduced and, as required by IFC Performance Standard 6, no planting of non-native flora will be undertaken anywhere within the Mine site.

10.5 Mitigation and Monitoring Measures

The mitigation requirements for Phase 1b are relatively modest and primarily restricted to the need to compensate for losses of habitat, particularly protected trees. The mitigation measures detailed below have been developed with reference to, and to ensure the compliance of the Project with, IFC Performance Standard 6 as well as applicable national legislation.

10.5.1 Construction and Operation

Prior to site clearance an ecologist should undertake a walkover or drive-by survey of the relevant land areas (depending on size of the relevant land areas) to check for the presence of any newly established ecological constraints requiring mitigation as part of good practice; such as, active mammal dens. This acts as a final check to ensure that any new constraints are accounted for. The ecologist will provide advice on the appropriate course of action should any issues be identified.

During construction, dust generation will be reduced as ground preparation includes moistening the soil, in order to improve compaction properties. This will reduce the generation of dust and any associated effects on vegetation in the immediate vicinity of the disturbing activities (see Section 7.5.3). A speed limit is in place on the access road to reduce the generation and dispersal distance of dust.

During construction as well as operation, vehicle movements will be in accordance with Mine guidelines. All drivers will receive training to reduce the risk of accidents and a speed limit is in place on the access road and internal roads for general safety reasons (See Section 14.5). Speed restrictions and driver training will also result in reduced levels of disturbance to wildlife and the generation of fugitive dust.

10.5.1.1 Habitat Conservation

TMLSA will mitigate/compensate for the loss of any trees protected under the Forestry Code by replanting. To facilitate this and to quantify the precise requirement for mitigation, the number of trees lost will be recorded for each specific component of Phase 1b.The mechanism through which mitigation/compensation will be provided will be determined through discussions with the relevant authorities.

To ensure that invasive alien plant species are not introduced, no intentional plantings of non-native flora will be undertaken. Where the establishment of vegetation is considered desirable to mitigate/compensate for loss of specific species or for amenity purposes, then this will be of native trees.

If and when the proposed airstrip is constructed, to partly compensate for the creation of the proposed airstrip the existing airstrip would eventually be removed and passively reinstated as natural habitat. This existing airstrip would therefore be available for compensatory tree planting. This will be dependent on the ability to ensure suitable conditions are available for tree planting and subsequent survival. Stony reg for example will not be suitable habitat to plant trees in.

10.5.1.2 Fauna

TMLSA shall instigate an awareness programme to educate workers and, potentially local communities regarding important local wildlife and shall prohibit personnel from participating in hunting, poaching or any trade in meat or other wildlife products in or near the Mine.

To prevent potential wildlife deaths which result from the drinking of tailing water which may contain elevated levels of cyanide, , bird-scarers (devices that emit noise or offer a visual threat to birds) will be deployed to deter birds from drinking from tailings ponds. The effectiveness of these devices is monitored by recording bird activity and numbers. In addition, the existing perimeter fence serves as exclusion for larger fauna.

Wildlife monitoring is already used to determine the numbers of birds and animals accessing the tailings ponds and dump leach facility. Any deceased animals are removed and identified, if possible, and recorded before being buried to prevent potential contamination of the food chain. Any dead birds found in the vicinity of the active processing, dump leach and TSF will be assumed to have suffered from cyanide poisoning and will be buried as a matter of precaution. Where poisoning incidents are identified an investigation of the cyanide treatment procedures will be completed. Based on the findings of the investigation, appropriate steps will be taken to reduce the risk of further poisoning events.

Although the presence or otherwise in the area of endangered bustard species has yet to be definitively determined, it is known that these birds are susceptible to collisions with fencing.

10.5.2 Closure

At closure, where appropriate, infrastructure will be removed and a strategy will be implemented (via the agreed Rehabilitation and Closure Plan) for the passive re-establishment of native flora and fauna. In particular, should pilot testing be successful, colonisation of the Mine site by protected trees could be bolstered by planting out established nursery stock.

There should also be a thorough survey for invasive species to ensure that all invasive plants are destroyed and any feral populations of fauna are removed upon Mine closure.

10.5.3 Monitoring

The Environmental Department shall liaise with contractors and undertake routine audits and inspections of contractor activities to ensure compliance with Project requirements for flora and fauna mitigation. Should pilot testing of tree plant be successful, the Environmental Department shall advise the contractor and/or specify when an ecologist needs to be used for a walkover or drive through of such areas prior to site clearance.

The Environmental Department shall expand its routine monitoring to detect any avian or mammalian mortality at TSF 3 starter cell and apply its EMS investigation and notification procedure to all incidents. Records will be kept of all other wildlife or livestock mortalities (such as, road kill, bird collisions with transmission wires/fences, and any venomous snakes killed by workers).

In addition to the on-going ecology surveys (birds and reptiles), the Environmental Department shall record any casual sightings of wildlife within the Mine site and commission further specialist surveys as required, such as the annual checks for invasive species and a post closure monitoring programme.

10.6 Evaluation of Mitigated Impacts

10.6.1 Construction and Operation

Given the lack of any significant nature conservation effects as a result of Phase 1b and taking account of the proposed mitigation, Phase 1b can be undertaken in accordance with the requirements of IFC Performance Standard 6.

With mitigation implemented, the significance of the predicted impact on habitats, vegetation, fauna and flora is assessed as adverse to low/negligible and the impact is assessed as not significant over the medium term, acknowledging that it will take time for vegetation to re-establish following construction phase disturbances.

Residual ecology impacts during construction and operation are assessed to be adverse, medium term and of negligible to low significance.

10.6.2 Closure

During closure, passive rehabilitation of flora and fauna will be undertaken in order to restore the landscape.

Residual ecology impacts during and post closure are assessed to be neutral, long term and of low significance.

10.7 Summary

A summary of the potential impacts of the proposed Phase 1b following the implementation of mitigation measures with respect to ecology are presented in Table 10-1

Table 10-1: Summary of potential residual impacts[1] - Ecology

Location	Nature of Impacts	Mitigation Measure	Project Phase[2]	Nature[3]	Duration[3]	Significance[3]
Mine site and Borefield	Clearance of vegetation and loss of habitat	Pilot testing of tree/other plantings to compensate for losses of protected trees/pasture at construction phase. Passive restoration of vegetation at Mine closure, including additional plantings of trees.	C O D	Adverse	Medium term	Low
	Disturbance and displacement of wildlife.	Vehicle movements will be in accordance with mine guidelines and speed limits. No other mitigation required.	C O	Adverse	Short term	Low
	Wildlife mortality as a result of cyanide poisoning.	Monitoring to verify lack of harm to wildlife. Remediation measures implemented where harmful effects identified. Precautionary bird scaring.	C O	Adverse	Medium term	Low
	Invasive/alien species	Survey for presence and destroy/remove as appropriate	C O D	Adverse	Medium term	Low
	Habitat Rehabilitation	Pilot testing of tree/other plantings; and/or appoint a nursery to propagate, growth and plant trees; and/or provide compensation on a value basis of the trees.	D	Neutral	Long term	Low

[1]Following implementation of proposed Mitigation Measures

[2]Project Phase: C = Construction, O = Operation, D = Closure

[3] Duration and significance refer to the predicted impact after the implementation of proposed mitigation measures and is based on the ratings provided in Table 5-2.

11 Socio-Economic

11.1 Introduction

This Section presents the methodology and baseline conditions to assess and outline the potential socio-economic impacts resulting from Phase 1b. In addition mitigation measures which aim to avoid, reduce, remediate or compensate for potential impacts are proposed and the residual impacts (impacts after mitigation measures are implemented) assessed.

11.2 Methodology

This Section draws on primary data gathered from community surveys and stakeholder interviews as well as secondary data obtained through a review of published sources. The following stages were followed for this assessment:

- **Definition of the socio-economic footprint and area of influence of Phase 1b**: was undertaken using GIS mapping, site visits and discussions with stakeholders and knowledge gained during previous community consultation exercises for stakeholders in the vicinity the of the Mine site;
- **Preparation of a Public Consultation and Disclosure Plan (PCDP)**: which sets out the range of information and procedures to guide the community sensitisation, survey and stakeholder engagement activities that are being undertaken for Phase 1b and the Project;
- **Review of existing socio-economic data at national and regional level**: this provided demographic information such as population numbers, structure and growth rates. In addition, statistics on education, health, life expectancy, poverty and sources of income for the country as a whole were obtained. Sources reviewed included: World Bank reports, Millennium Development Goals (MDG) reporting, World Health Organisation data and the national Strategic Framework to Combat Poverty 2011-2015;
- **Primary data collection**. Quantitative and qualitative socio-economic data was obtained for the communities that are likely to be either directly or indirectly affected by Phase 1b of the Project. The assessment undertaken for Phase 1b will draw mostly on the qualitative survey. Primary data collection involved the following activities:
    - Qualitative social survey, undertaken through visits to communities living within 30 km of the Mine site, the borefield and the access road. Qualitative data was collected through semi-structured interviews with community members. The qualitative survey took place in April 2011. Further interviews with local authorities and other stakeholders were also carried out in May 2011; and
    - Quantitative social survey, consisting of an extensive questionnaire survey including families living within 30 km of the Mine site, along the road from the Mine site and at the junction of the access road with the Nouakchott-Nouâdhibou N2 highway and borefield in June 2011. Selected household and income generating activities premises operating along and near the Nouakchott-Nouâdhibou N2 highway to the north of the mine access road are also being surveyed.
    - A further quantitative survey, is currently being undertaken will provide data to inform subsequent phases of the Project. Both the qualitative and quantitative surveys were undertaken by local social consultants and statisticians respectively.
- **Social impact assessment (SIA)**: the baseline data and Phase 1b project components were analysed to determine likely impacts. The SIA considered the potential impacts of

Phase 1b on the local community within the area of influence and wider socio-economic benefits for the nation as a whole. Proposals for mitigation and enhancement measures to address the significant impacts identified were also developed.

- **The area of influence:** is defined as that in which communities could be directly affected by Phase 1b of the Project. The area of influence defined for this assessment includes:
  - The area within a 30 km radius around the Mine site. Twenty two (22) families live within this area. These families have been previously consulted for other mine activities (Boumouzouna, 2009);
  - Access road; one family resides at the telecommunications mast along the access road; and
  - Junction of the access road and Nouakchott – Nouâdhibou N2 highway. Four families live at the junction of the access road with the Nouakchott – Nouâdhibou N2 highway and the borefield (Sondage Salé) (see Figure 1-1).

Phase 1b will also have wider impacts particularly in terms of employment that will be felt at the regional and national level.

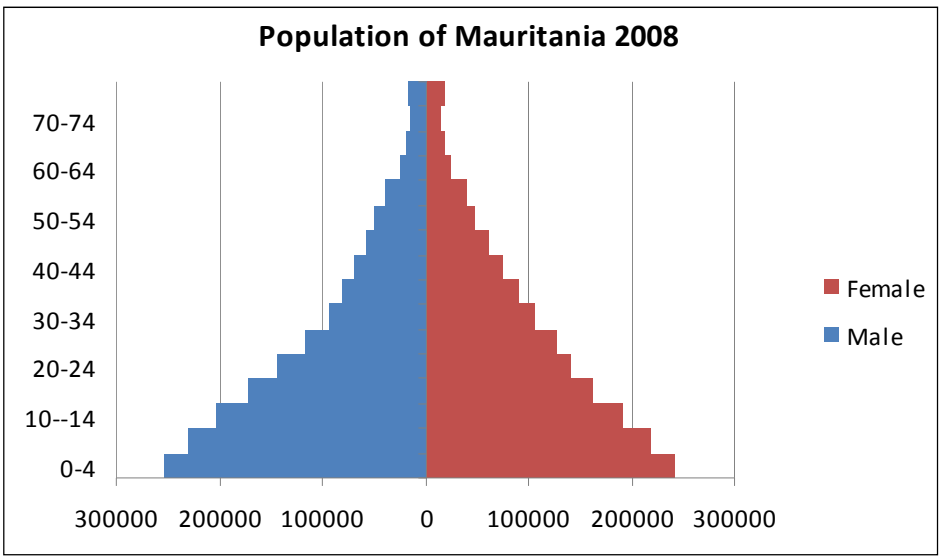
11.3 Baseline Conditions

11.3.1 National statistics and context

Mauritania's population is estimated at approximately 3.2 million (World Bank, 2009) and is mainly concentrated in the capital city of Nouakchott and along the Senegal River. According to the Mauritania National Statistics Office (NSO, 2008), the annual population growth rate is stable at 2.4%. Urban population growth is slightly higher than the rural at 3%. Rural population growth is expected to decline as migration to cities increases.

Mauritania's population pyramid for 2008 is typical of an 'expanding' population that is characterised by a high birth rate and a high mortality rate and low life expectancy. The pyramid also shows that a high proportion of the population is in working age (see Figure 11-1)

Figure 11-1: Mauritania's population pyramid



The nomadic nature of the Mauritanian people formerly accounted for the widespread distribution of the population across tribal villages and camps. However, severe droughts have led to a decline in the traditional way of life (World Bank 2009). Migration to the industrial and urbanised towns and capital has risen so that the urban population makes up 41% of the total population. From 2000 to 2008, Nouakchott's population increased by 52% (558,195 to 846,871 inhabitants) and Nouâdhibou's population increased by 50% (79,516 to 118,159 inhabitants) (Mauritania NSO, 2008).

Mauritania's gross domestic product (GDP) (as of 2008) is $3,030 billion with a Gross National Income (GNI) per capita of $2,100 (World Bank, 2009). According to Mauritania's official statistics, Mauritania's GNI index has steadily decreased throughout the eight years to 2008. Currently 20.8% of the urban population and 59% of the rural population are below the poverty line (NSO, 2008). The proportion of the total Mauritanian population below the poverty line has decreased from 57% in 1990 to 42% in 2008 (see Table 11-1).

The percentage of the local population that have access to drinking water increased from 37% in 1990 to 62% in 2008. In 2008, only 21% of the population had access to sanitation.

The Millennium Development Goals (MDG) used by the United Nations and leading development institutions to assess progress toward poverty reduction are a useful framework to characterize the socio-economic situation in Mauritania. Table 11-1 provides a summary of key Millennium Development Goals (MDGs) indicators for Mauritania.

Table 11-1: Relevant MDG indicators

Millennium Development Goal (MDG)	Past Performance		MDG Target
Between 1990 and 2015	**1990**	**2008**	**2015**
Goal 1. Eradicate extreme poverty and hunger			
Target 1.A Halve the % of people with income of < $1-a-day			
Proportion of population below the poverty line	56.6%	42%	28.3%
Target 1.B Achieve full and productive employment and decent work for all, including women and young people			
Total proportion of employment/ population	n/a	27%	100%
Unemployment rate	n/a	31.2%	0%
Target 1.C Halve, between 1990 and 2015, the proportion of people who suffer from hunger			
Proportion of children under 5 that are underweight	47%	39.4%	23.5%
Goal 2. Provide primary education for all			
Target 2.A. Ensure that all children complete primary school			
Primary school net enrolment	49%	71.6%	100%
Percentage of pupils finishing primary school	73.8%	49.3%	100%
Literacy rates (15-24)	45.8%	77.5%	100%
Goal 3. Promote gender equality and empower women			
Target 3.A. Eliminate gender disparity in primary and secondary education, preferably by 2005, and in all levels of education no later than 2015			
Ratio of girls/boys in primary school	0.72%	1.02%	1
Proportion of seats held by women in parliament	n/a	17.8%	-
Goal 4. Reduce child mortality			
Target 4.A. Reduce by 2/3 the under-five mortality rate			
Under-five mortality rate (per 1,000)	137.0	135.0	45.7
Infant mortality rate (per 1,000)	126.0	87.0	42.0

Goal 5. Improve maternal health			
Target 5.A. Reduce by 3/4 the maternal mortality ratio (per 100000 births)			
Maternal mortality ratio (for 100 000 births)	930	686	232
Target 5.B: Achieve universal access to reproductive health			
Proportion of married women (15-49) using a contraceptive method	5%	9%	100%
Goal 6. Combat HIV/AIDS, malaria and other diseases			
Target 6. Halt and begin to reverse HIV/AIDS			
HIV prevalence (%)	0.6%	0.6%	≤ 6%
Number of deaths among children (under 5) due to malaria	-	6%	≤ 0.6%
Goal 7. Ensure environmental sustainability			
Target 7.C. Halve, by 2015 the proportion of people without sustainable access to safe water and sanitation			
Population with access to drinking water	37%	62%	68.5%
Population with access to sanitation facilities	n/a	21.8%	≤ 0.5%

Mauritania's GDP is currently made up by agriculture (12.5 %), industries (46.7 %) and services (40.7 %). Industries are mainly natural resources based, including the mining of iron ore, gold and copper, fish processing and oil production. Mauritania's coastal waters are amongst the richest fishing grounds in the world and fish account for about 45% of exports. Approximately half of the Mauritanian population rely on agriculture and livestock as their main sources of livelihood, but the country is far from self-sufficient in food production and currently imports around 70% of its requirements.

The literacy rate is 57 % with an average of 4.4 % of the GDP being invested in the education system. The literacy rate among the 15 to 24s is higher with 78% and has risen from 45.8% since 1990 (see Table 11-1). Although the net primary school enrolment has increased from 49% in 1990 to 72% in 2008, the percentage of pupils finishing primary school has significantly decreased from 74% in 1990 to 49% in 2008 (see Table 11-1). The ratio of girls/boys in primary school is now roughly 1 to 1, an increase from 0.72 in 1990 (see Table 11-1).

Attendance to secondary and high education is very limited. Only around 21% of primary education students continue to secondary education. Higher education has an average enrolment of 2.7% (NSO, 2008). The Université de Nouakchott, the only university in the country, has an enrolment of roughly 10,000 students (A.C.A 2007).

For Mauritanian males, life expectancy at birth is 55, females have a slightly higher life expectancy of 60. The adult mortality rate is on the other hand significantly lower in comparison to the WHO African Region, with Mauritania's mortality rate (per 1,000) at 325 for males and 246 for females. Infant mortality rate has decreased to 87 per 1,000 in 2008 compared with 126 in 1990; however, it is still high compared with the 2015 MDG target of 46 per 1,000. Under-five mortality rate is also high (135 per 1,000 in 2008) and has not significantly decreased since 1990. Deaths among children under 5 due to malaria were 6% of the total in 2008. This is significantly higher than the MDG target of less than 0.6% of deaths by 2015. The proportion of children under 5 that are underweight has decreased from 47% in 1990 to 39% in 2008 (see Table 11-1).

The maternal mortality ratio is high (686 deaths per 100,000 live births in 2008) and although it has decreased from 930 in 1990, is still far from the target of 232 deaths per 100,000 by 2015.

There are limited medical health facilities and medical staff within Mauritania. The total expenditure on health as a percentage of the country's GDP is 4.2 %, and general government expenditure on health accounts for 76.8 % of the total expenditure on health (WHO 2006). Table 11-2 below shows numbers of health facilities and health professionals in Mauritania.

Table 11-2: Health facilities and health professionals

Health	2004	2005	2006	2007	2008
Number of Health Facilities	443	433	478	478	493
Health Posts	379	367	411	411	426
Health Centres	64	66	67	67	67
Geographical Accessibility to facilities (5km radius -%)	58.7	55.4	65	65	…
National Hospital Capacity (beds)	389	389	368	430	430
Medical Staff					
Number of Doctors	…	…	426	426	458
Number of Pharmacists	62	73	82	82	81
Number of Dentists	47	72	77	77	84

11.3.2 Local context and baseline

Information sources

The Mine has been in operation since 2007 and community relations activities have been on-going since that time. Information collected for previous EIAs (SNC Lavalin, 2004, Scott Wilson 2008a, b, c, d, 2009a, b and 2010a) as well as a specific community study undertaken by a local sociologist on the semi-nomadic community 30km around the mine site (Boumouzouna 2009) were used to define the area of influence to undertake baseline surveys. To prepare an up to date socio-economic baseline, data has been collected through community sensitisation exercises (which included qualitative surveys) and quantitative surveys. To obtain baseline information and to gain a knowledge of community issues, four community and stakeholder engagement exercises were conducted as part of Phase 1b and include the:

- **Community Sensitisation and Qualitative Surveys**: A community sensitisation exercise was undertaken within the Phase 1b area of influence (as defined above) in April 2011. The objectives were to raise local community awareness regarding the Project and Phase 1b in particular and to collect socio-economic information on the families residing in the area of influence. Stakeholders were invited to a public meeting where they could offer their commentary and suggestions on the environmental implications and SIA process for Phase 1b. Concerns raised during this preliminary exercise focused on issues related to water availability, employment opportunities and the improvement of the road to the Mine site. Information was also obtained on community composition, population numbers, livelihoods and general living conditions. A further qualitative survey was undertaken in June 2011 for the four families residing near Sondage Sale around the intersection of the mine access road and the Nouakchott – Nouâdhibou Highway. This survey focused on community water use, water access and borefield use.
- **Stakeholder consultation (10 May 2011 and 12 May 2011)**: Meetings with local authorities were scheduled in the two Wilayas, Inchiri and Dahklet-Nouâdhibou (the Mine is located in the former, while the borefield is in the latter) at Akjoujt on 10 May 2011 (separate meetings with the Wali and then with the Hakem and representatives of various local services), then at Nouâdhibou on 12 May 2011 (with the Administrative Wali and then the Economic

Development Wali). The objectives of these meetings were to inform the participants, issue formal invites and listen to any immediate feedback regarding Phase 1b of the Project and the public consultation process.

The feedback from the officials attending these meetings included the following points:

- Akjoujt**:**
    - Most of the area's population are not fully conversant with the French language, so the Phase 1b Non-technical summary should be translated into Arabic;
    - Organised site visits would be a good way to explain how the Mine works, the expansion program and its impacts, plus the planned mitigation actions.
    - Concern about in-migration and in particular any potential, non sustainable urban development close to the mine ('vision prospective') as was the case in the Guelb iron ore fields.
- Nouâdhibou**:**
    - Consideration of the company to fund a program to eliminate the old land minefields which kill or injure people and animals on an annual basis;
    - Following nine years of drought, the natural vegetation has suffered and participants felt that there is a need for 'reboisement' (reforestation) to replace lost vegetation.
    - Everyone is appreciative of existing efforts by the Mine to provide water for local communities, nomads and their animals, but this is mainly in the Inchiri Wilaya in which the mine is situated and should be extended into the Dakhlet-Nouâdhibou Wilaya.
    - The lack of health infrastructure such as mobile clinics, health centres or veterinary services is an issue for both people and livestock and some stakeholders asked that TMLSA increase its support for this.
- **Public consultation (15 May 2011)**: The public meeting was originally planned to be held at the Gare du Nord on 15 May 2011 but was cancelled by local administrative officers. The meeting was rescheduled for Wednesday 18 May 2011, at El Asma. Nevertheless, representatives of central government ministries, local administrations, NGOs and others did arrive at the Gare du Nord meeting and informal discussions were held in which stakeholders raised their various concerns regarding environmental and social issues. The feedback from this informal session was essentially the same as that reported at the re-scheduled public consultation meeting (see Section 20).
- **Public consultation (18 May 2011)**: The meeting held in El Asma on 18 May 2011 included various members of the local authorities, representatives of the local community and NGOs, alongside television and press personnel (128 people were in attendance). The meeting was chaired by the Inchiri Wali and the Hakem of the Moughataa of Akjoujt and allowed participants the opportunity to speak or record their views in a formal register (see Appendix 5). The main concerns and issues highlighted in the meeting related to water supply, re-vegetation and pasturage of the area due to prolonged period of drought, health and safety issues relating to the cyanide code and toxic substances, employment opportunities for locals and the effects of the expansion project on vulnerable groups. See Section 20 for further details of this meeting.

The key concerns from the local community and authorities have been presented in Table 20-1.

Baseline and local context

The Mine is based in the Inchiri Wilaya, a region covering 41,700 km^2 (SNC Lavalin, 2004). The region has a very low population density, with approximately 20,000 inhabitants (approximately 0.3% of the total population of Mauritania) (ONS, 2009). The Wilaya is made up of the administrative capital, Akjoujt Moughataa and two main communities, Akjoujt and Bennichab which also provide the nearest industries to the Mine. Bennichab has 8,400 inhabitants and contains areas of very high poverty and illiteracy. The majority of the Inchiri's population live in the Wilaya's administrative capital Akjoujt. Although Inchiri has the lowest population of all the regions in the country, some families have moved to the area in search of employment particularly the community setting up on the intersection of the mine access road and the Nouakchott-Nouâdhibou N2 highway.

The Mine itself is located 110 km north east from the nearest permanent community (louik, which is located outside Inchiri in the PNBA). The area of influence around the Mine site has the following characteristics:

- It has traditionally been a pastoral area and an area of transhumance to the neighbouring areas of Azeffal, Tigirit and Agchar;
- It is an area of high poverty;
- The population density is below the national average of 2 per km^2; and
- The environment is desertic and suffers from droughts, which partly account for this low density.

The qualitative survey identified that 22 families live within a 30 km radius of the Mine site (the area of influence). The majority of these families are located in two areas: El Mejhoulat and Imkebden. Figure 11-2 illustrates the locations of families within the area of influence of Phase 1b.

The total number of people in the 22 families is 83, of which 16 are children, 46 women and 10 are elderly (over 66). In addition, five of the families have disabled members. The age and gender distribution of the families has been provided below in Table 11-3.

Table 11-3: Age and gender distribution of families living in the proximity of the Mine site

Adults	Age					Total
	16 -30 years	31–40 years	41-55 years	56 -65 years	66-75+ years	
Men	5	4	3	4	5	21
Women	6	24	2	9	5	46
Children	**0-11 months**	**12 months- 5 years**	**6-10 years**	**11-15 years**		**Total**
Children	1	8	6	1		16

Typical employment among the families includes labourers, drivers, shop keepers and pastoralists. The families shepherd approximately 50 camels and 200 goats and sheep graze in the pastures that are located towards the north west and the south west of the Mine site. The herd belongs to families that live in the town and cities The majority of the families are poor and the animals provide a vital resource. The herds have been affected by a lack of water, diseases and the loss of plant coverage of the soil. There are also several established transhumant routes from south to north that are used by nomadic herds but generally these are located around 80 km from the Mine site.

The families use water stored in two 'water bladders' installed, by the Mine, two years ago in El Mejhoulat and Imkebden. These watering points for drinking water and livestock are refilled by TMLSA once a month with 300 m^3. The Mine also provides one vehicle for the use of these families.

At the junction of the access road and the Nouakchott-Nouâdhibou N2 highway, four families (19 people) reside. According to the qualitative survey undertaken in June 2011, the families moved to this area in search of employment when the mining operations commenced and the access road was constructed. The passing trade from both general and Mine-related traffic has allowed these families to establish a small inn with a restaurant and shop that constitute another source of income. These four families obtain their water from a well in Ouad Echibke (roughly 27 km north west) on the road to Nouâdhibou at wadi Chebka, or from a borehole at Bouamatou at KP 234 located on the route between Nouakchott and Nouâdhibou approximately 40 km to the south at R'Gueittat. The locations of the boreholes are shown on Figure 6-9. On average each household extracts 36 tonnes of water per month. Average water consumption per household is between 2-3 tonnes per month (70-100 litres/day) with the remainder being consumed by their livestock.

A further family lives at the location of the Mauritel communications mast along the access road.

There are currently no schools or government health facilities in the area. The local community have access to health services provided at the Mine site.

Note that no "indigenous people", as defined in either national legislation or IFC Performance Standards, have been identified the area of influence of this phase of the Project.

11.3.3 Existing and Future Workforce

The Mine's current workforce is approximately 900-1,000. Locals employed by TMLSA are from all around Mauritania, including about one-third from Nouakchott, and about 13% from each of Brakna and Trarza. Table 11-4 below provides a percentage breakdown of the Mauritanian employees working at the Mine by Wilaya of origin.

Table 11-4: Breakdown of Mauritanian workforce at the Mine by Wilaya

Wilaya	March 2011
Adrar	6%
Assaba	7%
Brakna	12%
Gorgol	8%
Guidimagha	4%
Hodh chargui	3%
Hodh gharbi	2%
Inchiri	4%
Nouâdhibou	9%
Nouakchott	27%
Tagant	4%
Tiris zemour	4%
Trarza	12%
Total	100%

Additional workers will be needed for the construction of the Project and approximately 6,000 are expected to be employed for Phase 1b. Several Phase 1b construction workers will

transition into Phase 2 and 3 construction activities. Furthermore, additional construction workers may be required for Phase 2 and 3 of the Project; this will be evaluated in subsequent EIAs.

Employment opportunities are advertised and appointed via the TMLSA's office in Nouakchott. Currently TMLSA representatives do not undertake recruitment drives via visits or employment/career road shows the area of influence.

11.3.4 Security

With regards to security issues, a gendarmerie detachment is permanently based at the Mine and TMLSA employs its own security managers to coordinate operations of security service providers. All security operational activities under the direct responsibility of TMLSA have clear and concise operating procedures that clearly indicate the extent of staff duties and responsibilities. The gendarmerie restricts access to the site by checking on official mine access documents. TMLSA also supports the Voluntary Principles on Security and Human Rights (VPSHR) which provide a series of actions that companies can take to implement security measures that respect human rights.

11.3.5 TMLSA's Existing Social Initiatives

TMLSA's currently provides social support to benefit both local and regional communities include (Scott Wilson 2008c):

- Provide potable water to nomadic families located within a 20 km radius of the Mine site;
- Allow local people to access the facilities of the Mine clinic and provide medical facilities for local nomadic children as arranged;
- Meet with local nomadic people on a regular basis as part of the community relations strategy; and
- Establish a community health program for local nomadic people within 20 km of the Mine.

TMLSA/Kinross have committed $10m over 3 years to support creation of a mining engineering school, and $2.5m to construct an emergency ward at the hospital in Nouakchott. The community development strategy will continuously be updated based on public consultation and socio-economic analysis, as described in Section 20.5.

11.4 Potential Impacts

The majority of Phase 1b Project components are located on-site, in areas which are already used for mine-related activities. The proposed airstrip and its associated facilities and the expansion of the borefield are the only activities that will result on an increase in the Mine's footprint. Potential social impacts of Phase 1b are defined as indirect effects on the community residing within the Projects area of influence (as defined above) and the mine's workforce. Indirect impacts are defined as those that will occur outside the project's area of influence.

The local communities also raised a series of concerns and aspiration during the sensitisation and consultation exercises, which focussed on issues wider than Phase 1b of the Project. These requests will be evaluated and addressed through consultative processes as described in Section 20.5, and are not considered mitigation actions for the purposes of this study.

11.4.1 Construction

Direct Impacts

Community

Given the scale of Phase 1b and that most of the development is within the mine footprint area, the impacts on the communities that reside in the area of influence of Phase 1b is considered to be low to negligible.

The key potential positive impact of the construction stage will be the creation of employment. Given the poverty levels of the families living in the proximity to the Mine site and in the wider region, one of the main concerns of both local authorities and residents is to ensure that they benefit from employment opportunities and other economic activities that result from the Project. Local authorities and communities were concerned about employment opportunities for local people, young persons, women, and those will low skills.

The construction activities related to Phase 1b may result in some employment generation for the local communities, both within Phase 1b's area of influence and regionally, in line with TMLSA policies for the Mauritanisation of the workforce. A total of approximately 6,000 jobs will be created for construction of Phase 1b. In addition, there may be an increase in income generated indirectly, for instance, additional small roadside shops or services along the Nouakchott-Nouâdhibou N2 highway.

It is not expected that construction activities within the Mine site will result in significant impacts (such as noise, vibration, dust or exposure to toxic substances) on the community as these activities will take place within the Mine site which is currently fenced off. In addition, no impacts from interaction with workers are expected as they will be accommodated on the Mine site and therefore interaction will not occur.

The loss of access to land associated with the proposed airstrip, and its perimeter fence, represents less 1% of the surrounding (30 km radius) area, Given the local and national trends of desertification and the low productivity of the land, the impact to grazing access is considered to be low to negligible.

Construction activities will result in an increase in traffic along the Nouakchott-Nouâdhibou N2 highway and along the Mine access road due to the need to transport construction workers, equipment and materials to the Mine site. An increase in traffic may result in a higher risk of accidents involving people and livestock. The full assessment of traffic impacts has been undertaken within Section 14.

As discussed in Section 6, the closest boreholes for potable and domestic use are located at around 27 km from the borefield to the north (Ouad Echibke) and 40 km to the south (Bouamatou). During construction there will be no impacts upon these users.

Given the socio-economic conditions in the project's area of influence, there is a possibility of an influx of people coming to the area seeking employment. This could lead to some disruption for the families that are currently living in the area. Any new residents would be competing with local families for the already scarce water resources, services and pastoral land. Lack of water and the loss of grazing land through desertification are key concerns of the local community and authorities (see Table 20-1 in Section 20). Measures to discourage the influx of people will continue into Phase 1 b.

Workforce

The construction works will require additional labour that should receive fair, respectful treatment and will need a reasonable standard of transport, accommodation and provisioning (food, water, personal safety equipment, etc.) to ensure their welfare whilst at the Mine site in line with the company's existing policies.

Construction activities are often associated with increased risks due to the range of potentially hazardous operations being undertaken. These can include accidents during excavations, earthworks, blasting, working at height, etc as well as health effects from routine exposure to noise, dusts and chemicals etc. These potential impacts will be minimised through existing Health and Safety policies in operation within the mine.

Indirect Impacts

The construction activities will generate approximately 6,000 new jobs and it is projected that approximately 40 - 50 % will go to Mauritanians. The construction phase will therefore have positive impacts at the regional and national level. Construction jobs by nature are temporary hence positive impacts will be short term as the jobs will be lost once the construction has been completed. Skills imparted to construction workers during the construction phase – particularly to the semi-skilled and non-skilled – will have permanent benefits.

11.4.2 Operation

Direct Impacts

Community

The main community impacts resulting from operation of Phase 1b will largely be similar to impact for the existing operation.

Phase 1b will not result in significant changes to mine operations, and a limited number of jobs may be created in operations. In line with TMLSA policies for the Mauritanisation of the workforce, employment opportunities would be available for the local communities in the area of influence as well as nationally. As discussed above, the loss of land associated with the proposed airstrip, and its perimeter fence, is anticipated to have a low to negligible impact upon the local community considering the relatively small area associated with the proposed airstrip and surrounding habitat conditions.

It is not anticipated that operation activities within the Mine site will result in significant impacts (such as noise, vibration, dust or exposure to toxic substances) on the community as these activities will take place within the Mine site. In addition, no impacts from interaction with workers are expected as they will be accommodated on the Mine site and therefore interaction will not occur.

During operation there will be an increase in traffic associated with the larger workforce and increase in materials and supplies needed to operate and maintain Phase 1b Project components. This increase in traffic will result in a higher risk of accidents along the access road and at the junction of the Nouakchott – Nouâdhibou N2 highway. The full assessment of traffic impacts has been undertaken within Section 14.

During operations, families may move to the area to be nearer their relatives working at the Mine site. In addition, people seeking employment may also move to the area. These additional inhabitants may cause disruption to the families that currently live in the area and may also cause competition for their scarce resources (i.e. water and grazing land). Lack of water and the loss of grazing land through desertification are key concerns of the local

community and authorities (see Table 20-1 in Section 20). However, the influx of people to the area has to date been discouraged by the Mine's security and the gendarmerie that is located on site. Measures to discourage the influx of people will continue into Phase 1 b.

During operation, it is proposed that 30,000m3/day of water be abstracted from the borefield. Groundwater modelling has been undertaken to determine the impact of this level of abstraction on the borefield brackish aquifer and surrounding fresh water aquifers and their users. Results indicated that the nearest fresh water aquifer users at Ouad Echibke and Bouamatou are located beyond the predicted cone of depression of the borefield so the impact magnitude is negligible to low. More detail is provided within Section 6.

Workforce

As Phase 1b, and subsequent Phases, construction nears completion, the construction workforce (temporary) will be downsized, although some additional job opportunities will accrue from Project operations. However, workers experiencing layoff will have gained skills that will improve their ability for re-employment.

Workers should receive fair, respectful treatment and will need a reasonable standard of transport, accommodation and provisioning (food, water, personal safety equipment, etc.) to ensure their welfare whilst at the Mine site in line with current company policies.

Operational phase health and safety issues will be mitigated and monitored also in line with current health and safety policies.

Indirect Impacts

The operation of the expanded mine will also generate employment at the regional and national level. This could include an increase in income generated indirectly, for instance, additional small roadside shops or services along the Nouakchott-Nouâdhibou N2 highway. Other indirect impacts to the economy include increased demand for consumer goods and services, generated by the workforce.

11.4.3 Closure

Direct Impacts

Community

Following closure of the Mine, facilities such as the TSFs, waste rock dumps and waste management facility will be rehabilitated and closed as per the Mines detailed rehabilitation and closure plan (see Section Table 20-1) to ensure they do not pose as a danger to local communities. The perimeter fence will be removed, re-opening the area to any nomadic migration corridors. Where practical, the land will be rehabilitated through passive revegetation providing pastoral grazing lands for local communities and their livestock.

Services and facilities provided by TMLSA to the local community will cease following closure, which may impact the communities if their self-capacity to secure community services and facilities is not enhanced during the operations period.

Workforce

The closure of the Mine, and hence Phase 1b, will mean the loss of a source of employment and income for workers (including local persons employed at the Mine). However, those workers that have been employed will have gained skills which can be redeployed elsewhere.

Some employees may be retained during and after the closure period for rehabilitation works and monitoring; however, it is anticipated that most of the workforce will be made redundant when the Mine closes.

11.5 Mitigation and Monitoring Measures

11.5.1 Construction and Operation

Mitigation, enhancement and monitoring measures for socio-economic impacts are similar for both construction and operation of Phase 1b Project components, and are therefore discussed together.

Community

TMLSA is committed to fully comply with the laws and requirements of the Islamic Republic of Mauritania in order to secure its license for on-going operations and to obtain broad community support for its expansion program.

To ensure the Mine is engaged with its stakeholders, the Mine shall expand its Community Relations Department and a Public Consultation and Disclosure Plan (PCDP) is being implemented at the time of writing this report. The PCDP requires that TMLSA conducts consultation with central and local authorities, affected communities, non-governmental organisations (NGOs), and other interested parties about environmental and socio-economic aspects of the Project, and consider the stakeholders' views. Consultation shall commence as early as practicable with information being made available in advance in a format and language that stakeholders can understand and continue as necessary throughout the operational lifetime of the Mine and for a post closure period yet to be defined.

A public Grievance Mechanism shall be maintained and will provide a transparent, responsive and efficient system for TMLSA to receive, respond to and seek resolution of stakeholder concerns in a systematic manner. This process aims to facilitate the resolution of verbal or written disputes and grievances as well as promote trust and build a positive rapport between the Mine and relevant stakeholders.

TMLSA is further committed to working with regional and local authorities and community TMLSA is further committed to working with regional and local authorities and community representatives on local recruitment and potential economic stimuli throughout the life of the Mine.

Specific mitigation measures identified for Phase 1b include:

- Continuation of the existing community support agreements as established in previous project impact assessments
- Employment policies and opportunities should be advertised both in nearby settlements and in the larger towns/cities (e.g. through road shows) to avoid an influx of persons to the Mine site;
- Hiring of casual and/or skilled labour at the Mine site itself should be minimised in order to discourage an influx of persons to the area seeking employment;
- All the drivers employed transporting equipment, materials and workers should receive suitable training to avoid an increase in accidents;
- Road signs should be placed along the Nouakchott – Nouâdhibou N2 highway, along the access road and within the Mine site warning of the increase in traffic;

- Transport for workers from major centres to/from the Mine site should be provided;
- Community awareness and sensitisation should be undertaken with regards to the increase in traffic, particularly in regard to any specific periods when abnormal or dangerous loads or large convoys are likely to be passing through the area;
- Influx of people to the mine site should continue to be discouraged; and
- Abstraction from the borefield will be monitored to assess any potential impacts on fresh water aquifers.

Enhancement measures to be undertaken in parallel to Phase 1b, but outside the scope of the ESIA will be developed as described in Section 20.5.

Workforce

TMLSA shall engage reputable contractors to undertake all construction works and to operate certain facilities post construction. The Mine shall only engage contractors that can demonstrate compliance with the Mauritanian Labour Code and satisfy the requirements of the IFC Performance Standard 2 on Labour, including work permits for non-national workers where required.

The Mine also shall specify that all contractors and sub-contractors have documented human resources policies and practices to ensure that there shall be strictly no engagement or other support for any forms of child or forced or bonded labor or human trafficking as defined in Mauritanian legislation and relevant international standards. In addition, young persons (defined as anyone less than 18 years old) must not be employed for any hazardous or 'excessive' physical work.

TMLSA shall additionally require that all contractors and sub-contractors have documented human resource policies and practices that treat people with fairness, respect and decency and address the following TMLSA requirements:

- An equal opportunities policy must be in place and be monitored;
- All employees are to be treated with respect and no forms of discrimination, harassment or abuse are to be tolerated;
- There are to be clear employment terms and conditions for all staff;
- Employees must know how and when their remuneration determined. Pay shall match or exceed national minimum wage levels and take account of the location of the mine and prevailing working conditions. Where applicable, overtime shall be voluntary and paid at an agreed rate;
- An employee consultation process is to be in operation in regards to matters of mutual concern such as workplace health and safety, accommodation/food standards, etc.;
- There must be no barriers to legitimate freedom of association through trade union membership and/or collective bargaining;
- Employees are to have appropriate vocational and environmental/health and safety training for their work;
- Workers are to be issued with identification badges;
- There must be a clear disciplinary procedure and an effective employee grievance procedure to respond to their valid concerns and any accusations of workplace discrimination, harassment or bullying; and

- The terms for leaving the employing organisation are to be explicit (i.e. voluntary cessation of work, retirement, or as a consequence of justified disciplinary action).

TMLSA shall require the assistance and cooperation of all Tasiast contractors and subcontractors in monitoring human resource performance, through the routine provision of data (such as workers' social security numbers) and information and facilitating any workplace inspections or compliance audits.

In regards to accommodation, the proposed construction camps shall consist of secure living facilities with housing, mess, recreational and sanitary facilities for all employees in accordance with applicable laws and international guidelines such as the IFC/EBRD Guidelines of worker accommodation.

Consequently, TMLSA and its contractors shall be responsible for the preparation and implementation of Occupational Health and Safety Management Plans in regard to the various risks and hazards associated with the construction activities of the mine's expansion program. They shall appoint such professional occupational health and safety personnel as required to implement safety management commitments and shall train personnel and others in safe working methods, including the use of personal protective equipment and emergency procedures.

The Mine shall continue to implement the Occupational Health and Safety Management Plan in regard to the various risks and hazards associated with its operational activities.

In order to comply with the IFC requirements, TMLSA shall also define a Retrenchment Plan for the Mine which will include provisions for managing any temporary lay-offs caused by 'unforeseen circumstances'. It is intended that this will be prepared during Phase 2 of the expansion program, when the composition of the full workforce will be determined.

11.5.2 Closure

Mitigation measures identified community and workers for this phase include:

- Provision of training to ensure that workers are able to find work after closure;
- Long term community plan to ensure the sustainability of the local communities following the closure of the Mine and the potential loss of water supply and other services; and
- Site rehabilitation and removal of any barriers/fencing (where safe to do so) that prevents access to useful pastureland (passive revegetation shall be undertaken to restore land use).

11.6 Evaluation of Mitigated Impacts

11.6.1 Construction

The local communities in proximity to the Mine site and the borefield should benefit from the numbers of jobs created during the construction stage. This benefit will be significant, assuming local residents supported in accessing jobs and suitable training is provided once employed.

To date the Mine has effectively discouraged the influx of workers, this is partly as a result of the Mine's remote location. Potential to control the influx of persons to the area is not wholly in the control of the Mine. However, given the policy to recruit employees in established population centres and to not use day labour hired at the mine itself, along with careful control over provision of water and other basic services, the residual impacts are considered to be medium term and of low significance.

The loss of pastoral land and access routes will be low to negligible, particularly in the context of grazing land available away from the fenced airstrip and mine site.

Effective implementation of measures to manage traffic risks will reduce the mitigated impact to short term, low significance (See Section 14).

Effective preparation and implementation of suitable Occupational Health and Safety Management Plans in regard to the various risks and hazards associated with the construction activities will reduce the mitigated impact to short term, low significance.

11.6.2 Operation

As Phase 1b construction nears completion, the construction workforce (which by nature will be temporary) will be downsized, although some additional job opportunities will accrue from Project operations. However, workers experiencing layoff will have gained skills that will improve their ability for re-employment. Therefore the loss of employment will be a short to medium term impact of moderate significance.

As for the Construction phase, the loss of pastoral land and access routes will be low/ negligible. As for the Construction phase, effective implementation of measures to control traffic will reduce the mitigated impact to short term, low significance (See Section 14).

If current approach to discouraging people from settling in the proximity of the mine site continue, the mitigated impact of the influx of people to the mine site would be reduced to medium term and low significance.

Development of suitable Occupational Health and Safety Management Plans in regard to the various risks and hazards associated with the operation of Phase 1b Project components will reduce the mitigated impact to short term, low significance.

11.6.3 Closure

As Phase 1b Project components are preparatory works to support the Project, the specific effects of closure are limited. The loss of the employment and benefits (e.g. water, health) related to the Mine will be significant for the local community, albeit mitigated to some extent by the training and skills that workers will have gained, which will increase their potential for further employment elsewhere. As such, there is a potential that following closure, the local community will migrate away from the area in search of employment.

The closure of the Mine and removal of the fence may result in some additional pastoral land being released and migration routes being reopened.

Residual beneficial socio-economic impacts post closure are assessed to be long term and of moderate significance.

Residual adverse socio-economic impacts post closure are assessed to be long term and of high significance.

11.7 Summary

A summary of the potential impacts of the proposed Phase 1b following the implementation of mitigation measures with respect to socio-economic are presented in Table 11-5.

Table 11-5: Summary of potential residual impacts[1] - Socio-Economics

Location	Nature of Impacts	Mitigation Measure	Project Phase[2]	Nature[3]	Duration[3]	Significance[3]
Mine site and Borefield	Increased employment	Adequate protection of worker rights and welfare (i.e. camp standards,); provision of training; ensuring that local employment is a priority.	C, O	Beneficial	Medium term	Moderate
	Exposure to health and safety risks at work	Implementation of OHS management plan to ensure employee health, safety	C, O	Adverse	Medium term	Low
	Increased risk in traffic accidents	Raise community awareness in traffic safety; mandatory environmental and safety training for all drivers	C, O	Adverse	Medium term	Low
	Influx of people to the area looking for work	Avoid hiring casual labour; Avoid hiring at the site; Advertise employment policies	C	Adverse	Medium term	Low
	Loss of pastoral land (and increased travel time to alternative)	No mitigation required	C, O	Adverse	Medium term	Low
	Temporary loss of employment	Retrenchment Plan	C, O	Adverse	Short – medium terms	Moderate
	Loss of employment (on closure)	Training of mine workers; Long term community development plan	O, D	Adverse	Medium term	Moderate
	Return of land to pasture and re-opening of migration corridors	n/a	D	Beneficial	Long term	Moderate

[1]Following implementation of proposed Mitigation Measures

[2]Project Phase: C = Construction, O = Operation, D = Closure

[3] Duration and significance refer to the predicted impact after the implementation of proposed mitigation measures and is based on the ratings provided in Table 5-2.

12 Archaeology and Cultural Heritage

12.1 Introduction

This Section presents the methodology and baseline conditions used to assess the potential impacts on archaeology and cultural heritage resulting from Phase 1b. In addition mitigation measures which avoid, reduce, remediate or compensate potential impacts are proposed and the residual impacts (impacts after mitigation measures implemented) assessed.

12.2 Methodology

As referred to in Section 2, this assessment takes into consideration national legislation, international guidance and Kinross standards.

A number of archaeological studies have already been undertaken for the Mine. These began with a brief, high-level field survey of the El Ghaïcha area, which identified over 180 sites in an area of *c*.600km² around the Mine site and associated infrastructure (Vernet & Naffé, Nouakchott University, January 2004). This overview formed the cultural heritage baseline for the SNC Lavalin, 2004 EIA and subsequent EIAs. A more detailed field survey of the West Branch site was carried out in order to inform the mitigation programme (Kaber, BEE/IMRS, January 2011).

The Mine has been subject to a non-intrusive baseline archaeological desk and field survey to establish an inventory of sites (Kaber, BEE/IMRS, March 2011).The results of this baseline survey were reviewed in the field in May 2011. This baseline archaeological desk and field survey was undertaken in two stages:

- A desk study reviewing available documents held by the Ministry of Culture (including the Register of Cultural Property), museums and publications, including the results of archaeological studies associated with commercial geological/prospecting projects; and
- An archaeological field survey of the Project area.

The survey was undertaken by an experienced Mauritanian archaeologist, on behalf of URS Scott Wilson. Results were reviewed in the field by a national archaeologist accompanied by a qualified and experienced international archaeologist. Reconnaissance was undertaken in a 4x4 vehicle, and sites were identified based on visual identification from a moving vehicle at ground level. Following initial identification, sites were visited on foot, a GPS point or polygon was recorded, and digital photographs were taken. Sites were subsequently plotted on a map of the proposed development.

Cartographic sources reviewed during the May 2011 site visit comprise the Institut Géographique Nationale 1957 Topographic Maps of Northwest Africa series, the US Army Map Service, Corps of Engineers 1963 maps (Scale 1:250 000) and the République Islamique de Mauritanie, Carte de l'Afrique de l'Ouest, 1970s (Scale 1:200 000).

Orthorectified satellite imagery (~0.5m resolution) was obtained from DigitalGlobe (Quickbird/WorldView) and Geoeye-1. This data was reviewed but did not prove useful in the detection, prediction or verification of archaeological sites, which proved difficult to distinguish from natural geological features and vegetation. The assessment of significance of cultural heritage sites and potential impacts, mitigation measures proposed and criteria for evaluating mitigated impacts follow international best practice and national legislation. They have been developed with reference to IFC Performance Standard 8 (IFC, 2006) and accompanying guidance (IFC, 2007), World Bank guidance on cultural heritage in environmental assessment (World Bank, 1994), as well as Kinross Standards (Kinross Corporate Responsibility

Management System 2004, Section 10.13 - Land Use) and the project-specific Environmental Design Criteria (Hatch, 2011).

12.3 Archaeological Background

The assessment aimed to establish an inventory of archaeological and cultural heritage assets within the Mine site and its immediate environs, including the proposed airstrip, and borefield.

12.3.1 Palaeoclimatic background

Human activity in the Tasiast region is closely linked to the underlying geology and ancient topography. The solid geology of the area comprises bands of laterite, with two ferruginous horizons. During the Quaternary period, the area was a sedimentary basin; there were four marine transgressions, which deposited shells and marine debris, and were followed by the dune formation or expansion during arid periods. Ogolian old red dune formations, which are often the focus of Neolithic occupation, date to the arid late Quaternary regression (*c*. 20,000 to *c*. 10,000 years BP).

The early Holocene Tchadian climate was humid, and the remains of large tropical animals, including 'Ethiopian' fauna, have been identified in northern Mauritania. Epipaleolithic populations subsisted by hunting and fishing, particularly in the vicinity of watercourses and freshwater palaeolakes during this phase (*c*. 11,000 to 9000 BP), although no lakes were located near the study area. Game included Sahelian fauna, such as antelopes and bovids. In the humid early Neolithic period, cattle and livestock breeding began to be adopted; Saharo-sahelian fauna, such as antelopes, gazelles and ostriches were hunted with bows, and freshwater lakes and marshes were exploited. Agriculture probably developed from about 3000 BP.

In the later Neolithic/protohistoric transition, the climate became increasingly arid, resulting in the migration of wild fauna to the south as river courses dried up, vegetation changed and dune systems expanded. Horses, and latterly, camels were introduced. This period is associated with considerable demographic and climatic stress. It was previously thought that during dry periods, populations retreated entirely from arid areas; however, there is increasing evidence that some form of occupation has persisted through dry phases, albeit in a more dispersed form.

A summary of the archaeology of the region is set out in Table 12-1.

Table 12-1: Archaeological/historical periods in Mauritania

Name		Sub Name	Period/Dates	Climate	Key sites
Pleistocene	Palaeolithic	Peuble Culture	*c*. 700,000 – *c*. 530,000 BP	Humid - Tafaritian Transgression	Adrar & Tiris
		Acheulean (*H. habilis)*	*c*. 350,000 – *c*. 70,000 BP	Humid - Aioujian Transgression	Adrar
		Aterien	*c*. 29,000 – *c*. 18,000 BP	Hyper-arid – Trarzian; Inchirian wet period; Ogolian	Adrar, Tiris, Western Mauritania including regs of Tasiast & Tirersioum
	Epipalaeolithic	Upper Palaeolithic	*c*. 11,000 – *c*. 9,000 BP	Tropical - Tchadian	Tiris
Neolithic		Early	*c*. 8,500 – *c*. 7,000 BP	Humid - Neolithic Subpluvial	North of Banc D'Arguin, Berouga (Tirersioum); Tasiast (Houeoutt, Mejhoula)
		Middle	*c*. 6,000 – *c*. 5,000 BP	Nouakchottian; increasingly arid	South of Banc D'Arguin; Inchiri; Amatlich (Khatt

Name	Sub Name	Period/Dates	Climate	Key sites
	Later	*c*. 4,200 – *c*. 2,800 BP	Arid Tafolien	Lemaiteg)
	Final/Transitional Chalcolithic/Copper Age	*c*. 3,000 – *c*. 2,000 BP	Semi-arid Tafolien	
Protohistoric	Non-literate culture cited in the writings of other cultures	*c*.2,000 BP – *c*.1000AD	Arid	Chalcolithic Inchiri; funerary monuments of western Mauritania, including Tasiast
Historic	Empire of Ghana	4th century AD	Arid	
	Almoravides	11th century AD		
	Hassan Emirates	16th century AD	Hyperarid	
	Colonial period	1900 - 1960		
	Independence	1960 to date		

12.3.2 Palaeolithic Period (c. 700,000 to 18,000 BP)

The 2004 study identified Palaeolithic occupation in the wider area, based on the identification of a number of quartz tools (*c*. 150,000 to 20,000 BP). The study suggested that these might be relatively late, possibly dating to the Aterian period (*c*. 29,000 to 18,000 BP). However, the present field study indicated that these artefacts probably date to the Neolithic period, based on the formation date of ogolian dunes and their stratigraphy. No Aterian period material has been identified within the Mine site.

12.3.3 Neolithic Period (c. 8,500 to 2,000 BP)

Neolithic sites in western Mauritania include coastal shell middens, rock art and occupation sites, located on the summits and slopes of ogolian dunes.

In the early Neolithic (c.8,500 to 7,000 BP), nomadic populations lived by hunting, fishing and gathering along the humid coastline and lush inland valleys. Remains include stone tools (projectile points, microliths, awls, scrapers, polished axes and waste flakes), stone querns, mortars and pestles for grinding or crushing foodstuffs, pottery bowls with stamped decoration or incised cross-hatching, and animal bones from kill, butchery and cooking sites. There are a number of early Neolithic sites in the Tasiast area, particularly in the Ben Amira region on its north eastern edge, and along the course of the former Khatt Atoui wadi which crosses the Tasiast plain from north east to south west (such as, Houeouats dunes and N'talfa oglat; Mejhoula dunes). Rock art depicts tropical animals such as giraffes, as well as people and horses. Human burials of this period are often heavily weathered, eroded and exposed out of ogolian dunes by wind. Burials are usually either supine extended or crouched, and may be lined with natural rocks. Grave goods, such as pottery or flint tools, may once have been present, but are rarely detectable due to the effects of wind erosion and redeposition.

During the middle to later Neolithic (*c*. 5,500 to 3,000 BP), the climate became increasingly arid, particularly after *c*. 4,000 BP, and populations began to migrate south, away from the expanding desert. In western Mauritania, a number of coastal sites have been investigated (Tintan to Cap Timiris, including Banc D'Arguin), as well as inland sites (Tijirit and Inchiri, particularly Amatlich the slopes of the Akchar and Agneitir dunes). Middle Neolithic tombs are more complex, and sometimes have layers of covering slabs; at inland sites, crouched burials are often accompanied by grave goods, such as necklaces of ostrich eggshell and West African bloody cockle shells (*Anadara senilis*), pebbles placed in the mouth and pottery vessels.

The later Neolithic is less well understood. Activity was concentrated in less dry areas, south of Nouakchott, towards the Senegal River (such as, western extent of Inchiri, and the Drhaïna, Aguilal Faye and Aftout Essahili massifs, and in the vicinity of Nouakchott). The period is characterised by the development of copper technology (Chalcolithic period), the expansion of agriculture and pastoralism, and the continuation of hunting and fishing, albeit on a smaller scale. Querns and polished stone tools are common, while arrowheads are relatively rare. Pottery has increasingly complex decoration and comes in a wide range of vessel forms. Little remains of settlements, which may have comprised seasonally occupied structures with roofs made of perishable materials that were easy to dismantle.

12.3.4 Protohistoric period (c. 2,000BP to 1,000AD)

As the climate grew more arid, sedentary occupation was largely replaced by a nomadic culture, constantly moving in search of pasture and surface water. It is unlikely that protohistoric populations continued to occupy the sites of late Neolithic open-air settlements on the tops and slopes of ogolian dunes. It is difficult to distinguish between the late Neolithic and the protohistoric period. Many of the tombs in Western Mauritania date to this long transitional period, which comprises the late Neolithic, the Chalcolithic, and the Protohistoric periods.

Tombs usually take the form of domed mounds of local stone; less common forms are 'antenna' tombs, or burials surrounded by a polygonal arrangement of vertical slabs/orthostats. Tombs are mostly located in more rocky areas and on prominent hill ridges, though some are situated on the ogolian dunes used as occupation sites in the preceding Neolithic period.

12.3.5 Historical period (c. 4th century AD to present)

The nomadic population has left little trace in the archaeological record. The 2004 study (SNC Lavalin, 2004) did identify an isolated metalworking site and several Muslim graves in the wider area. Approximately 30 miles east of the proposed development at Tasiast, at the foot of the Guelb Fask, is a Muslim cemetery, which developed around the tomb of Sidi Muhammas al-Kunti. The tomb remains an important site for the local population.

A series of Muslim tombs have been identified within the study area, comprising two single tombs north east of the proposed airstrip, a pair of tombs in the north of the Mine site and a cluster of Muslim tombs on a rocky ridge east of the proposed accommodation camp. These are all located within clusters of earlier protohistoric burials.

12.3.6 Intangible cultural heritage

Oral traditions and customs of the local population are closely connected to the nomadic way of life, even though certain traditions and customs have had to adapt to the changed conditions of town life. The area is well-known as a zone of transhumance for the large tribes. Traditional feasts and marriages are nowadays celebrated in the towns, with only a few and unimportant differences to the way they were celebrated in the nomadic milieu, yet the nomadic way of life, and the cultural fabric which sustains it, is in the meantime, fast disappearing. Nomadism, rich in cultural values though it may be, is threatened in Mauritania. The current practice of nomadism is bound to towns, especially as, for the most part, livestock are the property of townsmen who hire the services of nomadic shepherds.

Place-name evidence was assessed during the course of the review of the baseline survey in May 2011. Most of the toponyms in the area refer to landmarks such as prominent rocky outcrops, wadis, wells, vegetation and grazing areas, sand formations and fixed ogolian dunes. These often contain Hassānīya Arabic personal names, plant names or topographical metaphors. Mauritanian place-names occasionally contain some traces of Berber (Zénaga) or

Soniké vocabulary and loanwords (Monteil 1950), but in general, Mauritanian place-names have been coined relatively recently (Taine-Cheikh 1998). To date, none of the known place-names of the Tasiast area point to new heritage sites. However, a systematic data-gathering exercise on place-names is being undertaken as part of the EIA Social Survey (in progress, June/July 2011).

12.4 Knowledge Gaps

Decree No. 94-2004 relating to the Environmental Impact Study, Article 7, Section 5 states that '*the impact study essentially includes …an indication of the knowledge gaps and uncertainties encountered in finalising the necessary information'.* Knowledge gaps in the preparation of the Archaeology and Cultural Heritage section are:

- The mitigation strategy will be agreed in consultation with the IMRS and the Ministry of Culture, as well as any local populations concerned (see Section 11, Socio-economics), following EIA submission.
- The results of cultural heritage aspects of the Social Survey will be included in Phase 2, when the Social Survey is completed.

12.5 Baseline Conditions

There are no internationally recognised or legally protected cultural heritage features or areas, or proposed critical cultural heritage features or areas, within the Mine site or existing borefield area (IFC Performance Standard 8, 2006, paragraph 8-10). There are, however, a few of historic Muslim tombs which are protected by national/Islamic law and customary practice. See Figure 12-1 for locations are archaeological sites within the Mine site.

There is no evidence for Palaeolithic or Epipalaeolithic sites within the Mine site and no archaeological sites were located within the borefield area.

Neolithic sites identified within the Mine site comprise clusters of occupation sites located on ogolian dunes, situated towards the eastern and south eastern edges of the Mine site (West Branch **site 1**; Tasiast Project sites **25**-**30**, **31**, **32**-**38** & **47**). These sites are not necessarily contemporary or successive, and may span a period of several thousand years, probably in the middle Neolithic period. The occupation sites are located on the summits and slopes of ogolian dunes, and comprise surface scatters of lithics, pottery and quernstones; some are associated with eroded Neolithic human burials, and also with later, Protohistoric period tombs. Due to the thin soil cover on the dunes, it is likely that any sub-surface features will be shallow or will have been eroded away by seasonally shifting winds. These sites are further discussed in Section 12.5.1.

Protohistoric period heritage assets identified within the Mine site comprise six clusters of protohistoric tombs, and three isolated tombs, located on regs. These sites are further discussed in Section 12.5.2.

A series of Historic Muslim tombs have been identified within the Study Area, comprising single tombs (**Sites 14** & **17**), a pair of tombs (**6**), and a cluster of Muslim tombs (**24**). These are all located within clusters of earlier protohistoric burials.

Archaeological remains identified at the Mine site comprise two extensive clusters of Neolithic occupation sites located on ogolian dunes (**Sites 25-30**; **Sites 32-38**), and two isolated areas of Neolithic activity (**Sites 1**; **31**). There are six groups of protohistoric tombs (**Sites 2-5**; **7-12**; **13-17**; **20-23**; **39/40**; **40-44**) and one solitary tomb (**18**), located on regs. A single Muslim tomb

(**Site 14**), a pair of Muslim tombs (**6**) and a cluster of Muslim tombs (**24**) are located within clusters of earlier tombs. These sites are illustrated on Figure 12-1.

12.5.1 Neolithic sites

Neolithic sites comprised occupation areas on ogolian dunes. In the east of the study area, a major site was recorded, extending over several hundred square metres on and around an ogolian dune, and probably dating to the first half of the 5th millennium BP (Sites **25** & **26**). Finds included stone tools with evidence for manufacture on-site, pottery, ostrich eggshell and human bone. To the south of this major site are a series of smaller sites located on top of ogolian dunes, with smaller surface scatters of lithics and pottery (Sites **27**, **27b**, **28**, **29**).

In the south eastern corner of the study area was a further occupation site on the summit of, and around, a high ogolian dune. Lithics mainly comprise geometric microliths and pottery is cord-impressed; grinding stones are not common (Site **30**).

In the south of the study area is a further cluster of occupation sites on ogolian dunes. A number of these contain imported blocks of flint and evidence for a flint tool manufacturing industry, as well as occasional pottery and grinding stones (West Branch Site **1** & Project Sites **31**, **32**, **33**, **34**, **35**, **36**, **37**, **38**). Human bone was noted at Site **34**. Site **32** is particularly large, extending beyond the study area.

A further extensive occupation site, Site **47**¸ is located on an ogolian dune in the north west of the Mine site, and extends across gravels to the north west of the dune.

In addition to the occupation sites are two isolated find spots. In the north west of the site, pottery and quernstones were found (Site **1**), and in the northeast of the site, broken quernstones were recorded (Site **19**).

The directions of the desert winds change seasonally, resulting in generalised erosion of all aspects of these sites.

The value of Neolithic occupation sites is assessed as high, as they are upstanding monuments which have the potential to contribute significantly to research and they form coherent historic landscapes.

Table 12-2: Summary of Neolithic archaeological receptors within the Mine site

Site number	Scale of site	High dune	Flat dune	Large dune	Pottery	Cord impressed pottery	Stone tools	Stone tool manufacture	Imported flint blocks	Geometric microliths	Querns	Ostrich eggshell	Neolithic human remains	Protohistoric tombs
WB1	+		+		+++		++	++	+++	+++	+		++ (2+)	+ (2+)
25/26	+++				+++		+++	+++			++	+	+	+
27	+				+		+				+			
28	+		+		++		++							
29	+		+		++		++							
30	+	+			+		+							
31	+	+				++				+++	+			
32	+++			+	+		+++	+++	+++	+++	+			
33	+	+			+		+				+			
34	+++			+	+			+++	+++	+++	+		+	
35	+	+			+			+++	+++		+			
36	+	+			+			+++	+++		+			

37	++	+			+			+++	+++		+			
38	++	+			+			+++	+++		+			
47	+++	+		+	+		+	+			++			+ (3+)

Key - += present ; ++= moderate; +++= frequent/large size/quantities

12.5.2 Protohistoric sites

There are six groupings of protohistoric tombs, located in the north west of the Mine site (Sites **2**, **3**, **4**, **5**), the north east (Sites **7**, **8**, **9**, **10**, **11**, **12**; existing airstrip area), to the east-north-east (Sites **13**, **15**, **16**, **17**; proposed airstrip area), in the east (Sites **21**, **21**, **22**, **23**), in the south (Project Site **39**; West Branch Sites **3, 5** & **8**) and in the south west (Sites **40**, **41**, **42**, **43**, **44**). There are three isolated tombs which do not seem to form part of wider clusters (Sites **18**, **39** & **45**).

These tombs generally comprise a single tomb or cairn of rocks raised over one or several inhumations. There are two antenna tombs (West Branch Site **8** & Project Site **18**). In some cases, there are central tombs with smaller satellite tombs (Sites **11**, **20**, **21**, **42**). There are two areas where tomb fields are located on relatively elevated, prominent rocky ridges – these are located to the east of the proposed accommodation camp (Sites **20 – 24**), and in the southwest of the site (Sites **40 – 44**).

The value of such tombs is assessed as medium (single/paired simple tombs) or high (tomb fields/antenna tombs), as they are upstanding monuments which have the potential to contribute significantly to research and form coherent historic landscapes.

12.5.3 Historic sites

Historic period heritage assets have been identified within the Mine site, and comprise a single Muslim tomb to the northeast (Sites **14** & **46**, proposed airstrip area), located within a cluster of earlier protohistoric tombs. There are a pair of Muslim tombs in the north of the Mine site (Site **6**), again in an area of earlier burials. There is a cluster of Muslim tombs in the east of the site, east of the proposed accommodation camp (Site **24**), located on a prominent ridge and surrounded by earlier, Protohistoric burials.

These tombs comprise a single burial beneath a sub-rectangular cairn of fairly flat stones, with an un-inscribed stone grave marker at the head end of the burial. The occupants of the graves are not known; no visibly recent graves were identified. None of the graves are the subject of pilgrimages or particularly devotions.

The value of such tombs is assessed as high. Burials are protected under Mauritanian statute law and Sharia law, and these sites are respected by local populations.

12.6 Assessment of Site Significance and Research Agendas

National and regional research agendas are currently being developed by IMRS, but have not yet been formalised. Research agendas are important in establishing the significance and value of sites and are key to the Project Design for mitigation works, as they enable the prioritisation of sites, and ensure that fieldwork output is targeted, relevant and feeds constructively into capacity building and effective mitigation. General research agendas include:

- Establishing the character, location, extent, quality and state of preservation and of the surviving resource in order to assess its value in a local, regional, national or international context as appropriate (Kaber 2001; Vernet in press);
- Considering the landscape, topography and former water resources of the area and its influence on settlement patterns, communication networks and land use;
- Recognising and interpreting and spatial or functional continuity (or discontinuity) between Project phases;
- Integrating any pottery recovered into regional ceramic chronologies and type-series, using absolute dating where appropriate;
- Understanding the variability and form of lithic scatters and character of knapping debris; linking lithic technologies to pottery seriation and absolute dating; and,
- Investigating and draw together information regarding the chronological development of local environmental conditions in all periods.

Specific research agendas relevant to the range of sites identified within the Mine site, based on published papers on Mauritanian and Western Saharan fieldwork include:

- Population change, occupation patterns and adaptation to climatic transitions (Barusseau et al. 2007; Beaudet et al. 1976 ; Holl 2009; Jousse 2006; Le Houérou 1997; Petit-Maire (ed) 1979);
- Ancestor populations, human migratory routes and occupation patterns in the western Sahara (including isotopic analyses) (Holl 1989; Jousse 2006; Petit-Maire (ed) 1979);
- Location and development of palaeolakes, river courses and palaeochannels (Beaudet et al. 1976);
- Site formation and detection (aeolian coverage of Aterian sites (Pasty 1999); erosion of Epipalaeolithic and Neolithic sites (Hebrard 1973; Nguer & Rognon 1989));
- Development of Neolithic flora and fauna; hunting; impacts of domestication, livestock breeding and cereal cultivation (Holl 2009; Jousse 2006; Kaber et al. 1997 & 2003; Vernet & Tous 2004);
- Material culture and typologies of the late Neolithic/Chalcolithic/Protohistoric transition (Holl 2009; Lambert 1975; Vernet et al. 1992);
- Emergence and development of nomadism; and,
- Continuity and change in occupation patterns; reuse of prehistoric burial sites in the medieval Islamic period.

In the absence of published national guidelines, the significance of archaeological sites, monuments and artefact find spots is judged upon the extent of survival, their current condition, rarity, representivity, the importance of the period to which the monument dates, their fragility, their connection to other monuments (group value), their potential to contribute to information, understanding and appreciation, and the extent of documentation enhancing the monuments' significance (archival material/future research). Taking these criteria into account, each feature can be assigned a level of value in accordance with the six-point scale indicated in Table 12-3.

Table 12-3: Factors for assessing the value of archaeological receptors

Significance/ value	Key characteristics of archaeological receptor
Very high	World Heritage Sites Receptors of acknowledged international importance Receptors that can contribute significantly to international research objectives
High	Monuments & sites of national quality and importance Receptors that can contribute significantly to national research objectives
Medium	Monuments & sites that contribute to regional research objectives.
Low	Monuments & sites of local importance Receptors compromised by poor preservation and/or survival or contextual associations. Receptors of limited value, but with the potential to contribute to local research objectives
Negligible	Receptors with very little or no surviving archaeological interest.
Unknown	The importance of the resource cannot be ascertained

12.7 Potential Impacts

Potential impacts may be temporary or permanent, direct or indirect and may occur throughout the life of the Project, or otherwise be restricted to either the construction or operational phases. Impacts can be considered in terms of direct, indirect and cumulative impacts. The magnitude of an archaeological impact can be judged on a five-point scale (see Table 12-4).

Table 12-4: Factors in the assessment of the magnitude of impact (archaeology/cultural heritage)

Factors in the Assessment of Magnitude of Impacts	
High	Change to most or all key archaeological elements such as the resource is totally altered Comprehensive changes to setting
Moderate	Changes to many key archaeological elements, such that the resource is clearly modified Considerable changes to setting
Low	Changes to key archaeological elements,, such that the receptor is slightly altered Slight changes to setting
Negligible	Very minor changes to elements or setting
No change	No change

Potential impacts on Neolithic, protohistoric and historic period archaeological receptors include:

- Total or partial removal of sites (such as, tombs) and surface scatters (such as, occupation sites) due to groundwork's/mining/dumping;
- Damage caused by vehicle tracking over sensitive/vulnerable assets; and
- Piecemeal removal of portable antiquities from widespread Neolithic finds scatters or interference with tombs.

Without mitigation, these will result in a moderate to high adverse and long term impact, as receptors will be irreversibly removed. However, with appropriate mitigation including design to avoid impacts where practical, archaeological receptors can be avoided, protected or recorded in mitigation, resulting in a low, adverse long term impact.

All known archaeological sites in the Mine site area are surface sites, and are therefore sensitive to illegal looting and opportunistic souvenir hunting, resulting in the 'sterilisation' of sites and the loss of irreplaceable heritage (Vernet 2000; Keenan 2005). According to the International Council of Museums, looted 'objects cannot be understood once they have been removed from their archaeological context and divorced from the whole to which they belong. Only professional archaeological excavations can help recover their identity, their date and their location'. Particularly vulnerable sites include those in the vicinity of staff camps and access roads, and prominent, highly visible ogolian dunes (such as, sites **WB1** & **31-38**). Extensive sites with surface scatters including pottery and stone tools (such as, Neolithic occupation sites) are particularly vulnerable. The risk of looting related to the increase in the population at the Mine site will be of short term (construction period) or medium term (operations) duration, with lesser impacts during the closure phase. It is judged that opportunistic looting results in a moderate to high adverse impact, due to the alteration of the archaeological resources. With appropriate mitigation, such as staff awareness training, temporary demarcation, exclusion fencing, archaeological excavation and/or enclosure fences, the impact can be reduced to a low, adverse long term impact.

12.7.1 Construction

During the construction phase, the following activities will completely or partially remove archaeological deposits (if present):

Direct impacts from the construction of the proposed development

- Ground preparation activities relating to the construction of the accommodation camp and the airstrip area;
- Terracing and excavation work (embankments and bunds);
- Diversion of utilities and drainage; and,
- Rubble and waste dumping.

Indirect impacts from the construction of the proposed development

- Potential illicit removal of archaeological artefacts from within the Mine site or the surrounding area; and,
- Vehicle tracking.

Temporary construction impacts

- The movement of traffic and transport across the site;
- Increase in noise and visual intrusion;
- The use of temporary topsoil storage areas; and,
- The installation and use of temporary road diversions.

Direct construction impacts

A number of sites will not experience any *direct* construction impacts, including Neolithic find spots (Sites **WB4**, **WB5** & **WB7**; Tasiast Expansion Sites **1** & **19**), Neolithic dune-top occupation sites (Site **WB1**, Tasiast Expansion Sites **25**-**30**; Sites **31**-**38**), Protohistoric tombs (**2-5**; **7**-**12**; **18**; **39**; **40-44**, **45**), and Muslim tombs (Site **6**).

In the airstrip area, known sites comprise Protohistoric tomb sites **13**, **15**, **16 17** & Muslim tombs **14** and **46**. East of the accommodation camp, sites comprise Protohistoric tomb sites **20**,

21, **22**, **23**, **24** and Muslim tombs **24**, all located on a long rocky ridge. Project elements have been designed to avoid any *direct* construction footprint impact on these sites, in accordance with IFC guidance (IFC, 2006 & 2007), Kinross Standards (2004) and project-specific Environmental Design Criteria (Hatch, 2011).

The construction of the proposed airstrip and accommodation camp will lead to low or moderate adverse *direct setting* impacts (see ICOMOS 2005 Xi'an Declaration). The historic landscape and its tranquillity are already affected by existing development in terms of visual and noise intrusion; in the long term (post-closure), these impacts are reversible. The proposed developments will not diminish the understanding of the historic use and significance of the landscape or of these sites (**13**, **14**, **15**, **16 17, 20**, **21**, **22**, **23**, **24** & **46**). The tombs to the east of the accommodation camp, oriented towards a former course of the Khatt Atoui river to the northeast, will undergo a low adverse *direct setting* impact, due to cumulative visual intrusion in an area already affected by previous development. The tombs in the vicinity of the proposed airstrip will undergo a moderate adverse *direct setting* impact.

Indirect construction impacts

Without mitigation measures, the increase in the population of the Mine site related to construction activity may have the moderate to high adverse indirect impact of increasing looting across the whole Mine site, not just in the vicinity of the proposed project components.

Sites (**13**, **14**, **15**, **16 17, 20**, **21**, **22**, **23**, **24** & **46**) will experience a moderate/high adverse *indirect* construction impact, due to the potential for an increase in looting due to the greater proximity of increased numbers of staff to these sites. More distant sites, such as the dune-top Neolithic occupation sites (Sites **25**, **26**, **27**, **28**, **29**, **30**, **31**, **33**; **32**, **34**, **35**, **36**, **37**, **38**, **47**) will experience a moderate adverse impact due to the risk of looting.

All cultural heritage sites within the Mine site are vulnerable to vehicle damage, in particular the tombs and the Neolithic surface scatters on the old dunes. This damage may involve crushing of artefacts, rutting, soil displacement and increased erosion. Without mitigation, this may result in a moderate to high adverse *indirect* impact.

Temporary construction impacts

The construction phase will involve a temporary increase in traffic and transport, noise and visual intrusion. It is judged that this will have a low to moderate impact on the *setting* of cultural heritage sites, as these factors are reversible.

The use of unlikely potential temporary topsoil storage areas and the installation and use of temporary road diversions have the potential, if not mitigated, to result in moderate to high adverse *direct* impacts on cultural heritage resource.

12.7.2 Operation

During the operational phase, the following activities have the potential to completely or partially remove archaeological deposits, if present:

- Movement of vehicular and human traffic over undisturbed areas of the site;
- Illicit removal of archaeological artefacts from within the site or the surrounding area.

Direct operational impacts

The operation of the proposed airstrip, the accommodation camp and the waste management facility will lead to low or moderate adverse *direct setting* impacts (see ICOMOS 2005 Xi'an Declaration). The historic landscape and its tranquillity are already affected by existing

development in terms of visual and noise intrusion; in the long term (post-closure), these impacts are reversible. The proposed developments will not diminish the understanding of the historic use and significance of the landscape or of these sites. The tombs to the east of the accommodation camp (**20**, **21**, **22**, **23**, **24**), oriented towards a former course of the Khatt Atoui river to the northeast, will undergo a low adverse *direct setting* impact, due to cumulative visual intrusion in an area already affected by previous development. The tombs in the vicinity of the proposed airstrip (**13**, **14**, **15**, **16 17**, **46**) will undergo a moderate adverse *direct setting* impact. The tombs to the west of the Waste Management Facility (**40**-**44**) may undergo an intermittent low adverse direct setting impact as this facility involves incineration and the emission of smoke and dusts.

Indirect operational impacts

Without mitigation measures, the increase in the population of the Mine site related to construction activity may have the moderate to high adverse indirect impact of increasing looting across the whole Mine site, not just in the vicinity of the proposed project components.

Sites (**13**, **14**, **15**, **16 17, 20**, **21**, **22**, **23**, **24** & **46**) will experience a moderate/high adverse *indirect* operational impact, due to the potential for an increase in looting due to the greater proximity of an increased Mine population. More distant sites, such as the dune-top Neolithic occupation sites (Sites **25**, **26**, **27**, **28**, **29**, **30**, **31**, **33**; **32**, **34**, **35**, **36**, **37**, **38**, **47**) will experience a moderate adverse impact due to the increased risk of looting.

All cultural heritage sites within the Mine site are vulnerable to vehicle damage, in particular the tombs and the Neolithic surface scatters on the old dunes. This damage may involve crushing of artefacts, rutting, soil displacement and increased erosion. Without mitigation, this may result in a moderate to high adverse *indirect* impact.

12.7.3 Closure

It is not anticipated that Mine rehabilitation and closure will result in any additional impacts. Sites will remain vulnerable to looting and to vehicle damage.

12.8 Mitigation and Monitoring Measures

12.8.1 Overview of mitigation measures

> If [sites of cultural, historic, or other archaeological interest] are identified on mine territory, appropriate protection and/or mitigation measures will be developed and implemented in consultation with appropriate authorities and experts.
>
> Cultural resources discovered during project activities (chance finds) will be evaluated for mitigation. Unmarked graves will be reported to the proper authorities. Vandalism and degradation of cultural resource sites and unauthorised collection of artefacts will be minimised during project construction, operations and closure.
>
> The Kinross Standards (EHS Management System, 2004)

As archaeological sites are a finite and irreplaceable resource, all direct impacts are of long term duration. For practical reasons, when sites cannot be preserved by altering the scheme design, most sites will not be relocated, but will be excavated and recorded in mitigation, according to the principle of 'replacement by record'.

The Project will comply with relevant Mauritanian laws on the protection of cultural heritage, and relevant international laws. It will apply internationally recognised practices with regard to

studies, documentation and protection. Any impacts on cultural heritage protected by national/Islamic law and customary practice, such as Muslim tombs, will be appropriately mitigated with the informed participation of national or local cultural heritage regulators, any affected communities and other key stakeholders.

In all cases, human remains and funerary objects shall be treated with dignity and respect at all times, regardless of ethnic origins, cultural backgrounds or religious affiliations.

12.8.2 General archaeological mitigation measures

Where the project involves adverse impacts on physical cultural resources, appropriate measures for avoiding by design where practical, minimising, mitigating and/or compensating these impacts will be applied. The following general archaeological mitigation measures are proposed, applicable during the construction, operation and closure phases.

All fieldwork must be permitted and will be undertaken either by or supervised by a Ministry of Culture approved archaeological specialist. The IMRS is responsible for the protection of cultural heritage in Mauritania. Any anticipated adverse impact on the identified archaeological sites due to mining activity must be notified to the IMRS to enable the IMRS to undertake an archaeological watching brief on works, in collaboration with the mining company.

Table 12-5: Principles of Archaeology and Cultural Heritage Mitigation Measures

Mitigation and compensation principles
Avoid or minimise impacts by design;
Avoid impacts during construction and operation;
Ensure the systematic stewardship of cultural heritage;
Reduce the risk of looting, vandalism and damage;
Undertake mitigation/replacement by record;
Provide sites with protection;
Undertake technical and institutional capacity building; and
Promote, enhance and conserve cultural heritage.

Outline mitigation proposals have been discussed and agreed with a national archaeologist (Directeur du patrimoine culturel, Ministère de la culture, de la jeunesse et des sports & national cultural heritage expert for UNESCO). Outline recommendations are as follows:

- **Avoid or minimise impacts by design**:
    - Design project components to avoid or minimise impacts where practical on cultural heritage identified in baseline studies (IFC PS8 2006, para 4).
- **Avoid impacts during construction and operation**:
    - Flag vulnerable sites (temporary flagging)
    - Fix traffic routes (one-track policy) to avoid vehicle rutting. Carefully consider the movement of traffic across the Mine site, to avoid tracking across known sites, such as, Neolithic dunes and burials of all periods.
- **Ensure the systematic stewardship of cultural heritage**:

- Put in place management, monitoring and reviewing systems, by developing and implementing a Cultural Heritage Management Plan and Chance Find Procedures as part of the site Environmental Management Plan.
- Chance Find Procedures will be developed in collaboration with the Ministry of Culture and IMRS. All chance finds will be reported, adequately protected and promptly assessed by a qualified archaeologist. Chance find procedures shall apply to any archaeological sites of interest that may be discovered during mine operations, as well as any stray finds or portable objects found on the Mine site or in its environs.

- **Reduce the risk of looting, vandalism and damage**:
  - Vulnerable sites are to be recorded prior to and in the course of mine development.
  - Sites may require protective fencing.
  - Provide on-site employee training on the protection of archaeological sites, with particular emphasis on the illegality of unauthorised collection of archaeological objects (Framework Law No. 2005-046 on the Protection of Tangible Cultural Heritage & 1970 UNESCO Convention on Cultural Property).
- **Mitigation/replacement by record**:
  - Where there are no technically or financially practical alternatives to removal, and the overall benefits of the project outweigh the anticipated cultural heritage loss from removal, cultural heritage will be removed using the best available technique.
  - Appropriate techniques include sample excavation (Neolithic dune-top sites); targeted excavation prior to construction (Protohistoric tombs); targeted watching brief alongside construction (if Chance Find Procedures triggered); analysis and reporting of finds assemblages/human remains; public dissemination of information (in accordance with IFC Performance Standard 8 Guidance Note 2007, para. G12 relating to disclosure of sensitive sites).
- **Give sites permanent protection**:
  - Where sites are indirectly impacted, enclose sites with a mesh fence with a gate for access/maintenance and signage indicating the legal protection afforded to the site and providing information about date and type of the site (in accordance with IFC Performance Standard 8 Guidance Note 2007, para. G12 relating to disclosure of sensitive sites).
  - It is acknowledged that such enclosures will themselves have a setting impact, and may highlight the location of sites. This has been discussed with IMRS, who advise that this is the preferable mitigation method.
- **Undertake capacity building**:
  - Contribute to technical and institutional capacity building, through staff training, exchange of institutional expertise, community participation.
  - The training of local environmental technicians in site and artefact recognition has been started, in order to strengthen their capacity for handling chance finds incidents, to ensure a rapid response and the effective monitoring of cultural heritage protection measures.

- Establish, support and enhance the capacity of local institutions to undertake mitigation works and the long-term museum conservation, stewardship and monitoring of cultural heritage (World Bank, 1994).

- **Promotion, enhancement and conservation of cultural heritage**:
  - Contribute to wider social and economic development through enhancing understanding of the heritage resource, promoting conservation principles, and assuring the museum curation, interpretation and display of any cultural heritage displaced as a result of the project construction and operation. (World Bank, 1994).
  - Work with local and national authorities to promote, where appropriate, archaeological tourism/displays and awareness of archaeological sites to mine staff and local populations (in accordance with the principles of IFC PS8 2006, para 11 on project use of cultural heritage).

Disclosure of sensitive sites

The requirements of IFC Performance Standard 8 Guidance Note 2007, para G12 relating to disclosure of sensitive sites have been noted. Although flagging sites and having fixed vehicle routes may inadvertently raise the visibility of vulnerable cultural heritage sites, and thus make them more vulnerable to looting, IMRS staff indicated in May 2011 that the preferred method of physical site protection was temporary flagging, to be followed by fenced enclosure.

A Cultural Heritage Management Plan will be prepared, setting out the system for minimising impacts on cultural properties and developing a clear cultural heritage alert process (Chance Find Procedures). This will also be accompanied by a staff training programme and cultural heritage awareness will be integrated into the site induction process.

12.8.3 Construction

Sites in the vicinity of the proposed airstrip

Sites in the vicinity of the proposed airstrip comprise Sites **13**, **15**, **16** & **17** (Protohistoric tombs) and Sites **14** & **46** (Muslim tombs).

- The extent of impacts has been limited by designing the scheme to avoid direct physical impacts.
- A one-track policy will be established to limit vehicle rutting. In accordance with the Environmental Design Guidelines (Hatch, 2011) and Kinross Standards (2004, No. 10.13), '*a safety strip 50 m wide must be established, with respect to the location of the existing sites'*.
- Sites will be surrounded with mesh fence enclosures (*c.*1.5m high), with an access gate and signage indicating their legal protection under Mauritanian Law (No. 2005-046 on the Protection of Tangible Cultural Heritage) and providing heritage interpretation – type of site, time period etc.). This reduces the risk of looting, vandalism and damage, provides protection and also contributes to promotion and enhancement of cultural heritage.
- The Cultural Heritage Management Plan and Chance Find Procedures will be implemented.

Sites in the vicinity of the proposed new accommodation camp

Sites in the vicinity of the proposed accommodation camp comprise Sites **20**, **21**, **22**, **23**, **24** (Protohistoric tombs) and Site **24** (Muslim tombs).

- The extent of impacts has been limited by designing the scheme to avoid direct physical impacts.
- A one-track policy will be established to limit vehicle rutting. In accordance with the Environmental Design Guidelines (Hatch 2011) and Kinross Standards (2004, No. 10.13), '*a safety strip 50 m wide must be established, with respect to the location of the existing sites'*.
- Sites will be surrounded with mesh fence enclosures (*c.*1.5m high), with an access gate and signage indicating their legal protection under Mauritanian Law (No. 2005-046 on the Protection of Tangible Cultural Heritage) and providing heritage interpretation – type of site, time period etc.). This reduces the risk of looting, vandalism and damage, provides protection and also contributes to promotion and enhancement of cultural heritage.
- The Cultural Heritage Management Plan and Chance Find Procedures will be implemented.

Discovery of a previously unknown site/accidental discovery

Chance find procedures, which identify what measures, should be taken in the event that physical cultural heritage, such as archaeological sites or objects, are encountered, will be prepared and implemented as part of the EMP. Chance Find Procedures will form part of the Cultural Heritage Management Plan, which itself will be integrated into site Environment Management System.

No culturally significant archaeological or historical sites, remains or objects (including graves) accidentally discovered during prospection, groundwork's, excavation or construction shall be disturbed until properly investigated.

Sites threatened by vehicle damage

All known sites within the Mine site are vulnerable to vehicle damage, in particular the Neolithic surface scatters on the old dunes and the tombs. Damage may involve crushing of artefacts, rutting, soil displacement and increased erosion.

- In order to avoid indirect impacts due to the increasing site population and activities, vulnerable sites should be flagged (temporary flagging).
- Where feasible (depending on ground conditions/type of sand), a one-track policy should be put in place to limit vehicle rutting. In accordance with the Environmental Design Criteria (Hatch 2011) and Kinross Standards (2004, No. 10.13), 'a safety strip 50 m wide must be established, with respect to the location of the existing sites'.

Sites threatened by potential looting

A number of Neolithic occupation sites characterised by extensive surface artefact scatters are potentially threatened by looting. These comprise Sites **WB1**, and Tasiast Expansion sites **27**, **28**, **29**, **30**, **31**, **33**, **25**, **26**, **32**, **34**, **35**, **36**, **37**, **38** and **47**.

- The extent and impact of looting will be limited through a integration of cultural heritage issues into staff inductions, a staff information campaign, the enforcement of a Mine site staff environmental code of conduct, and the strict application of Chance Finds Procedures, all of which will make reference to Framework Law No. 2005-046 on the Protection of Tangible Cultural Heritage & 1970 UNESCO Convention on Cultural Property and the 1970 UNESCO Convention on Cultural Property.
- The Cultural Heritage Management Plan and Chance Find Procedures will be implemented.
- Depending on the timetable and design of further Tasiast Project works, sites that are judged to be particularly vulnerable will EITHER be surrounded with mesh fence enclosures OR be recorded prior to or in the course of mine development (targeted sample excavation).

12.8.4 Operation

It is not anticipated that Mine operation will result in any additional impacts. Chance Find Procedures, the Cultural Heritage Management Plan and measures to control looting and vehicle damage will continue to be applied during the operational phase.

12.8.5 Closure

It is not anticipated that Mine rehabilitation and closure will result in any additional impacts. Chance Find Procedures, the Cultural Heritage Management Plan and measures to control looting and vehicle damage will continue to be applied during the active closure phase.

12.8.6 Monitoring

The Environmental Department shall regularly undertake audits and inspections, as set out in the Cultural Heritage Management Plan and Chance Find Procedures in accordance with the EMS management schedule. Audit and inspection checklists shall be amended as appropriate to include checks on construction works, correction application of the Chance Find Procedure and adequate protection of existing sites. In the event that such monitoring identifies incidents involving loss or damage to cultural heritage, this shall be notified to IMRS and senior TMLSA management. Records of audit/inspection findings and any follow-up shall be retained.

12.9 Evaluation of Mitigated Impacts

Taking account of the proposed mitigation, the Project can be undertaken in accordance with the requirements of IFC Performance Standard 8.

With mitigation, the significance of the predicted impact on cultural heritage is assessed as low to moderate adverse and the impact is assessed as significant over the long term, as archaeological remains are a finite and irreplaceable resource.

The mitigation of archaeological remains through excavation and recording will contribute to the national knowledge base, and the project will contribute to local and expatriate staff training in EMS and the development and enforcement of Chance Finds Procedures. The Project has the potential to make a significant contribution to institutional capacity building, in terms of reinforcing national planning policy and regulatory systems, feeding into the national inventory, promoting scientific exchange, and exploring opportunities for heritage interpretation and dissemination.

During the construction, operation and closure phases, mitigation will involve the protection of threatened sites through the installation of enclosure fences. There will be staff training on cultural heritage management, and a staff education campaign regarding antiquities theft. A Cultural Heritage Management Plan will be developed and Chance Find Procedures will be updated and implemented in consultation with IMRS. Vehicles will adhere to controlled routes identified by signage and vulnerable sites will be flagged. The condition of archaeological sites will be monitored as part of the site environmental monitoring programme and any changes reported to IMRS.

Residual archaeological and cultural heritage impacts during construction, operation and closure are assessed to be adverse, long term and of negligible to low significance.

12.10 Summary

A summary of the potential impacts of the proposed Phase 1b following the implementation of mitigation measures with respect to archaeological and cultural heritage are presented in Table 12-6.

Table 12-6: Summary of potential residual impacts1 – Archaeology and Cultural Heritage

Location	Nature of Impacts	Mitigation Measure	Project Phase[2]	Nature[3]	Duration[3]	Significance[3]
Mine site and Borefield	Construction of proposed airstrip, accommodation camp and ancillary facilities, utilities etc. impacting on Protohistoric and Muslim tombs	Avoid by design Protect sites by fencing. Implement Chance Finds Procedures Implement Cultural Heritage Management Plan & monitoring	C O D	Adverse	Long term	Low /Moderate
	Location of other facilities, utilities etc.	Avoid by design Implement Chance Find Procedures	C O D	Adverse	Long term	Low/Negligible
	Looting/degradation of surface scatters and tombs	Staff information campaign & environmental staff training Vulnerable sites EITHER to be fenced OR to be recorded prior to and in the course of mine development. Implement Chance Finds Procedures. Implement Cultural Resource Management Plan & monitoring.	C O D	Adverse	Long term	Low
	Damage to sites caused by vehicle tracking	Temporary flagging of sites Controlled routes (one track policy), signage Implement Cultural Resource Management Plan & monitoring.	C O D	Adverse	Long term	Low
All stages of Project	Destruction of archaeological remains	EMS. Develop and implement Chance Finds Procedures & control vehicle tracking	C O D	Adverse	Long term	Negligible

[1]Following implementation of proposed Mitigation Measures

[2]Project Phase: C = Construction, O = Operation, D = Closure

[3] Duration and significance refer to the predicted impact after the implementation of proposed mitigation measures and is based on the ratings provided in Table 5-2.

13 Landscape and Visual

13.1 Introduction

This Section presents the methodology and baseline conditions used to assess the potential impacts on the character and visual amenity resulting from Phase 1b. In addition mitigation measures which aim to avoid, reduce, remediate or compensate potential impacts are proposed and the residual impacts (impacts after mitigation measures implemented) assessed.

13.2 Methodology

As referred to in Section 2, this assessment takes into consideration national legislation, international guidance and Kinross standards.

In the absence of national guidelines, the format and content of this assessment is based on guidance from the Countryside Agency/Scottish Natural Heritage and the Landscape Institute and Institute of Environmental Management and Assessment given in:

- Guidelines for Landscape and Visual Impact Assessment, Second Edition, IEMA/LI 2002 (GLVIA); and
- Landscape Character Assessment, (Guidance for England & Scotland) 2002 (CA/SNH 2002).

These publications form the standard reference for undertaking landscape character and visual assessment in accordance with European standards but are applicable to projects elsewhere. This guidance recommends a two-stage approach to landscape and visual assessment comprising an initial desktop review of published information, including designations, followed by a site based visit.

13.3 Baseline Conditions

13.3.1 Landscape

13.3.1.1 Mine Context and Description

The Mine does not lie within an area of protected landscape and the key characteristics of the Mine landscape within and surrounding the Mine are presented in Table 13-1 below

Table 13-1: Key Landscape Characteristics

Key Landscape Characteristics
A national scale landscape, occupying approximately 75% of Mauritania and forming part of the wider Sahara desert.
Isolated, sand dominated landscape of undulating topography.
Limited vegetation cover and land use but sufficient in some areas for sporadic grazing.
Inhabitation largely confined to small numbers of local nomads occupying temporary/semi-permanent structures and the community of workers at the Mine.
Mining activities are a locally significant element of the landscape but of a scale which is dwarfed by the landscape context.

13.3.1.2 Landscape Quality

The landscape surrounding the Mine is open desert typical of the Saharan context and the majority of Mauritania and is illustrated in Photograph 13-1 and Photograph 13-2.

The landscape of the Mine and its immediate context has no distinctive landscape features which are unique and is unremarkable apart from the presence of the existing Mine. As a result the landscape context is considered to be of low quality.

13.3.1.3 Landscape Sensitivity

Assessment of the sensitivity of the landscape resource determines whether a landscape type or area can accommodate change arising from a development without detrimental effects. This capacity to accommodate change is dependent on existing land use, the pattern and scale of the landscape, visual enclosure/openness, scope for mitigation in character with the existing landscape and the value placed on the landscape.

The Mine landscape is considered to be of low sensitivity to the proposed development in Phases 1b, which is essentially a continuation of an existing use, for the following reasons:

- (Apart from the proposed airstrip) Phase 1b will not extend beyond the current boundaries of the Mine, allowing retention the intact of the surrounding landscape;
- The landscape context includes an established similar use on the Mine; and
- There will be no significant loss of characteristic landscape elements.

13.3.1.4 Landscape Capacity

Landscape capacity is defined as “the degree to which a particular landscape character type or area is able to accommodate change without significant effects on its character, or overall change of landscape character type. Capacity is likely to vary according to the type and nature of change proposed.” (CA/SNH 2002)

In the case of Phase 1b the landscape currently includes similar operations over the majority of the Mine.

13.3.2 Visual

The Guidelines for Landscape and Visual Impact Assessment (IEMA/LI 2002) note that sensitivity of receptors depends on a number of factors. Visual impacts result from change to the appearance of the landscape as a result of the proposed development either intruding into, or obstructing existing views, or by their overall impact on visual amenity and character. The sensitivity of receptors relates principally to three factors:

- Receptor’s function whilst exposed to view;
- Degree of exposure to view; and
- Period of exposure to view.

The criteria used to assess the magnitude of visual impacts are as follows:

- Value of existing views;
- Degree of change to existing views;

- The availability and amenity of the alternative views; and
- Distance to receptor.

Impacts may be considered as beneficial (i.e. positive) as well as adverse. The magnitude of a visual impact in this assessment may be described as very high, high, medium, low or very low. Professional judgement is inherent in determining the category of impact. The assessment of visual impacts is based upon views obtained at the time of assessment.

The sensitivity of a receptor and the level of impact upon it can be combined to assess the significance of the resultant effects.

Representative photographs of the context of the Mine were taken from viewpoints in February 2011. Three viewpoint types have been chosen to represent the typical range of views of the Mine.

A summary of views experienced from various categories of viewpoint is provided below:

- Intermittently inhabited properties occupied by nomadic/semi-nomadic peoples;
- Tracks within the desert used primarily by nomadic/semi-nomadic peoples and workers at the Mine; and
- The Mine access road and worker locations around the Mine.

Existing screening from locations in the wider landscape is largely derived from the landform of the sand dunes and rocky ridgelines. Views of the existing Mine are obtained in close proximity from a small number of extremely isolated locations, primarily accessed by those within the Mine site (see Table 13-2).

Table 13-2: Visual Sensitivity

Viewpoint Category	Sensitivity	Baseline Significance
Residential on a temporary basis (nomadic/semi nomadic)	Medium	Medium: the existing Mine is a prominent element of the view in an otherwise undeveloped landscape
From locations close to the perimeter fence accessed on foot or camel (nomadic/semi nomadic)	Low	Medium: the existing mine complex is a prominent dominant element of the view in an otherwise undeveloped desert landscape
Workers at the Mine	Very Low	Low: those connected to the mine are not considered significant /permanent receptors of impacts and use the buildings as work/living space

13.4 Potential Impacts

13.4.1 Construction and Operation

Phase 1b Project components are located on-site. Due to the nature of Phase 1b activities, landscape and visual impacts during both construction and operation will be similar and thus are assessed together.

13.4.1.1 Landscape

Development may have an adverse or beneficial impact on landscape character through removal of characteristic landscape elements; or the introduction of uncharacteristic elements which contrast with the existing landscape character; or the creation of elements that achieve

biodiversity/landscape objectives through the re-establishment of characteristic landscape features.

Phase 1b activities will be similar in nature to that currently experienced on-site. Potential landscape effects applicable to the proposed development are therefore considered to comprise:

- Some original, characteristic, landscape elements of value will be lost as a result of the development;
- The proposed airstrip development will involve some loss of trees which are locally scarce and an important landscape element; and
- The TSF starter cell and the existing borefield and proposed borefield expansion will remain as a permanent element of the landscape.

The GLVIA indicate that the magnitude of a landscape impact relates to:

- The size, extent or degree of change to a landscape or to individual landscape components;
- Whether there is a direct impact resulting in the loss of landscape components, or change beyond the land take of the scheme having an impact on the character of the area; and
- Whether the impact is permanent or temporary.

Indirect landscape effects may result from cumulative impacts within the wider landscape arising from direct impacts on site or external influences off site, such as traffic/dust/water which may change landscape character.

The proposed development will not give rise to any identifiable indirect effects on landscape character.

13.4.1.2 Visual

Changes in views may give rise to adverse or beneficial visual impacts through obstruction in views, alteration of the components of the view and through the opening up of new views by the removal of screening.

This Section presents the predicted visual effects of the proposed development, at representative viewpoints, taking mitigation into account. Potential visual effects arising from the development, excluding mitigation, may include:

- Change in the nature of views and increased visibility of new buildings/extended buildings and other infrastructure.
- During the construction period there will be potential for visual impact arising from temporary use of cranes/machinery etc which add to intrusion within a view.
- Visual impact arising from the height, scale and nature of the buildings and the degree to which this will change the nature of the view.

The existing perimeter fence will act to restrict the proximity of views and therefore reduce magnitude of the visual impact.

The extent to which Phase 1b will give rise to additional visual impact is considered in Table 13-3 in relation to the representative viewpoint categories. The impacts are described for each viewpoint category during the construction and operation.

Table 13-3: Potential Visual Impacts during Construction and Operation

Viewpoint Category	Impact	Significance
Residential on a temporary basis (nomadic/semi-nomadic)	Increased infrastructure will be viewed prominently and is of similar scale compared to existing infrastructure but will not change the overall nature of the view or add significantly to visual impact.	Low
From locations close to the perimeter fence accessed on foot or camel (nomadic/semi-nomadic)	The increased infrastructure will be viewed prominently and will increase visual impact but not change the overall nature of the view in comparison with the baseline.	Low
Workers at the Mine	The increased infrastructure will be viewed prominently but will not change the overall nature of the view.	Negligible

13.4.2 Closure

Potential impacts during closure are assessed to be the same as those experienced during construction and operation. However, the extent to which Phase 1b will give rise to additional visual impacts post closure is considered in Table 13-4 in relation to the representative viewpoints.

Table 13-4: Potential Visual Impacts Post Closure

Viewpoint Category	Impact	Significance
Residential on a temporary basis (nomadic/semi nomadic)	Once the infrastructure is removed the Phase 1b areas of the Site will largely revert to desert. The TSF 3 starter cell, existing and proposed borefield will remain as a large scale engineered structure but of relative insignificance in the scale of the landscape.	Negligible
From locations close to the perimeter fence access on foot or camel (nomadic/semi nomadic)	Once the infrastructure is removed the Phase 1b areas of the Site will largely revert to desert. The TSF 3 starter cell, existing and proposed borefield will remain as a large scale engineered structure but of relative insignificance in the scale of the landscape.	Negligible
Workers at the Mine	n/a.	n/a

13.5 Mitigation and Monitoring Measures

The nature of Phase 1b Project components and the location of the Mine in a remote desert location are such that no specific mitigation or monitoring measures are proposed for landscape or visual impacts through the life of the Project.

13.6 Evaluation of Mitigated Impacts

As no mitigation measures are required, the impact following implementation of mitigations measures will have the same significance as those stated in Section 13.4.

Residual landscape and visual impacts during construction and operation are assessed to be adverse, medium term and of negligible to low significance.

Residual landscape and visual impacts post closure are assessed to be neutral, long term and of negligible significance.

13.7 Summary

A summary of the potential impacts of the proposed Phase 1b following the implementation of mitigation measures with respect to air quality are presented in Table 13-5.

Table 13-5: Summary of potential residual impacts[1] - Landscape and Visual

Location	Nature of Impacts	Mitigation Measure	Project Phase[2]	Nature[3]	Duration[3]	Significance[3]
Mine site and Borefield	Change in landscape	No mitigation measure required	C O D	Neutral	Medium term	Negligible
	Visual impact of additional infrastructure and equipment		C O D	Neutral	Medium term	Negligible

[1]Following implementation of proposed Mitigation Measures

[2]Project Phase: C = Construction, O = Operation, D = Closure

[3] Duration and significance refer to the predicted impact after the implementation of proposed mitigation measures and is based on the ratings provided in Table 5-2.

14 Traffic

14.1 Introduction

This Section presents the methodology and baseline conditions used to assess the potential impacts on traffic resulting from Phase 1b. In addition, mitigation measures which aim to avoid, reduce, remediate or compensate potential impacts are proposed and the residual impacts (impacts after mitigation measures implemented) are also assessed.

14.2 Methodology

As referred to in Section 2, this assessment takes into consideration national legislation, international guidance and Kinross standards.

Existing data on current traffic volumes to/from the Mine, combined with information from the engineering design team regarding construction and operation of proposed new infrastructure, was used to assess the impact on traffic at the Mine during Phase 1b construction and operation.

14.3 Baseline Conditions

The Mine site is accessed from the main Nouakchott – Nouâdhibou N2 highway by a 60 km two-lane unsealed access road. The access road to the Mine site was previously a track which linked nomadic/semi nomadic people to the highway and was predominantly used to deliver water to drop-off points in the region. Following commissioning of the Mine, the track was upgraded to an unsealed access road which is regularly maintained. As part of Phase 1a(i) of the Project the access road will be upgraded to a two lane hard surfaced access road.

Currently the access road is used by Mine traffic and water delivery vehicles which supply water for local people. There are approximately fourteen truck load deliveries per day (HFO, diesel, reagents and other consumables); two personnel bus deliveries per day and 5 to 10 vehicle movements per hour along the access road during the day, although this has recently temporarily increasing due to the commencement of construction activities associated with the West Branch expansion and scoping/other activities associated with the Project.

Within the Mine site a network of internal Mine roads exists for Mine traffic only. These Mine roads are also unsealed. The roads are however speed restricted and regularly maintained (including dust suppression and removal of sand accumulations) for safety reasons and to reduce the production of dust.

14.4 Potential Impacts

Potential impacts on traffic involve increasing traffic volumes and vehicle movements as a result of Phase 1b. Increases in traffic also has the potential to result in increases to dust generated by its movement and this is assessed in Section 7.

14.4.1 Construction

During construction of Phase 1b, there will be an increase in vehicles for transporting workers and the delivery of construction materials and equipment. During construction of Phase 1b traffic movements, additional to existing, may increase by approximately 22 vehicles per day to transport equipment, materials and other consumables.

Due to the increased volume of traffic during construction, there is a higher risk than normal of accidents along Nouakchott – Nouâdhibou N2 highway, at the junction of the access road and the N2, along the access road and within the Mine site.

14.4.2 Operation

It is anticipated that during operation of Phase 1b, there will be an increase in vehicle movements associated with the larger workforce that will be necessary to operate and maintain the new infrastructure. It is anticipated that on the Mine site there will be an additional 18 trips per day to transport workers from accommodation to areas of work; and 10 trips per day to transport workers from Nouakchott to the Mine. During operation the transportation of equipment, materials and other consumables is anticipated to remain at an additional 22 vehicles per day.

During operation there is a higher risk of accidents associated with increased traffic within the Mine site, and to a lesser extent along the access road and at the junction of the access road and the Nouakchott – Nouâdhibou N2 highway.

14.4.3 Closure

During the closure of Phase 1b infrastructure there will be a steady reduction in the number of personnel employed at the Mine. This will result in a corresponding reduction in traffic movements both to and from the Mine and internally on the Mine roads. Eventually, following closure of all the Mine facilities there will be a period of monitoring and maintenance during which a small number of workers will use the area and traffic volumes during this period will be negligible.

It should be noted that if alternative post mining uses are identified for any of the Mine infrastructure there could be a level of traffic associated with these activities although they are likely to be less that those experienced with the fully operational Mine.

14.5 Mitigation and Monitoring Measure

14.5.1 Construction and Operation

During construction and operation of Phase 1b, mitigation measures for traffic impacts will be the same and so are discussed together.

Mine workers and contractor drivers will undergo specific training to reduce the risk of accidents on the Mines access road and internal. Delivery drivers will be given instructions on entering and leaving the Mine site and will be required to stay on the designated road. The access road and all roads within the Mine site will be clearly marked and sign posted to ensure that vehicles only operate on designated roads. Further signage shall be installed to provide clear directions to various components of the works/installations, and provide general road safety advice and warnings. In addition a speed limit has been set for the access road and within the Mine site and this will continue to be enforced.

Mine security will be notified in advance of deliveries of fuel and other potentially hazardous materials. Suppliers shall be required to plan movements of hazardous goods such as explosives, bulk fuel and chemicals, or heavy, wide or slow-moving loads and supplies shall also be required to consider the need for security for such shipments.

Community awareness should be provided with regards to the increase in traffic, particularly in regard to any specific periods when abnormal or dangerous loads or large convoys are likely to be passing through the area.

Stakeholders will be able to report traffic incidents via the Mines grievance procedure and if any such complaints are receive TMLSA will initiate corrective actions where needed. All road traffic accidents and incidents, including any wildlife or livestock mortalities and any spills of fuel or hazardous materials or wastes, shall be reported to the Mine's Security in the first instance, who will then inform the Environmental and/or Safety departments, who will investigate as necessary.

Routine monitoring of road conditions will be undertaken to ensure the internal Mine site roads and access road remain in a good condition.

14.5.2 Closure

Traffic movement associated with closure and with any longer term monitoring of rehabilitation will be required to abide by national traffic regulations and traffic signs.

No monitoring measures are required post closure.

14.5.3 Monitoring

Traffic (category and volume) entering and leaving the site shall be monitored by Security staff at the gatehouse(s). All companies delivering hazardous goods shall be required to report on their shipments.

The Community Relations officer shall monitor stakeholder complaints about road traffic, and where necessary initiate corrective actions.

The Environment and/or Safety departments shall monitor the condition of roads, signage and the nature and causes of any road traffic accidents or incidents, including wildlife mortalities. All road users shall be encouraged to report any concerns they have about road conditions.

14.6 Evaluation of Mitigated Impacts

The volume of traffic associated with construction and operation of Phase 1b will be very noticeable on the access road, with peak traffic volumes potentially increasing by up to a factor four. Although there will be an increase in vehicles movement as a result of Phase 1b, they are considered to be minimal in the context of existing vehicle movement at the Mine. Furthermore the continued implementation of road safety and other traffic related mitigation measures will result in a low significance impact.

Subsequent Phases of the Project are likely to result in a substantial increase in traffic along the main Nouakchott-Nouâdhibou N2 highway and along the Mine access road. The anticipated impacts from this increase in traffic will be assessed and reported in the subsequent EIA's for the Project (Phase 2 and Phase 3).

Residual traffic impacts during construction and operation are assessed to be adverse, short term and of low significance.

Residual traffic impacts during closure are assessed to be neutral, short term and of negligible significance.

14.7 Summary

A summary of the potential impacts of the proposed Phase 1b following the implementation of mitigation measures with respect to traffic are presented in Table 14-1.

Table 14-1: Summary of potential residual impacts[1] - Traffic

Location	Nature of Impacts	Mitigation Measure	Project Phase[2]	Nature[3]	Duration[3]	Significance[3]
Mine site and Borefield	Increased traffic	The enforcement of driver training and speed limits along all roads. Ensure that all roads are clearly sign posted.	C O	Adverse	Short term	Low
			D	Neutral	Short term	Negligible
	Traffic accidents		C O	Adverse	Short term	Low

[1]Following implementation of proposed Mitigation Measures

[2]Project Phase: C = Construction, O = Operation, D = Closure

[3] Duration and significance refer to the predicted impact after the implementation of proposed mitigation measures and is based on the ratings provided in Table 5-2.

15 Waste Management

15.1 Introduction

This Section presents the methodology and baseline conditions used to assess the potential impacts on waste management resulting from Phase 1b. In addition mitigation measures which aim to avoid, reduce, remediate or compensate potential impacts are proposed and the residual impacts (impacts after mitigation measures implemented) assessed.

15.2 Methodology

As referred to in Section 2, this assessment takes into consideration national legislation, Kinross standards and international guidance including the IFC EHS Guidance for Waste Management Facilities.

The legal framework for solid waste management in Mauritania is based on Law No. 2000-045 (Environmental Code) of which Chapter II covers waste management policy. This chapter defines guidelines for national waste management policy, including definitions of waste types and responsibilities.

The Ministry of the Interior is responsible for solid waste management activities of municipal authorities, whilst the Ministry of the Environment – Department of Pollution and Environmental Emergencies is responsible for promoting and supporting local policies for sustainable waste management, and for controlling waste treatment operations.

15.3 Baseline Conditions

15.3.1 Current Waste Management

Waste management activities at the Mine are operated in accordance with the Tasiast Waste Management Plan (WMP) which forms part of the overall EMS for the Mine. Waste is classified at source as follows:

- **Putrescible**: organic material from food preparation and dining rooms;
- **Non-hazardous**: those wastes which for their physical/chemical characteristics do not present a threat to human health or the environment and may be either incinerated or sent to landfill for permanent disposal; and
- **Hazardous**: wastes generated principally in the industrial processes of the operation or maintenance and which possess one of the six characteristics (corrosive, reactive, explosive, toxic, inflammable or biologically infectious) that make them a threat to human health or the environment. Included in this category are materials contaminated with oil & grease, used batteries and containers or packaging for chemicals. Medical waste is also classified as hazardous.

15.3.2 Waste Management Facilities

The Mine site includes a waste compound to accommodate solid wastes produced on-site. The compound includes a small landfill comprising four cells, one of which is lined with high-density polyethylene (HDPE). The compound is located south of the accommodation camp and east of the process plant and following the commissioning of the two incinerators the cells are used principally for non-combustible dry non-hazardous waste.

Current incinerator capacity on-site comprises two diesel fired top loading units (INCINER8 A2600 units with a chamber capacity of 1200kg of waste) which have recently been commissioned and are used to dispose of combustible and putrescible waste. The incinerator is operated on a batch (i.e. non-continuous) basis. Ash from the incinerator and non-combustible wastes are placed in the landfill on-site.

The existing WMF was designed to meet the needs of 900-1,000 personnel and an operational capacity of 10,000 tpd. It has essentially reached capacity and new facilities are required to meet the expanding demands of the Project.

A Hazardous Liquids Facility, for waste oils, is operated by TOTAL who has the exclusive contract for supply of all fuel and lubricants to the mine. As part of the contract TOTAL supplies a tank within the existing plant area which is filled with waste oil and solvents and periodically removed from the Mine site (for disposal at Nouakchott or in Senegal depending upon type of waste).

Redundant plant and equipment is stored in a dedicated area within the main compound.

The camp and office complex are provided with wheeled bins for deposit and temporary storage of waste prior to incineration or landfill.

As part of the expansion project, the existing waste management facilities will be replaced with a new waste management facility comprising:

- Sorting area (for reception and sorting of waste from the site);
- Incinerators (for treatment of combustible waste, including sewage sludge);
- Landfill (for disposal of non-hazardous waste); and
- Hazardous waste storage facility (for secure temporary storage of hazardous wastes). .

15.3.3 Waste Types and Arisings

Due to the remote location, waste from the Mine site is predominantly managed on-site rather than being transported to an off-site location elsewhere in Mauritania. The Mine produces the following general categories of waste, not related to extraction and processing of the ore or waste rock:

- **Waste oils and lubricants**: All used waste oil and solvents are directed to a dedicated waste oil storage tank at the Hazardous Liquids Facility operated by TOTAL and are collected for off-site disposal at a suitable facility in Nouakchott or in Senegal. Materials contaminated with oil and grease such as cleaning materials, oil filters etc. which are combustible are directed to the incinerator facility.
- **Scrap metals**: Scrap metal (largely comprising redundant plant and equipment) is currently stored on site.
- **Laboratory waste**: Laboratory waste arises from the on-site laboratory and comprises contaminated coupelles, crucibles and glass containers together with small quantities of reagents (such as, acids) and packaging. All laboratory waste is stored temporarily on site before being collected by a contractor and transported off-site for treatment and disposal.
- **Healthcare waste**: Healthcare waste is generated from the on-site medical centre and includes hazardous healthcare waste such as sharps and pathological/infectious waste (materials contaminated with bodily fluids or potential pathogens). It is currently stored in a

lined cell within the waste compound prior to collection by an approved contractor for final disposal at a suitable off-site facility.

- **General Solid Waste**: General solid waste arises from the office and camp and comprises general mixed refuse. It is disposed of by on-site incineration.
- **Kitchen Waste**: Kitchen waste arises from the camp and comprises food and packaging waste. It is currently disposed of by on-site incineration.
- **Waste Water Sludge**: Sludge arises from septic tanks used to treat domestic waste water and is disposed of via landfill.

15.4 Potential Impacts

15.4.1 Construction and Operation

Wastes are associated with a range of potentially damaging impacts including: odours/dusts/emissions; vermin/disease; leachate contamination; litter disposal; etc.

During construction of the Project, in addition to the various construction wastes (timber, steel, cable, plastics, etc.), there will be a marked increase in organic waste from the temporary labour force being housed in the proposed accommodation camp. It is estimated that 11,650 m^3/year of non hazardous waste will be disposed of via the proposed landfill cells and a further 4,120 tonnes/year of organic wastes will be incinerated.

Throughout the operation of the Project, the Mine will have approximately 2,500 permanent staff that will generate approximately 2,720 tonnes of organic wastes to be incinerated. Increased production will generate further non hazardous wastes - currently estimated as approximately 1,410 m^3/year - which will be landfilled.

Table 15-1 below describes the main types of waste and estimated quantities that will be generated by Phase 1b Project components during both construction and operation of Phase 1b.

Table 15-1: Estimated Waste Management Generation

Component	Waste Types	Timing	Estimated Quantities
TSF 3 starter cell	Construction waste comprising surplus materials and packaging	C	Dependent on construction techniques adopted. Amount of non-inert waste likely to be small
	Excavation waste from re-grading etc	C	Small quantities of uncontaminated soil/rock
Commencement works for process plant Site formation and foundations	Construction waste comprising surplus materials and packaging	C	Amount of non-inert waste likely to be small
	Excess spoil from excavations for structures	C	Uncontaminated soil/rock – quantities to be determined
Concrete batch plant • 50 – 100,000 m^3	Construction waste comprising surplus materials and	C	Amount of non-inert waste likely to be small

Component	Waste Types	Timing	Estimated Quantities
production capacity	packaging		
	Waste concrete from truck washout	O	Small quantities of inert waste
Power plant • Six 5MW HFO generating sets and fuel handling facilities	Construction waste comprising surplus materials and packaging;	C	Amount of non-inert waste likely to be small
	Waste oil and sludge	O	Quantities dependent on detailed design of facility
Fuel Farm • Multiple tanks with total capacity of approximately 68,000 m^3	Construction waste comprising surplus materials and packaging	C	Amount of non-inert waste likely to be small
	Excess spoil from excavations for structures including fuel tanks	C	Small quantities of uncontaminated soil/rock
Water treatment systems • Process/potable water supply • 2 No. Sewage treatment systems (1,000 m^3/d and 200 m^3/d)	Biosolids from waste water treatment facilities	O	Assuming sludge production rate of 0.08 kg/person/day[8] (dry solids), sludge arisings = 131 tpa (dry solids). Assuming 15% dry solids content for dewatered sludge from filter press, total sludge arisings = 131 x (1/0.15) = 873 tpa
	Treatment chemicals	O	Small quantities
	Concentrated brine from process/potable water treatment	O	Quantities dependent on detailed design of facility
Waste management facilities • Landfill • Hazardous waste storage facility • Incinerators • Storage area for recycling	Construction waste comprising surplus materials and packaging;	C	Amount of non-inert waste likely to be small.
Incinerators	Residual ashes from waste incineration and any materials rejected from process as unsuitable	O	Amount of residual ash disposed to landfill is likely to be moderate over the life of the mine
Accommodation camp • Accommodation camp of 6,000 bed capacity • Catering and recreation facilities	Construction waste comprising surplus materials and packaging	C	Amount of non-inert waste likely to be small (modular accommodation blocks to be used)
	Domestic and kitchen waste from camp	O	Assuming domestic waste generation rate of 2.2L (0.0022m^3)

[8] UNFCCC "Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories", Chapter 5 - Waste

Component	Waste Types	Timing	Estimated Quantities
	inhabitants		per person per day, annual solid waste arisings from the camp will be 6,000 x 0.0022 x 365 = 4,818 m^3 per annum (tpa). Assuming an uncompacted waste density of 0.2t/m^3, estimated waste quantity is 0.2 x 4,818 = 963.6 tpa
Airstrip, including: • Runway • Taxiway • Apron/helipad/fuelling facility • Terminal • Hanger • Vehicle parking area	Construction waste comprising surplus materials and packaging	C	Amount of non-inert waste likely to be small.
	Excess spoil from excavations for structures including hangers, offices and fuel farm	C	Small quantities of uncontaminated soil/rock
	General refuse from terminal operations	O	Small quantities of commercial/domestic type waste
Borefield expansion • Additional water supply boreholes • Pumping facilities • Mobile power supplies	Construction waste comprising surplus materials and packaging	C	Amount of non-inert waste likely to be small
	Excess spoil from excavations	C	Small quantities of uncontaminated soil/rock
	Small quantities of waste lubricants/oil from operation of mobile power supply	O	Negligible quantities of lubricants

15.4.2 Closure

On closure of the Mine, the incinerators and other waste management facilities will be removed from the site. The landfill will remain in-situ. A formal closure procedure will be adopted for the landfill which will comprise capping of the landfill with an impermeable cover system; and where necessary, monitoring to insure the closure capping is and long-term management of any impacts arising from the generation of landfill gas and/or leachate.

15.5 Mitigation and Monitoring Measures

15.5.1 Construction and Operation

15.5.1.1 General Approach

The general approach to mitigating solid waste management impacts will be the preparation and implementation of the Project and Mine Waste Management Plans. The Project Waste Management Plan will include guidance on:

- Waste minimisation/prevention;
- Identification and segregation of waste materials at source;

- Recycling/reuse of suitable materials will be undertaken where possible; and
- Treatment and disposal of specific waste streams.

All wastes will be managed in accordance with applicable local regulations and will be consistent with the waste characteristics. The Project and Mine Waste Management Plans will reflect the waste hierarchy, placing priority on waste minimisation, followed by recycling or reuse if economically practicable, then by environmentally sound methods of treatment and/or disposal. Strict compliance with waste segregation rules will be needed.

For example, it is proposed that the Mine will minimise the use of plastic water bottles on-site. Employees will be issued with a refillable container and additional water geysers will be installed throughout the Mine. Accordingly, plastic water bottles will substantially minimised in the Mine's waste streams, reducing the need for their incineration or landfill. In addition, crushing equipment will be installed to compact certain wastes like 200 gallon oil barrels and aerosol containers to reduce storage and/or transport volumes and therefore mitigate the associated impacts.

The proposed Waste Management Facility (WMF) will comprise the following individual components:

- Covered sorting area with concrete bays to ensure correct waste segregation, compactors to reduce the volume of used packaging materials, weighing station; and staff facilities;
- Two batch incinerators designed to comply with IFC air emissions standard, each with a nominal 9 tonne per day capacity;
- Non-hazardous waste landfill with a capacity of approximately 10,000 m^3; it will comprise a 2 m deep excavation with a 2 m high berm to have a 4 m depth and will be surrounded by a 2 m high fence to collect windblown litter (deposited ashes / dusts will be buried or covered to prevent their dispersal) and the base of the landfill will be sloped to allow for drainage; and
- Hazardous waste storage facility with separate bays for used batteries, electronics, chemicals/contaminated packaging, etc.

15.5.1.2 Non-Hazardous Wastes

Combustible non-hazardous waste will be managed using the proposed new incinerators; and non-combustible non-hazardous waste will be disposed of in the new landfill.

15.5.1.3 Hazardous Waste

Hazardous waste will be collected and temporarily stored in a secure location prior to collection by a suitable contractor and disposal or treatment at a licensed off-site third party facility. The storage facility will be in the dedicated waste compound and will be designed so as to prevent co-mingling or contact between incompatible wastes. Waste will be stored under cover in suitable closed containers which are capable of preventing accidental releases to soil, air or water, and appropriate secondary containment will be provided in the case of liquid wastes stored in volumes greater than 220 L. The secondary containment will have available volume equal to at least 110% of the largest container or 25% of the total volume of liquid waste stored.

Due to the current absence of suitable hazardous waste management infrastructure in Mauritania, this storage facility is being designed with a 5-year holding capacity so that hazardous wastes can be safely and securely stored pending the identification of suitable off-

site disposal solutions for each separate hazardous waste stream (i.e. via approved third party hazardous waste transport, brokerage, treatment and or disposal service providers).

Hazardous waste collection, transport and management on-site will be carried out solely by staff who have been appropriately trained, and access to storage areas will be limited to these trained staff. The location of the hazardous waste storage area will be clearly marked on site plans and the area will be provided with suitable warning signs. Material Safety Data Sheets (MSDS) or equivalent information will be provided for all waste materials and made available to any staff managing these materials, and all wastes will be clearly labelled to identify its contents. An emergency spill response plan will be prepared for the waste facility.

Hazardous waste transported off-site will be shipped via licenced third-party in secure containers which are clearly labelled with the material and hazard type, and will be accompanied with a manifest or trip-ticket that describes the load and its hazards. Any trans-boundary shipments of waste to treatment facilities outside Mauritania will be carried out in accordance with the necessary local and international regulations and guidelines.

Records will be complied and retained which will detail the quantities and types of hazardous waste that are generated, the type and duration of storage, and the off-site transport and disposal/treatment arrangements.

15.5.1.4 Waste Oils

Waste oil and solvents will continue to be stored in a dedicated waste oil storage tank at a facility operated by TOTAL and collected for off-site disposal at a suitable facility

15.5.1.5 Specific Mitigation Measures

The specific mitigation measures that will be adopted to ensure responsible management of the wastes arising from Phase 1a of the project are shown in Table 15-2 below.

Table 15-2: Waste Management Mitigation Measures

Component	Waste Types	Mitigation Measures
TSF 3 starter cell	Construction waste comprising surplus materials and packaging	Ensure waste is segregated at the point of generation and taken to waste compound for management – combustible material to be incinerated, non-combustible/inert material placed in landfill
	Excavation waste from site formation	Re-use as part of earthworks or place in development rock stockpiles
Commencement works for process plant Site formation and foundations	Construction waste comprising surplus materials and packaging	Ensure waste is segregated at the point of generation and taken to waste compound for management – combustible material to be incinerated, non-combustible/inert material placed in landfill
	Excess spoil from excavations for structures	Re-use as part of earthworks or place in development rock stockpiles
Concrete batch plant	Construction waste comprising surplus materials and packaging	Ensure waste is segregated at the point of generation and taken to

Component	Waste Types	Mitigation Measures
• 50 – 100,000 m^3 production capacity		waste compound for management – combustible material to be incinerated, non-combustible/inert material placed in landfill
	Waste concrete from truck washout	Crush for re-use as secondary aggregate, such as, in haul road construction or place in development rock stockpiles
Power plant • Six 5MW HFO generating sets and fuel handling facilities	Construction waste comprising surplus materials and packaging	Ensure waste is segregated at the point of generation and taken to waste compound for management – combustible material to be incinerated, non-combustible/inert material placed in landfill
	Waste oil and sludge	Any waste oils, fuels, oily sludge's and solvents to be stored in the hazardous liquids facility operated by TOTAL and removed for appropriate off-site disposal
Fuel Farm • Multiple tanks with total capacity of approximately 68,000 m^3	Construction waste comprising surplus materials and packaging	Ensure waste is segregated at the point of generation and taken to waste compound for management – combustible material to be incinerated, non-combustible/inert material placed in landfill
	Excess spoil from excavations for structures including fuel tanks	Re-use as part of earthworks or place in development rock stockpiles
Water treatment systems • Process/potable water supply • 2 No. Sewage treatment systems (1,000 m^3/d and 200 m^3/d)	Biosolids from waste water treatment facilities	Dispose of by on-site incineration, landfilling or land application (following stabilisation)
	Treatment chemicals	Collect any hazardous waste and temporarily store in waste compound pending off-site disposal at suitably licensed facility.
	Concentrated brine from process/potable water treatment	Use on site for dust suppression
Waste management facilities • Landfill • Hazardous waste storage facility • Incinerators • Storage area for recycling	Construction waste comprising surplus materials and packaging;	Ensure waste is segregated at the point of generation and taken to waste compound for management – combustible material to be incinerated, non-combustible/inert material placed in landfill
Landfill	Litter and incinerator ash (wind dispersal)	Erection of 2m high mesh fence around perimeter of WMF to catch windblown litter; burial or application of covering layer to incinerator ash deposits
Accommodation camp	Construction waste comprising surplus materials and packaging	Ensure waste is segregated at the point of generation and taken to

Component	Waste Types	Mitigation Measures
• Temporary construction camp of 6,000 bed capacity • Catering and recreation facilities		waste compound for management – combustible material to be incinerated, non-combustible/inert material placed in landfill
	Domestic and kitchen waste from camp inhabitants	Dispose of by on-site incineration
Airstrip, including: • Runway • Taxiway • Apron/helipad/fuelling facility • Terminal • Hanger • Vehicle parking area	Construction waste comprising surplus materials and packaging	Ensure waste is segregated at the point of generation and taken to waste compound for management – combustible material to be incinerated, non-combustible/inert material placed in landfill
	Excess spoil from excavations for structures including hangers, offices and fuel farm	Re-use as part of earthworks or place in development rock stockpiles
	General refuse from terminal operations	Dispose of by on-site incineration
Borefield expansion • Additional water supply boreholes • Pumping facilities • Mobile power supplies	Construction waste comprising surplus materials and packaging	Ensure waste is segregated at the point of generation and taken to waste compound for management – combustible material to be incinerated, non-combustible/inert material placed in landfill
	Excess spoil from excavations	Re-use as part of earthworks or place in development rock stockpiles
	Small quantities of waste lubricants/oil from operation of mobile power supply	Any waste lubricants to be stored in the hazardous liquids facility operated by TOTAL and removed for appropriate off-site disposal

15.5.2 Closure

In order to manage the potential closure issues associated with landfill the following measures will be implemented:

- Capping and re-profiling of the landfilled areas with at least 1 m of earth/rock.
- Re-grading of the area to blend with adjacent topography.
- The re-profiled surface of landfill and associated areas will be treated in accordance with the Surface Management Plan.

This closure approach does not include potential closure cost savings for alternative uses for infrastructure and buildings by the Government or other third parties after closure. Such opportunities will be investigated during the operational life.

15.5.3 Monitoring

The contractor responsible for the WMF will monitor and report various operational parameters (data) including the types and quantity of wastes entering the landfill, incinerator feedstock and emissions performance of the incinerators.

The Environmental department will in addition undertake periodic checks for odours (olfactory), dust emissions (visual) and abusive waste disposal (such as, windblown litter/debris/ash outside waste facility), As appropriate, periodic analyses of ashes/residues and emissions shall be commissioned to verify compliance with adopted standards including those specified by the IFC EHS Guidelines for Waste Management Facilities.

15.6 Evaluation of Mitigated Impacts

Given the design of the proposed WMF, the mitigation requirements for Phase 1b are modest and primarily restricted to the need to ensure rigorous application of the separate Project and Mine Waste Management Plans – i.e. more disciplined approach to waste segregation, cessation of open pit or other burning of wastes and finding suitable, approved waste management contractors for the disposal of hazardous wastes, particularly if there are to be any transboundary movements of waste.

15.6.1 Construction

The Project Waste Management Plan shall propose adequate measures for the management of all anticipated construction wastes, although it is noted that hazardous wastes may need to be stored at the WMF until such time as alternative means of off-site disposal of each hazardous waste stream can be identified and implemented. However, the hazardous waste store is being designed to accommodate up to 5 years accumulation of hazardous wastes to allow time to identify the required solutions.

Residual waste impacts during construction are assessed to be adverse, medium term and of low to moderate significance.

15.6.2 Operation

Both the landfill and the 2 new incinerators will require operational procedures to ensure the correct management of waste. These procedures will include:

- **Landfill**: waste segregation and handling; quarantine procedure for potentially unsuitable wastes; covering of incinerator ash; and emergency preparedness and response; and
- **Incinerator:** quality and quantity of feedstock and ashes/residual wastes; operating efficiency; and emissions from the process.

However, there may be potential issues such as lack of sufficient storage capacity if suitable off-site facilities are not identified for the disposal of all the hazardous waste streams within 5 years, or if such solutions require transboundary shipments.

If necessary, additional storage capacity can be provided until such time as a suitable off-site disposal facility has been identified.

The landfill will be designed, constructed and operated as an engineered sanitary landfill in accordance with international best practice and relevant IFC performance standards.

Residual waste impacts during construction are assessed to be adverse, long term and of low to moderate significance.

15.6.3 Closure

At final closure of the landfill (or indeed upon closure of any individual cell) the affected area will be covered with a capping layer designed and constructed to minimise any migration of liquids through the closed facility and function with minimum maintenance. The cap should be designed to ensure adequate storm drainage, minimise any erosion of the materials used for capping and ensure the stability and integrity of the closed facility. .

Residual waste impacts post closure are assessed to be neutral, long term and of moderate significance.

15.7 Summary

A summary of the potential impacts of the proposed Phase 1b following the implementation of mitigation measures with respect to air quality are presented in Table 15-3.

Table 15-3: Summary of potential residual impacts[1] - Waste Management

Location	Nature of Impacts	Mitigation Measure	Project Phase[2]	Nature[3]	Duration[3]	Significance[3]
Mine site	Generation of domestic and hazardous wastes from camp and passenger terminal building	Segregate wastes into appropriate categories for subsequent disposal/treatment using on-site landfill and incinerators. Hazardous wastes to temporary on-site storage prior to disposal to a suitable off-site facility	O	Adverse	Medium term	Moderate
	Generation of construction waste	All construction waste to be collected and returned to waste compound for management. Combustible waste to be incinerated. Non-combustible waste to be disposed of in on-site landfill.	C	Adverse	Short term	Low
	Surplus excavated soil/rock	Surplus soil/rock to be re-used in construction.	C	Adverse	Short term	Low
	Biosolids from waste water treatment facilities	Dispose of by on-site incineration, landfilling or land application (following stabilisation)	O	Adverse	Medium term	Moderate
	Treatment chemicals	Collect any hazardous waste and temporarily store in waste compound prior to off-site disposal at suitably licensed facility.	C O	Adverse	Medium term	Low
	Concentrated brine from process/potable water treatment	Use on site for dust suppression	O	Adverse	Medium term	Low

Location	Nature of Impacts	Mitigation Measure	Project Phase[2]	Nature[3]	Duration[3]	Significance[3]
	Waste oil and sludge	Stored in the hazardous liquids facility operated by TOTAL and removed for appropriate off-site disposal	C O	Adverse	Medium term	Moderate
	Leachate and landfill gases at waste management facilities	Adequate capping of facility	O D	Adverse	Long term	Moderate
Borefield	Small quantities of waste lubricants/oil	Waste lubricants/oil to be collected and returned to Mine site for management at TOTAL hazardous liquids facility.	C O	Adverse	Medium term	Low
	Small quantities of construction waste	Construction waste to be collected at point of generation and transported to Mine site for landfill or incineration. Surplus soil/rock to be re-used in construction.	C	Adverse	Short term	Low

[1]Following implementation of proposed Mitigation Measures

[2]Project Phase: C = Construction, O = Operation, D = Closure

[3] Duration and significance refer to the predicted impact after the implementation of proposed mitigation measures and is based on the ratings provided in Table 5-2.

16 Climate Change

16.1 Introduction

This Section presents the current carbon footprint for the Mine and the potential impacts on climate change resulting from Phase 1b.

16.2 Mine's Carbon Footprint

As the Mine is operational, it already emits greenhouse gases from a number of direct and indirect sources including, *inter alia*:

- Embedded emissions in raw material and equipment supply chains;
- Fuel consumption by mining and construction vehicles and equipment, including the transport of materials and workers to and from site;
- Fuel consumption of stationary and mobile sources including power plant and mobile generators;
- Potential direct uncontrolled emissions of greenhouse gases, such as Hydrofluorocarbons (HFCs, from chiller/refrigeration plant) and Sulphur Hexafluoride (SF_6 from insulation and current interruption systems in electric power transmission);
- Combustion of ammonium nitrate fuel oil used for blasting operations; and
- Disposal of wastes to on-site open-pit burning, incineration and/or landfill.

There are currently no legal requirements in Mauritania in regard to calculating or reporting greenhouse gas emissions. However, Kinross measures and voluntarily publishes information on the carbon footprint from its operations through its commitment to the Carbon Disclosure Project[9].

Available information on the current level of greenhouse gas emissions at the Mine is limited, as there are no systems in place to measure contributions from supply chain, blasting operations or waste disposal and there is no off-site fuel consumption data in relation to deliveries to the Mine. Any direct losses of HFCs and SF_6 are not considered to be material (i.e. they will form less than 1% of the total greenhouse gas emissions from operations).

However, an indication of the Mine's carbon footprint can be obtained by multiplying the estimated annual direct consumption of fuels at the Mine by a conversion factor to calculate its emissions, expressed as tonnes of CO_2 equivalent[10] (tCO2e).

HFO is used by the three 2.4 MW generators in the power plant. Diesel fuels eight 1 MW generators (with a further four 1MW generators already approved for installation in summer 2011) plus the range of vehicles, assorted mining and other equipment, including mobile generators at both the Mine and its borefield.

Table 16-1 below uses annualised 2010 monthly data for fuel consumption at the Mine and the standard conversion factors used by Kinross to calculate an estimation of the Mine's current direct annual contribution to global greenhouse gas emissions.

[9] See https://www.cdproject.net/en-US/Pages/HomePage.aspx.

[10] A unit of greenhouse gas emissions calculated by multiplying the actual mass of emissions by the appropriate global warming potential of a gas, which is quantified in units of carbon dioxide. This enables emissions of different gases to be added together and compared with carbon dioxide.

Table 16-1: Estimated Direct Carbon Footprint for the Mine

Fuel	Unit	Estimated Annual Consumption	Conversion Factor (t/l)	tCO2e
HFO for Power Plant	litres	10,275,000	0.0029	29,797.50
Diesel for Power Plant	litres	2,445,000	0.0027	6,601.50
Diesel for vehicles, plant and mobile generators (excluding borefield)	litres	15,750,000	0.0027	42,525.00
Diesel for mobile generators at the borefield	litres	1,285,000	0.0027	3,469.50
TOTAL				**82,393.50**

At less than 82.500 tCO_2e per annum, this may be locally and nationally significant but represents less than 0.0003% of global greenhouse gas emissions[11].

16.3 Potential Impacts

Phase 1b will result in additional greenhouse gas emissions, which will mean a contribution to overall global warming. It is generally considered that there is a causal link between greenhouse gas emissions and climate change effects, although at the present time it is not possible to make a direct link between such emissions and the specific consequences of global warming (such as any changes to: sea level, land and sea temperatures; cyclone intensity; frequency of extreme weather events including storms, drought and flood; or any associated loss of biodiversity, etc.).

16.3.1 Construction

Due to the general lack of existing vegetative cover, land clearance activities are not expected to result in significant emissions from degradation processes of removed plant materials (methane) or from the changes in ground cover.

Use of construction vehicles and equipment will generate additional emissions of greenhouse gases, however the increase in CO_2 emission is likely to be approximately 10% of diesel for vehicles (Table 16-1) keeping in mind that most of the diesel for this category is consumed by the existing mining fleet.

16.3.2 Operation

In addition to any increase in fuel consumption resulting from additional Mine vehicles and equipment, there will be substantial, additional emissions from the new, interim power generating capacity being installed as part of this phase.

The proposed power plant will consist of 6 x 5 MW HFO-fired engines and its additional HFO consumption alone could account for +/- an extra 120,000 tCO_2e emissions per annum[12].

[11] The US Carbon Dioxide Information Analysis Centre collated data for the UN and estimated a global total of 29.3 billion tCO2e in regard to 2007.

[12] This figure indicates that the current IFC threshold of 100,000 tCO2e per annum will be triggered, requiring the proponent to quantify and monitor annually using an internationally recognised methodology, and evaluate

However, it should be noted that following finalizing the Project feasibility study and the Phase 2 power configuration (approximately 150 MW to 170 MW), a decision will be made as to the ongoing utilization of both the existing HFO power plant and the Phase 1b HFO power plant. For the purposes of evaluating this EIA, the Phase 1b power plant was assumed to operate for 18 to 24 months, before being retained as an emergency generation plant. The Phase 2 EIA will assess necessary changes resulting from the feasibility study for the operating duration of the Phase 1b power plant and Phase 2 power plant.

16.3.3 Closure

It is considered unlikely that there will be any significant greenhouse gas emissions following decommissioning of the facilities and site rehabilitation.

technically and financially feasible options to reduce those emissions. Note that this threshold may be reduced to 25,000 tCO2e per annum when the revised IFC Performance Standards are published later this year.

17 Analysis of Alternatives

17.1 Introduction

This Section presents a description of the alternatives considered for Phase 1b of the Project. The "zero option" considers that the Project will not take place and that operations at the Mine will continue as present. The "phased option" considers alternative locations and technologies considered for Phase 1b.

17.2 The Zero Option

The zero option does not deliver the substantial value improvement for stakeholders that is achieved through the expansion. The operations would then cease and the Mine will be closed.

The Project will allow the existing operations to expand and for the Mine to continue with an increased work force for a further 16 years. It will also maximise efficiency and productivity and revenue. The zero option has therefore been discounted as it does not maximise ore recovery from the deposit nor does it deliver the greatest value to all stakeholders. In turn the benefits of increased employment opportunities, infrastructure development and contribution to the national economy will not be realised.

17.3 Project Components - Phase 1b

With the exception of the proposed airstrip, site selection options for Phase 1b Project components outside of the Mine site were not investigated. This is a brownfield Project, with the location of the deposits and supporting infrastructure already determined. It is therefore preferable from both environmental and economic grounds to develop the additional infrastructure for the Project within the existing fenced perimeter of the Mine site. Wherever possible, alternative locations for the proposed Phase 1b infrastructure have been explored to minimise environmental impacts.

The alternatives considered for Phase 1b Project components are summarised below.

17.3.1 Commencement Works, Concrete Batch Plant, Accommodation Camp, Waste Management Facilities and Water Treatment Facilities

Alternative areas for development of the Phase 1b components outside of the existing Mine site boundary have been discounted to avoid new disturbance and a larger Mine footprint than present. Within the Mine site, facilities have been located to ensure that impacts upon sensitive receptors are avoided, wherever practicable. Alternative locations within the Mine site were explored for the accommodation camp with the current proposed location being the most suitable. Alternative technologies for facilities (such as waste and water management) have been considered in the design process and the technologies selected present the best available option to meet the Project's Environmental Design Criteria (Hatch, 2011).

17.3.2 Power Plant and Fuel Farm

Originally, it was planned to expand the existing power plant and fuel farm by locating the proposed Phase 1b facilities adjacent to the existing power plant. However, due to the proposed location for the new CIL process plant (to be permitted in Phase 2) this has been discounted. The Phase 1b power plant has therefore been located on the western side of the Mine site. Taking in to account meteorological factors, this also allows for a suitable attenuating distance between the emissions and the existing and proposed accommodation

camp. Alternative approach to the delivery of power have been considered in the design process; the supply of low sulphur HFO for the proposed power plant has been investigated, however presently this fuel type cannot be obtained until mid 2012. Until such time as low sulphur HFO is available, current quality HFO (<2.5% sulphur HFO, which however averages approximately 1% sulfur) will be used and the appropriate mitigation measures have been outlined in this EIA.

17.3.3 TSF 3 Starter Cell

As agreed with the Ministries, the TSF 3 starter cell is required to replace TSF 2 and to accommodate tails from the existing CIL process plant. A number of locations within the Mine site were considered, however these were discounted to ensure that impacts upon sensitive receptors are avoided, for economic reasons, and the selected site, which is close to the new Project CIL process plant location to be permitted in Phase 2 appears to offer the best solution, notwithstanding the need to pump the slurry from the existing CIL process plant over an extended distance.

17.3.4 Airstrip

Due to the future height and location of the proposed new waste rock dump along the current airstrip flight approach path, it will be necessary to develop a proposed airstrip and associated ancillary facilities at some point in the Project mine life.

Alternative locations with the Mine site boundary have been considered, however these have been discounted as there was insufficient land available. It is proposed to locate the proposed airstrip outside of the Mine site to allow for necessary take off and landing clearance.

17.3.5 Borefield

Additional water requirements are needed to support Project construction and additional dump leach material. There is no other suitable groundwater resource currently available closer to the Mine site than the existing and proposed borefield expansion. The water quality at the existing and proposed borefield expansion is brackish and of low quality. In addition, the existing and proposed borefield expansion continues to demonstrate low impact significance to fresh water users and high sensitivity groundwater receptors. It is necessary to temporarily increase abstraction from the borefield. Sea water supply is an alternative that is being considered as a long-term alternative as part of Phase 3 of the Project.

18 Environmental Management

18.1 Introduction

This Section presents the Environmental Management Plan (EMP) for Phase 1b of the Project. It consolidates the proposed mitigation measures for significant environmental and social impacts, and provides the framework for implementing and monitoring those measures. It has been produced as a stand-alone section of this EIA, but can be incorporated as appropriate into the existing EMP for the Mine.

An EMP is already in place for the Mine and is in line with Mauritanian legislation and international standards. The EMP was prepared in February 2008 (Scott Wilson, 2008c) and approved by the Mauritanian Government in September 2008. It was developed in line with Decrees No. 2004-094 and No. 2007-105 and the Guide to preparing an Environmental Impact Assessment for the Mining Sector (Minister in Charge of the Environment and the Minister of Industry and Mines, November 2006). It built upon the framework EMP developed for the Tasiast Gold Project EIA (SNC Lavalin, 2004) and is complemented by the subsequent EMP developed for the West Branch Development EIA (Scott Wilson, 2010a).

18.2 Approach to Environmental Management

The existing Tasiast EMP was designed in accordance with TMLSA policy (currently being reviewed against Kinross requirements), relevant Mauritanian legislation and international best practice, so that it can be systematically audited and reviewed allowing for continual improvement. As specified in Decrees No. 2004-094 and No 2007-105, this EMP for Phase 1b identifies the measures that must be implemented at the Mine to successfully avoid, reduce and compensate/off-set any detrimental consequences on the environment. Its requirements will be incorporated into the overall EMP. Performance against the EMP shall be subject to routine auditing and inspection, with periodic progress reporting to the regulatory authorities.

The Tasiast EMP is currently in the process of being integrated into an Environmental Management System (EMS) for the Mine, which reflects the principles and stipulations of the ISO 14001 international standard. The EMP for Phase 1b has therefore been developed with both the existing EMP and the EMS structure in mind, in addition to reflecting the requirements of national legislation and international best practice (IFC Guidelines).

It is intended that the EMP for Phase 1b of the Project will be fully integrated into the existing EMP and EMS, once the EIA has been approved by the Mauritanian Government. This integration will include incorporation of Phase 1b EMP requirements into the core EMS documents, which are as follows:

- SGED-04: Environmental Monitoring Plan;
- SGED-05: Cyanide Plan;
- SGED-06: Waste Management Plan;
- SGED-07: Environmental Emergency/Spill Prevention and Response Plan; and
- SGED-08: Public Consultation and Disclosure Plan.

These documents are supported by procedures, which are specific instructions for each aspect of the EMS. The key EMS Procedures for the Mine are as follows:

- SGEP01: Analysis of Environmental and Social Aspects and Impacts;

- SGEP02: Identification of Compliance Requirements;
- SGEP03: EMS Improvement Objectives;
- SGEP04: Competency Assurance;
- SGEP05: Environmental and Social Training;
- SGEP06: Preparation and Revision of EMS Documents;
- SGEP07: EMS Audits;
- SGEP08: Corrective and Preventive Actions;
- SGEP09: EMS Management Reviews; and
- SGEP10: Environmental Management of Contractors.

Figure 18-1 shows how the EMP for Phase 1b will be integrated with the Mine's existing EMP and EMS and Table 18-1 presents a framework action plan for integration of the Phase 1b into the EMS/EMP Revision.

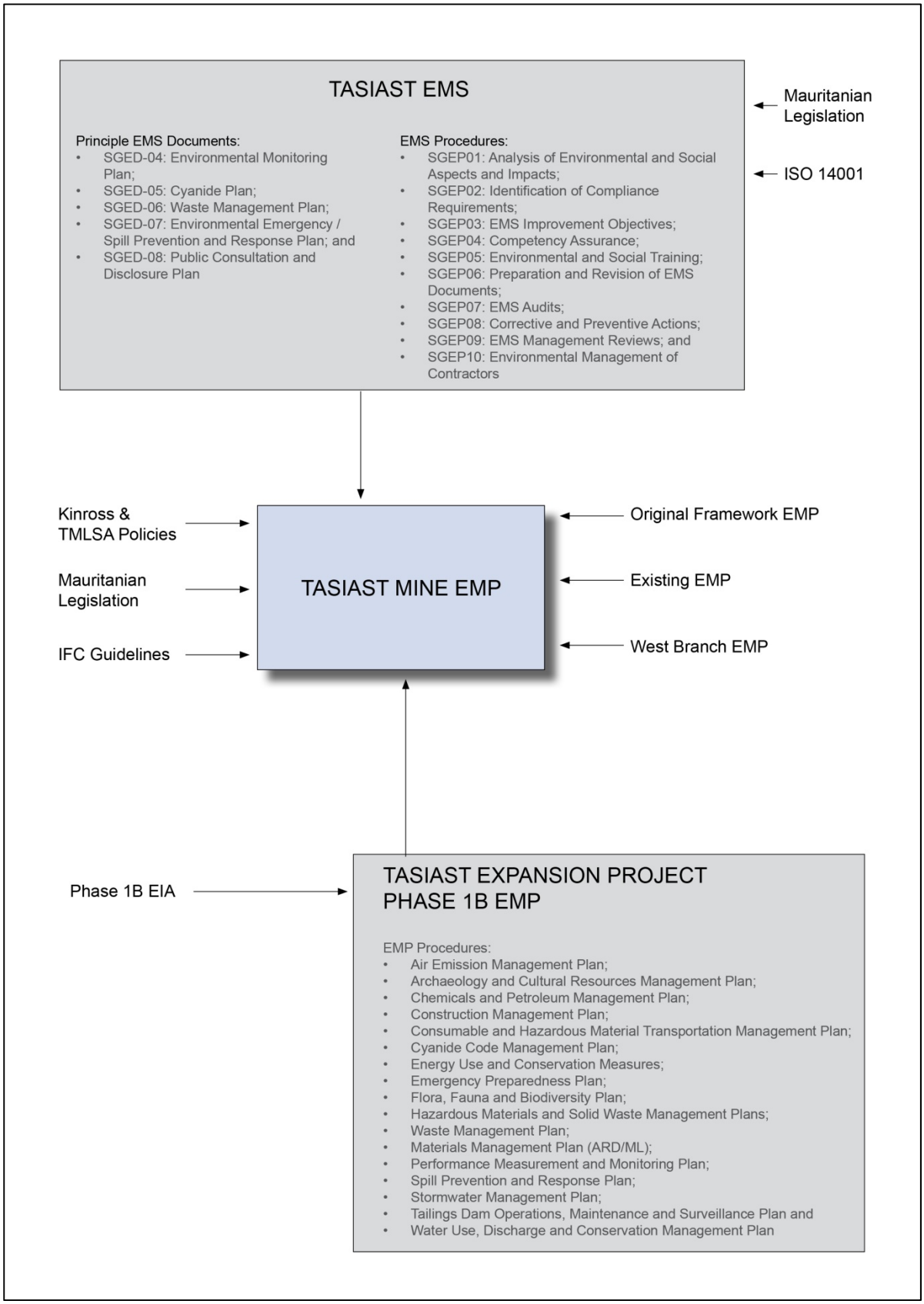


Figure 18-1: Integration of Phase 1b EMP into the Mine's Existing EMP

Table 18-1: Action Plan for integration of Phase 1b Environmental Management Plan into the EMS/EMP for the Mine

Item	Actions Required	Responsibility	Timescale from Phase 1b EIA Approval
1	Review existing EMP, integrate Kinross corporate policies and update with Phase 1b items	Environment Department (Environmental Manager) with support from Project Team and Consultants	3-6 months
2	Review EMS in view of updated EMP	Environment Department (Environmental Manager) with support from Project Team and Consultants	6-9 months
3	Review EMP/EMS Implementation budget & resources	Environment Department (Environmental Manager)/Project Team	6-9 months
4	Inform department heads of updated EMP highlighting key issues and agree implementation strategy and timescale	Environment Department (Environmental Manager)/Project Team	6-12 months
5	Training for HSE/environmental technicians and other identified site staff as necessary	Environment Department (Environmental Manager)/Project Team with support from Consultants	6-12 months
6	Review of contractors' HSE procedures and performance in view of updated EMP	Environment Department (Environmental Manager)/Project Team with support from Consultants	6-12 months
7	Allocation of additional resources e.g. spill kits, storage bunds, waste management facilities	Environment Department (Environmental Manager)/Project Team	9-12 months
8	Expand current monitoring programme to include Phase 1b and instigate additional monitoring where specified in the EMP.	Environment Department (Environmental Manager)/Project Team	12-18 months
9	Inform site staff and local community of key aspects of Phase 1b development	Environment Department (Environmental Manager)/Community Relations	12-18 months

18.3 Environmental and Social Management Programme

18.3.1 Overall Approach

TMLSA is committed to limiting the impacts of its operations at the Mine in line with Mauritanian legislation, Kinross/TMLSA policy and recognised international best practice (as defined in the IFC's standards). In order to achieve this, TMLSA have implemented an environmental management programme for the Mine as detailed in Section 6 of the existing EMP (Scott Wilson, 2008c).

To support the TMLSA environmental and social management programme, an EMS has been developed and is being progressively implemented. The EMS provides a structured policy, objectives and procedures to manage and monitor the mine's environmental impacts, including the implementation of the measures set out in the EMP.

As part of its combination with Red Back Mining Inc. TMLSA will update the EMS in line with relevant Kinross corporate requirements where these differ from what is articulated in the current documentation (e.g. the EMS will incorporate the Kinross Engineered Risk Assessment procedure, see Section 18.6). It may also need to be significantly re-structured to reflect the organisational structure being proposed for TMLSA, particularly in regard to community relations and corporate responsibility reporting structures.

The Mine's environmental and social management programme has been designed so that it can be reviewed and updated on a systematic basis in line with the principles of continual improvement. The programme includes details of the area of impact, objectives to reduce negative or enhance positive impacts, specific targets adopted to achieve those objectives, and definition of responsibilities for implementing the programme. The objectives and targets listed in the environmental management programme have been documented on a component basis in order to assist future audits and the evaluation of the existing EMP (Scott Wilson, 2008c).

Figure 18-2 shows the principles of continual improvement which underpin the Mine's environmental and social management programme.

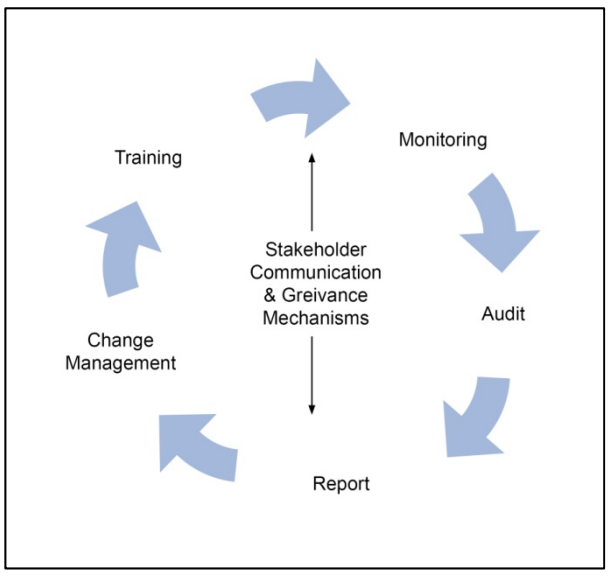


Figure 18-2: Environmental and social management process

In order to assist with easy understanding of the Phase 1b components in the context of the EMP, Table 18-2 identifies the relevant sections of the existing EMP which would correspond to the Phase 1b project components. In all cases, TMLSA will need to impose environmental management and supervision where contractors are being used to construct and/or operate the project components of this phase. Table 18-2 also identifies the responsible department that would work with the environment team to implement the EMP.

Table 18-2: Summary of Phase 1b project components which in relation to the existing Tasiast EMP

Project Component	Tasiast EMP Reference	Department Responsible for supporting Environment Department/Project Team
New accommodation camp	N/A (refer to Tasiast EMS)	Logistics
New TSF 3 starter cell	Tailings (TSF)	Processing
New power plant	Energy (ENG)	Maintenance
New fuel farm	Energy (ENG)	Maintenance
Temporary borefield water abstraction increase	Water Supply (WA)	Maintenance
Commencement works (Foundation works for new mill, CIL process plant and power plant)	ROM Pad and Processing Facilities (PF), Energy (ENG)	Processing/Maintenance
Proposed airstrip	Transport Management (TM)	Logistics/Security
Stakeholder engagement	PCDP	Community Relations

18.3.2 Roles and Responsibilities

Overall responsibility for all of the operations at the Mine rests with the General Manager of TMLSA. In addition, responsibility for implementing the EMP rests with the General Manager with support from the Environment Department and in particular the Environmental Manager. The Community Relations Department and the Health and Safety Department also play a key role in EMP implementation; however, all departments have specific responsibilities relating to environmental protection for their departmental activities. The roles and responsibilities of each department in relation to the EMP for Phase 1b of the Project are shown in Table 18-2.

Figure 18-3 illustrates the relationships between Kinross/TMLSA/Contracts and these roles are outlined in further detail below.

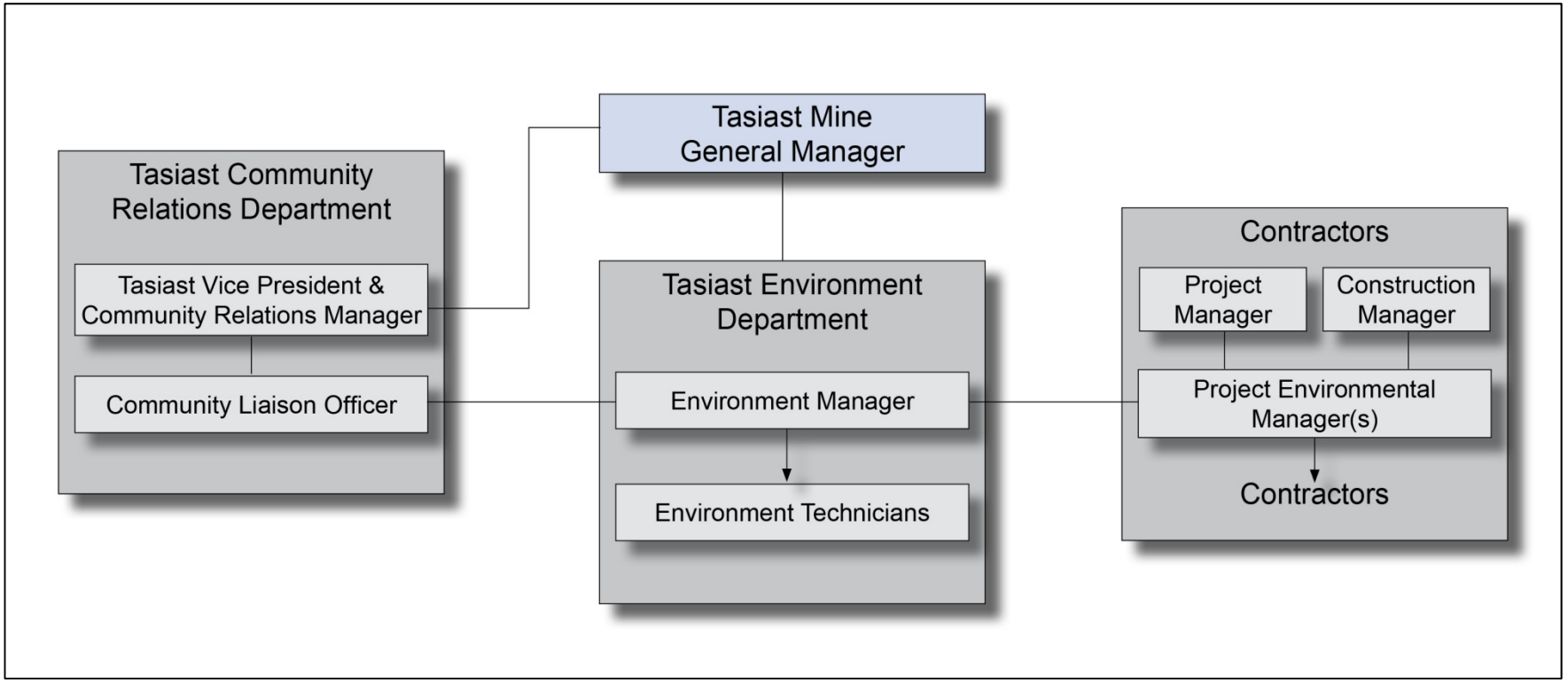


Figure 18-3: Kinross/TMLSA/Contractors relationships

18.3.2.1 Tasiast Environment Department

The Mine has an Environment Department, with three full time staff comprising an Environmental Manager and two Environmental Technicians. The Mine's Environmental Manager and supporting team will have direct responsibility for ensuring that environmental best practice and the EMP are followed at all times. The Environment Department's duties include:

- Reviewing all aspects of on-site environmental management, including contractor performance and any site-specific initiatives directly instigated or managed by the Mine (e.g. temporary employment of local people for specific tasks);
- On-site accountability for the implementation of the integrated EMP (with relevant parts delegated to Contractors as appropriate);
- Site inspections and any formal auditing of both Mine and contractor responsibilities;
- Collation and checking of environmental monitoring data; and
- Support for reporting to the competent authorities, Kinross Corporate and stakeholders.

18.3.2.2 Tasiast Community Relations Department

The Mine has a Community Relations Department based in the Nouakchott Office which comprises a Community Relations Manager (the TMLSA Vice President) and a Community Liaison Officer. The Community Relations Department works closely with the Environment Department and will be responsible for implementing any mitigation measures related to social impacts identified in the EIA. They will also be responsible for ongoing social monitoring, including community liaison, stakeholder engagement and grievance mechanisms.

18.3.2.3 Tasiast Health and Safety Department

The Health and Safety Department at the Mine is closely integrated with the other departments and the largest departments, Mining, Processing and Maintenance, have their own specific H&S staff. The H&S department works closely with the Environment Department to deal with environmental accidents and incidents that pose a risk to human health and safety, for example traffic accidents or chemical spills.

18.3.2.4 Contractors

Some construction and operational functions related to the Project will be outsourced, therefore responsibility for implementing certain aspects of the EMP will be delegated to the contractors as necessary. Where this is the case, contractors will assume responsibility for implementing the Mine's environmental, health and safety and other requirements; although the Mine's Environmental Manager will monitor performance to ensure suitable and sufficient standards are maintained.

The EMP will be implemented in line with the core Project phases of Construction, Operation and Closure and will be aligned with the relevant management plans for each engineering phase. For example, TMLSA's contracted Project Management Team will implement a Construction Management Plan that integrates approach to the environmental and occupational health and safety management of all activities being undertaken by contractors

engaged on construction work. This will ensure that all contractors and any sub-contractors or other organisations or individuals working on their behalf:

- Are fully informed of the Mine's environmental policy and EMS and are aware that their compliance shall be monitored;
- Are able to meet all relevant environmental legislative or regulatory requirements associated with the activity that they are engaged in; and
- Can minimise negative impacts on the environment by considering potential pollution risks, minimizing waste and resource consumption, and protecting the local environment.

The Mine will be responsible for issuing contract documents, which will include relevant clauses or conditions relating to environmental protection, (as well employment and health and safety, as per IFC Performance Standards 2 & 3). Principal contractors shall be responsible for appointing their own environmental, health and safety representative(s) who will have responsibility for implementing and updating the Contractor's environmental management policies and procedures. Where selected contractors do not have environmental policies or standards that meet the Mine's requirements, the Mine/Project Environmental/Health and Safety Managers shall impose the site rules or other environmental procedures as appropriate.

Some additional training (audits) and equipment (e.g. hand-held noise monitor) will be required to support implementation of this EMP.

18.3.3 Environmental Commitment Register

The foundation of the Environmental Programme is a 'Commitment Register' which details how the environmental impacts of the Project will be mitigated, and who has responsibility for this mitigation in order to meet the Mine's environmental management objectives. The Commitment Register is presented in Table 18-3 and is based on the impacts identified in Sections 6-16, along with the relevant mitigation requirements. Impacts have been grouped by technical subject area as follows:

- SW – Surface Water (Section 6)
- GW – Groundwater (Section 6)
- AQ – Air Quality (Section 7)
- NV – Noise and Vibration (Section 8)
- SL – Soils and Land Use (Section 9)
- E – Ecology (Section 10)
- SE – Socio Economics (Section 11)
- AH – Archaeology and Cultural Heritage (Section 12)
- LV – Landscape and Visual (Section 13)
- T – Traffic (Section 14)
- W - Waste (Section 15)
- CC – Climate Change (Section 16)

A more detailed summary of mitigation (and monitoring) requirements for each project is provided in Appendix 4 on a component by component basis.

Table 18-3: Environmental Commitments Register

Ref No.	Issue	Impact	Location	Phase	Nature of Impact	Duration	Significance	Management Objective	Mitigation / Monitoring	Responsibility
SW1	Surface Water	Change in surface water runoff and quality	Mine site	C, O , D	Adverse	Long term	Low	Prevent clean runoff water from external areas from entering Mine site facilities; safely convey storm water out of the site; containment of potentially contaminated water; maintain ambient surface water quality	Storm water management, monitoring and emergency response. Regular checks on TSF 3 and associated equipment, including independent certification upon commissioning and periodic Engineered Risk Assessments during operations to determine integrity.	Maintenance Department/ Contractors, supported by Environment Department
SW2	Surface Water	Change in surface water runoff and quality	Borefield	C, O , D	Neutral	Long term	Low	Maintain ambient surface water quality and quantity	Storm water management, monitoring and emergency response especially around key facilities and installations (e.g. fuel farm secondary containment areas)	Maintenance Department/ Contractors supported by Environment Department
GW 1	Ground water	Change in groundwater quantity and quality	Mine site	C, O, D	Neutral	Long term	Negligible	Maintain ambient groundwater quality and quantity	Monitoring boreholes on site to be routinely checked for water levels and water quality	Maintenance Department / Contractors supported by Environment Department

Ref No.	Issue	Impact	Location	Phase	Nature of Impact	Duration	Significance	Management Objective	Mitigation / Monitoring	Responsibility
GW 2	Ground water	Change in groundwater quantity and quality	Borefield	C	Adverse	Short term	Low	Maintain ambient groundwater quality and quantity	Good practice during drilling process and test pumping prior to use.	Maintenance Department / Contractors supported by Environment Department
GW 3	Ground water	Removal of Groundwater Storage	Borefield	O, D	Adverse	Long term	High to Moderate	Avoid over abstraction	Good management practice and monitoring of quantity abstracted and water levels	Maintenance Department / Contractors supported by Environment Department
GW 4	Ground water	Effects on fresh water users	Borefield	O, D	Neutral	Long term	Negligible	Minimise adverse impacts on local water users	Monitoring and borefield management	Maintenance Department / Contractors supported by Environment Department
GW 5	Ground water	Effects on fresh water resources (edge of fresh water aquifer)	Borefield	O, D	Adverse	Medium term	Moderate	Minimise adverse impacts on regional fresh water resources	Monitoring and borefield management	Maintenance Department / Contractors supported by Environment Department
AQ1	Air Quality	Particulate emissions during construction, operation and closure	Mine site and Borefield	C, O, D	Adverse	Short Term	Low / Negligible	Best Practicable Means	Best Practicable Means (all sources of fugitive emissions)	Maintenance Department / Contractors supported by Environment Department
AQ2	Air Quality	Process emissions from power plant	Mine site	O	Adverse	Medium Term	Low / Negligible	Minimise particulate emissions	Locate plant away from sensitive receptors (such as camp locations)	Maintenance Department / Contractors supported by Environment Department

Ref No.	Issue	Impact	Location	Phase	Nature of Impact	Duration	Significance	Management Objective	Mitigation / Monitoring	Responsibility
AQ3	Air Quality	Process emission from the waste management facility	Mine site	O	Adverse	Long Term	Low / Negligible	Best Practicable Means	Locate plant away from sensitive receptors and control emissions to below EU WID limit value	Maintenance Department / Contractors supported by Environment Department
AQ4	Air Quality	Operational power/ incinerator and other point /fugitive sources of emissions (e.g. venting fuel farm tanks)	Borefield	C	Adverse	Short Term	Negligible	Efficient use of power supply	Commissioning tests. Monitor fuel quality and operational parameters (to estimate emissions and carbon footprint);if needed, annual checks by independent laboratory	Maintenance Department / Contractors supported by Environment Department
NV1	Noise	Construction and Closure Noise	Mine site and Borefield	C, D	Adverse	Short Term	Low / Negligible	Minimise excessive noise levels as far as practicable and where possible avoid excessive noise near office areas and accommodation areas at times of peak use.	Best Practicable Means as defined in Chapter	All Contractors / Departments, supported by Environment Department
NV2	Vibration	Construction Closure Vibration	Mine site and Borefield	C, D	Adverse	Short term	Negligible	Minimise vibration as far as practicable and where possible avoid near office areas	Best Practicable Means as defined in Chapter	All Contractors / Departments, supported by Environment Department

Ref No.	Issue	Impact	Location	Phase	Nature of Impact	Duration	Significance	Management Objective	Mitigation / Monitoring	Responsibility
								and accommodation areas at times of peak use.		
NV3	Noise	Operational Noise	Mine site and Borefield	O	Adverse	Medium Term	Negligible	Minimise excessive noise levels as far as practicable and where possible avoid excessive noise near office areas and accommodation areas at times of peak use.	Control techniques and Site Management Practices	All Contractors / Departments, supported by Environment Department
NV4	Vibration	Operational vibration	Mine site and Borefield	O	Adverse	Medium Term	Negligible	Minimise vibration as far as practicable and where possible avoid near office areas and accommodation areas at times of peak use	Best Practicable Means	All Contractors / Departments, supported by Environment Department
SL1	Soils and Land Use	Soil contamination	Mine site and Borefield	C, O, D	Adverse	Short Term	Low/ Negligible	Reduce risk of soil contamination and be able to minimise the effects if it does occur	Designated parking areas for vehicles and plant; refuelling protocols ; chemical storage areas/ containment; Emergency Response Plan	All Contractors / Departments, supported by Environment Department
SL2	Soils and Land Use	Soil disturbance	Mine site and Borefield	C, O	Adverse	Short Term	Low/ Negligible	Limit soil disturbance	Limit disturbance; locate borrow pits within existing infrastructure	All Contractors / Departments, supported by Environment

Ref No.	Issue	Impact	Location	Phase	Nature of Impact	Duration	Significance	Management Objective	Mitigation / Monitoring	Responsibility
									area/s or close to new infrastructure area/s. Close / secure borrow pits as soon as practicable.	Department
SL3	Soils and Land Use	Soil compaction	Mine site and Borefield	C, O	Adverse	Medium Term	Low/ Negligible	Limit soil compaction	Efficient movement of heavy plant inform Mine staff of key project developments.	All Contractors / Departments, supported by Environment Department
SL4	Soils and Land Use	Soil Erosion	Mine site and Borefield	C, O, D	Adverse	Medium Term	Low/ Negligible	Limit soil erosion	Use designated roads and tracks around the Mine site	All Contractors / Departments, supported by Environment Department
SL5	Soils and Land Use	Land take / loss of pasture / barrier to movement	Mine site and Borefield	C, O	Adverse	Medium Term	Low/ Negligible	Limit land take requirement	No mitigation required.	All Contractors / Departments, supported by Environment Department
SL6	Soils and Land Use	Restoration of soil and land	Mine site and Borefield	D	Beneficial	Long Term	Low/ Negligible	Restoration of soil and land use to close to pre-mining conditions	Rehabilitation of land use	All Contractors / Departments, supported by Environment Department
E1	Ecology	Clearance of vegetation and loss of habitat	Mine site and Borefield	C, O, D	Adverse	Medium Term	Low	Minimise the loss of vegetation and compensate for protected tree species and significant loss to habitat	Pilot test tree planting, and/or appoint a nursery to propagate, growth and plant trees; and/or provide compensation on a value basis of the trees.	All Contractors / Departments, supported by Environment Department
E2	Ecology	Disturbance and displacement of	Mine site and	C, O	Adverse	Short Term	Low	Minimise disturbance to	Vehicle movements will be in	All Contractors / Departments,

Ref No.	Issue	Impact	Location	Phase	Nature of Impact	Duration	Significance	Management Objective	Mitigation / Monitoring	Responsibility
		wildlife.	Borefield					wildlife	accordance with mine guidelines and speed limits. No other mitigation required.	supported by Environment Department
E3	Ecology	Wildlife mortality as a result of cyanide poisoning.	Mine site and Borefield	C, O	Adverse	Medium Term	Low	Reduce the risk of wildlife coming into contact with cyanide enriched waters	Use of bird scarers and fencing of tailings ponds to prevent access.	Process Department / Contractors supported by Environment Department
E4	Ecology	Invasive / alien species	Mine site and Borefield	C, O, D	Adverse	Medium Term	Low	No invasive/alien species present	Survey for presence and destroy / remove as appropriate	Maintenance Department / Contractors supported by Environment Department
E5	Ecology	Habitat Rehabilitation	Mine site and Borefield	D	Beneficial	Long Term	Low	Natural re-colonisation of habitat	Passive revegetation	Environment Department
SE1	Socio-Economics	Increased employment opportunities	Mine site and Borefield	C, O	Beneficial	Medium Term	Moderate	Prioritise the employment of Mauritanian nationals where possible	Adequate protection of worker rights and welfare (i.e. camp standards,); provision of training; ensuring that local employment is a priority.	HR / Community Relations
SE2	Socio-Economics	Exposure to health and safety risks at work	Mine site and Borefield	C, O	Adverse	Medium Term	Low	No H&S Incidents	Implementation of OHS management plan to ensure employee health, safety	H&S Department, supported by Environment Department
SE3	Socio-Economics	Increased risk in traffic accidents	Mine site and Borefield	C, O	Adverse	Medium Term	Low	Reduce risk of traffic incidents	Raise community awareness in traffic safety; training for	H&S Department / Community

Ref No.	Issue	Impact	Location	Phase	Nature of Impact	Duration	Significance	Management Objective	Mitigation / Monitoring	Responsibility
									drivers	Relations supported by Environment Department
SE4	Socio-Economics	Influx of people to the area looking for work	Mine site and Borefield	C, O	Adverse	Medium term	Low	Manage community expectations to avoid influx of people	Avoid hiring casual labour; Avoid hiring at the site; Advertise employment policies	HR / Community Relations
SE5	Socio-Economics	Loss of pastoral land at airstrip (& associated increase in travel)	Mine site	C, O	Adverse	Medium term	Low	Minimise loss of pastoral land and support vulnerable families	No mitigation proposed	Community Relations supported by Environment Department
SE6	Socio-Economics	Temporary loss of employment	Mine site	C, O	Adverse	Short-Medium Term	Moderate	Transferable skills for workers	Retrenchment Plan	HR / Community Relations
SE7	Socio-Economics	Loss of employment	Mine site	O, D	Adverse	Long term	Moderate	Community development & provision of transferrable skills to Tasiast employees	Training of mine workers; Long term community development plan	HR / Community Relations
SE8	Socio-Economics	Return of land to pasture and re-opening of migration corridors	Mine site and Borefield	D	Beneficial	Long term	Moderate	Grazing land areas at Mine closure to be returned to pre-mining condition	n/a	Community Relations supported by Environment Department
AH1	Archaeology and Cultural Heritage	Construction of proposed airstrip, Accommodation Camp and ancillary facilities, utilities etc. impacting on Protohistoric and Muslim tombs	Mine site	C, O, D	Adverse	Long term	Low to Moderate	Avoid destruction / damage of known archaeological sites	• Avoid by design • Protect sites by permanent fencing. • Implement Chance Finds Procedures • Implement Cultural	All Contractors / Departments, supported by Environment Department

Ref No.	Issue	Impact	Location	Phase	Nature of Impact	Duration	Significance	Management Objective	Mitigation / Monitoring	Responsibility
									Resource Management Plan & monitoring	
AH2	Archaeology and Cultural Heritage	Potential disturbance of sites due to proximity with location of other facilities, utilities etc.	Mine site and Borefield	C, O, D	Adverse	Long term	Low to negligible	Avoid by design Implement Chance Find Procedures	• Avoid by design • Implement Chance Find Procedures	All Contractors / Departments, supported by Environment Department
AH3	Archaeology and Cultural Heritage	Looting/degradation of surface scatters and tombs	Mine site and Borefield	C, O, D	Adverse	Long term	Low	Avoid destruction / damage of known archaeological sites	• Staff information campaign & environmental staff training • Vulnerable sites EITHER to be permanently fenced OR to be recorded prior to and in the course of mine development. • Implement Chance Finds Procedures. • Implement Cultural Resource Management Plan & monitoring.	All Contractors / Departments, supported by Environment Department
AH4	Archaeology and Cultural Heritage	Crushing of sites by vehicles	Mine site and Borefield	C, O, D	Adverse	Long term	Low	Avoid destruction / damage of known archaeological sites	• Temporary flagging of sites Controlled routes (one track policy), signage	All Contractors / Departments, supported by Environment Department

Ref No.	Issue	Impact	Location	Phase	Nature of Impact	Duration	Significance	Management Objective	Mitigation / Monitoring	Responsibility
									• Implement Cultural Resource Management Plan & monitoring	
AH5	Archaeology and Cultural Heritage	Destruction of archaeological remains	All stages of Project	C, O, D	Adverse	Long term	Negligible	Implement Chance Finds Procedures & control vehicle tracking	EMS. Develop and implement Chance Finds Procedures & control vehicle tracking	All Contractors / Departments, supported by Environment Department
LV1	Landscape and Visual	Change in landscape	Mine site and Borefield	C, O, D	Neutral	Medium Term	Negligible	Not applicable	No mitigation measure required	Not applicable
LV2	Landscape and Visual	Visual impact of additional infrastructure and equipment	Mine site and Borefield	C, O, D	Neutral	Medium Term	Negligible	Not applicable	No mitigation measure required	Not applicable
T1	Traffic	Increased Traffic	Mine site and Borefield	C, O	Adverse	Short Term	Low	Optimise traffic levels where practical to do so and comply with traffic rules around site.	Ensure compliance with legislation e.g. carriage of hazardous materials and use of security escorts where necessary; monitoring of complaints from local community	H&S, supported by Environment Department
T2	Traffic	Traffic Accidents	Mine site and Borefield	C, O	Adverse	Short Term	Low	Minimise the risk of traffic accidents	The enforcement of driver training and speed limits along all roads. Also ensure that all roads are clearly sign posted. Accident reporting procedure in place.	H&S, supported by Environment Department
W1	Waste	Generation of domestic and	Mine site	O	Adverse	Medium Term	Moderate	Waste management	Segregate wastes into	All Contractors / Departments,

Ref No.	Issue	Impact	Location	Phase	Nature of Impact	Duration	Significance	Management Objective	Mitigation / Monitoring	Responsibility
		hazardous wastes from camp and passenger terminal building						system in place, minimise litter, reuse of materials where practical.	appropriate categories for subsequent disposal/treatment using on-site landfill and incinerators. Hazardous wastes to temporary on-site storage prior to disposal to a suitable off-site facility	supported by Environment Department
W2	Waste	Generation of construction waste	Mine site	C	Adverse	Short Term	Low	Waste management system in place, minimise waste where practical.	All construction waste to be collected and returned to waste compound for management. Combustible waste to be incinerated. Non-combustible waste to be disposed of in on-site landfill.	All Contractors / Departments, supported by Environment Department
W3	Waste	Surplus excavated soil/rock	Mine site	C	Adverse	Short Term	Low	Minimise surplus excavation material where practical.	Surplus soil/rock to be re-used in construction where possible.	Contractors / Mining Department supported by Environment Department
W4	Waste	Bio-solids from waste water treatment facilities	Mine site	O	Adverse	Medium Term	Moderate	Appropriate disposal of bio-solids	Dispose of by on-site incineration, landfilling or land application (following stabilisation)	Maintenance Department / Contractors supported by Environment Department

Ref No.	Issue	Impact	Location	Phase	Nature of Impact	Duration	Significance	Management Objective	Mitigation / Monitoring	Responsibility
W5	Waste	Treatment chemicals	Mine site	C, O	Adverse	Medium Term	Low	Avoidance of chemical spills	Collect any hazardous waste and temporarily store in waste compound prior to off-site disposal at suitably licensed facility.	Treatment / Maintenance Departments /Contractors supported by Environment Department
W6	Waste	Concentrated brine from process / potable water treatment	Mine site	O	Adverse	Medium Term	Low	Alternative use for saline water identified	Use on site for dust suppression	Treatment / Maintenance Departments / Contractors supported by Environment Department
W7	Waste	Waste oil and sludge	Mine site	C, O	Adverse	Medium Term	Moderate	Avoidance of spills	Waste oils, stored in the hazardous liquids facility operated by TOTAL and removed for appropriate off-site disposal	All Contractors / Departments, supported by Environment Department
W8	Waste	Leachate and landfill gases	Mine site	O, D	Adverse	Long Term	Moderate	Adequate capping of facility	Adequate capping of facility	
W9	Waste	Small quantities of waste lubricants/oil	Borefield	C, O	Adverse	Medium Term	Low	Avoidance of spills	Waste lubricants/oil to be collected and returned to Mine site for management at TOTAL hazardous liquids facility.	All Contractors / Departments, supported by Environment Department
W10	Waste	Small quantities of construction waste	Borefield	C	Adverse	Short Term	Low	Waste management system in place, minimise waste where possible.	Construction waste to be collected at point of generation and transported to Mine site for landfill or incineration. Surplus soil/rock to	All Contractors / Departments, supported by Environment Department

Ref No.	Issue	Impact	Location	Phase	Nature of Impact	Duration	Significance	Management Objective	Mitigation / Monitoring	Responsibility
									be re-used in construction.	
CC1	Climate Change	Increased GHG Emissions contributing to global warming	Mine site and Borefield	C,O	Adverse	Medium-Long Term	Low	Minimise GHG emissions as far as practicable; calculate and publish annual carbon footprint data (define methodology)	Monitoring of energy consumption	Maintenance Department / Contractors, supported by Environment Department

18.4 Environmental Monitoring

A monitoring programme has been developed for Tasiast Mine and is set out in the existing EMP. The general Mine monitoring programme is presented in Table 18-4 this will be extended to include the Phase 1b expansion (see discussion below). The Environment Department will be responsible for overseeing and auditing all environmental monitoring, with the Community Relations Department in charge of social programme monitoring. Elements of the environmental sampling/monitoring may be undertaken by contractors or outsourced to external laboratories as appropriate. The monitoring programme will be reviewed and updated on an annual basis.

The current environmental monitoring programme for the Mine is outlined in Table 18-4 below. Some aspects of the monitoring programme are still in the process of being implemented and revised in conjunction with the EMS.

Table 18-4: Existing Tasiast Environmental Monitoring Programme

Issue	Monitoring Locations	Parameters	Frequency
Climate	Weather Station – Tasiast Gold Mine	Rainfall, Wind Speed and Direction, humidity, Temperature, Evaporation	Daily
Air Quality	Office complex	CO_2, NO_2, SO_2, Ammonia, Particulates, additional heavy metals if identified in ores	Annually
Surface Water	No perennial surface water	Any issues arising from storm events	As/when occur
Groundwater levels	All boreholes within the Mine site and east and west of the borefield.	Groundwater levels for integration into groundwater model	Weekly
	Water abstraction points within 50 km of the Aquifer (Bennichab, Wadi Chibka)	Groundwater levels	Quarterly
Groundwater Quality	Water quality of the borefield	pH, Turbidity, TDS, TSS, EC, Ca, Mg, Na, K, Cl, Sulphates, Bicarbonate	Monthly
	Shallow boreholes around leach facility, and TSF II	Heavy metals (as per IFC EHS Guidelines for Mining), cyanide (WAD) and major cation/anion content (if water can be extracted)	Quarterly
	Mine site monitoring boreholes	Heavy metals (as per IFC EHS Guidelines for Mining), cyanide (WAD) and major cation/anion content (if water can be extracted)	Quarterly
Potable water supply	RO plant	WHO guidelines	Annual
Cyanide Levels	Processing Plant, TSFs, TSF/leach facility pipelines, leach facility and solution ponds and CN storage area	Cyanide – through indirect monitoring by measuring flows and concentrations of cyanide throughout the process HCN (emergency HCN detectors at strategic locations – part of TMLSA Occupational Health and Safety monitoring)	Daily/Continuously

Issue	Monitoring Locations	Parameters	Frequency
Dust	TSFs, leach facility, Crusher, Open Pit, Haul roads and Waste Rock Dumps	Visual assessment of dust concentrations	Daily
Acid Rock Drainage	Waste Rock, Ore Stockpiles, Tailings	Acid Base Analysis of waste rock, stockpiles and tailings	Annually
Flora and Fauna	TSFs/leach facility	Record bird and animal fatality at each TSF/along access road. Record other sightings/incidents involving birds, mammals and reptiles.	Daily with monthly reports (including photographic records) to be forwarded to PNBA
Environmental Management Programme	Tasiast Gold Mine	Audit of the Environmental Management Programme	Internally (6 months); Independently (Annually)

Additional monitoring requirements recommended for the Phase 1b are detailed in Table 18-5 and are based on the impacts and mitigation measures identified in Table 18-3.

Table 18-5: Phase 1b Tasiast Environmental Monitoring Programme

Issue (Receptor)	Monitoring Locations	Parameters	Frequency
Surface Water & Groundwater	New TSF 3 starter cell; borefield; water treatment plant; sewage treatment plant	Monitoring boreholes to be analyzed for pH, Turbidity, TDS, TSS, EC, Ca, Mg, Na, K, Cl, Sulphates and Bicarbonate; and water levels checked. TSF decant water also to be analyzed periodically; routine checks for seepage/leaks from TSF. Annual water balance for mine to be calculated. Potable water quantity & quality to be monitored & sewage effluent. Performance against Stormwater Management Plan and Water Use, Discharge and Conservation Management Plan.	Borehole & TSF decant water sampling to be aligned with Mine's existing quarterly monitoring programme, or more frequent if contamination suspected. TSF seepage/leak monitoring to be incorporated into daily site inspections.
Air Quality	Existing camp, DLF, fuel farm, Cyanide Store, West Branch (locations will be reviewed following 3 months of results); dust inspections across whole Mine site; power station emissions and fuel quality/quantity at fuel farm.	NO_2, NO_x, SO_x, Ozone & Acid Gases; Visual dust assessment; emissions performance; fuel consumption including quality. Performance against Air Emission Management Plan.	Continual monitoring over a monthly period throughout construction of Phase 1b components; dust levels to be monitored as part of daily site inspections.
Noise & Vibration	Current and proposed accommodation	'Free field' noise measurements at height of 1.2m using all-weather protected microphones.	Construction and operation of Phase

Issue (Receptor)	Monitoring Locations	Parameters	Frequency
	camps and offices	Performance against Construction Management Plan.	1b.
Soils & Land Use	TSF 3 starter cell	pH and Heavy metals. Performance against Construction Management Plan.	One baseline survey has been undertaken and future surveys to be reviewed in line with Mine's existing environmental monitoring programme.
Ecology	All Phase 1b components at Mine site & Borefield, with particular emphasis on bird and wildlife sightings at TSF3.	All environmental issues, including waste management, chemical spills, soil and water contamination, ecology, etc. Performance against Flora, Fauna and Biodiversity Plan.	Daily site inspections and periodic audits.
Socio-Economic (community perceptions, accommodation camps, employee terms & conditions, occupational H&S)	Local Community; Mine site	Public Consultation & Grievance Mechanisms; Compliance with Tasiast standard for camp accommodation; Validity of Work Permits, fair conditions of contract, worker consultations, disciplinary actions and grievance procedure; Provision of suitable resources including trained specialists, risk assessments and controls (Lock-Out, Tag-Out and Hot Works methods, PPE, training and information). Accidents/incidents and injuries. Performance against Public Consultation and Disclosure Plan, Site Responsibility Plan, OHS Management Plan.	Supervision by HR, H&S and Community Relations team as appropriate; periodic site inspections and audits.
Archaeology & Cultural Heritage	All Phase 1b components at Mine site & Borefield	Chance Finds, condition of known sites (e.g. any incidents resulting in loss or damage). Performance against Archaeology and Cultural Resources Management Plan.	Routine site inspections of known sites & periodic audits.
Landscape & Visual	N/A	N/A	N/A
Traffic	Access Road and internal mine roads	Traffic category & volume monitored at gatehouse; complaints monitored by Community Relations Department; condition of road signs & accidents monitored by H&S. Performance against OHS Management Plan.	Continuous

Issue (Receptor)	Monitoring Locations	Parameters	Frequency
Waste Management	Mine Site	Volumes & types of wastes entering landfill ; incinerator feedstock & performance; odour & litter checks; long term leachate/gas monitoring from landfill. Performance against Waste Management Plan.	Quarterly reporting of waste operations
Climate Change	Power Station & Fuel Farm	Fuel consumption; GHG reporting.	Quarterly, with annual data being used to calculate carbon footprint.

18.4.1 Environmental and Social Management Plans

The environmental and social management programme will be supported by a set of tailored environmental and social management procedures for specific aspects of the Project, which provide guidelines and protocols for the day to day activities during construction, operation and closure of the Mine.

Development of these procedures will be an evolving process in collaboration with Kinross corporate policies and integration of the EMS and existing working practices. Where necessary, new documentation will be developed. Where there is no equivalent in the Mine's existing EMS, the new documentation shall be prepared during the construction stage by the Project Management Team/Project Environmental Officer in liaison with the Environmental Department, and then adapted for the operational phase upon handover to the Environmental Manager.

It is anticipated that specific plans developed for the Project will include the following:

- Air Emission Management Plan;
- Archaeology and Cultural Resources Management Plan;
- Chemicals and Petroleum Management Plan;
- Construction Management Plan;
- Consumable and Hazardous Material Transportation Management Plan;
- Cyanide Code Management Plan;
- Energy Use and Conservation Measures;
- Emergency Preparedness Plan;
- Flora, Fauna and Biodiversity Plan;
- Hazardous Materials and Solid Waste Management Plans;
- Waste Management Plan;
- Materials Management Plan (ARD/ML);
- Performance Measurement and Monitoring Plan;

- Spill Prevention and Response Plan;
- Stormwater Management Plan;
- Tailings Dam Operations, Maintenance and Surveillance Plan;
- Water Use, Discharge and Conservation Management Plan;
- Public Consultation and Disclosure Plan;
- Site Responsibility Plan;
- Occupational and Community Health and Safety Management Plan;
- Community Development Plan; and
- Retrenchment Plan.

18.4.2 Auditing and Reporting

Audits will be undertaken at regular intervals throughout the Project life, and also in response to any perceived non-conformance incidents, in order to assess the level of compliance with the EMP. The Mine's Environmental Manager will devise and undertake a programme of internal environmental site inspections and more formal audits to ensure compliance with the EMP; this will include weekly inspections to be carried out by the Project Environmental Officer during construction works. It is also recommended that the Kinross corporate team undertakes less frequent, but routine audits. An independent audit will take place bi-annually to objectively validate the success of otherwise of the Mine's performance.

The audit process will identify actual and potential instances of non-conformance that will require various levels of corrective actions to address the causes and/or consequences and prevent their occurrence or recurrence. Such actions will be implemented by the responsible TMLSA department or contractor and checked by the Environment Department to ensure they are effective in addressing the original problem. In addition, any urgent environmental issues identified during routine workplace inspections by the Environment Department will be followed up by a memo to the relevant contractor detailing any necessary corrective action.

Contractors will be responsible for the overall condition of the facilities and general housekeeping within their designated area of responsibility, including any specific environmental and health and safety controls. Contractors will be inspected and audited by their own, trained management or personnel as appropriate. Contractors will be required to submit regular progress reports to the Environmental Manager detailing their environmental performance.

Quarterly/Annual Environmental Reports will be produced by the Environmental Manager and will be incorporated into the existing reporting programme on environmental performance to the Ministry of Environment.

18.5 Emergency Response Plans

Under Mauritanian legislation and in keeping with best international practice, the EMP is required to consider emergency response planning. Key risks that were identified for the existing Mine site are as follows (SNC Lavalin, 2004).

- Fire at the diesel storage facilities or power plant, following any leakage of diesel, lubricant oil or transformer cooling oil or ignition of vapour accumulated in tanks during maintenance;

- Spillage of cyanide or cyanide solution during transfer, handling or storage causing harm to people and the environment;
- Accidental mixing, heating of cyanide or cyanide in solution causing release of toxic hydrogen cyanide;
- Accidental spills of other harmful chemical products;
- Accidental explosion of ANFO during explosives preparation;
- Pit failure, caused by unstable geotechnical conditions; and
- Waste rock dump or TSF failure caused by extreme climatic conditions such as extreme rainfall events, which significantly exceed the design criteria for the TSF and waste rock dump.

Of these risks, the following are particularly relevant to the Phase 1b expansion.

- Fire at the HFO/diesel storage facilities or power plant or incinerator or waste management facility (sorting area/crushers/used tire store), e.g. following any leakage of fuel, lubricant oil or transformer cooling oil or ignition of vapour accumulated in tanks during maintenance (HFO power plant, fuel farm and airstrip) or other source of ignition of flammable materials;
- Accidental spills of fuels or other harmful chemical products (Water treatment facilities, TSF 3, hazardous waste storage facilities) in gas, liquid or solid form with resulting in releases of toxins or other harmful substances to the environment;
- TSF failure caused by extreme climatic conditions such as extreme rainfall events, which significantly exceed the design criteria for the TSF and waste rock dump (TSF 3), or seismic events (latter unlikely).

An additional risk relates to the potential for a plane crash at the new airstrip, which will be designed to take larger planes.

Specific emergency response procedures will be reviewed/developed by TMLSA to address all risks identified in connection with the Project. These procedures will be incorporated into the EMS and will include descriptions of actions to be taken in the event of emergencies, set out clear lines of responsibility for actions, list all relevant contact numbers for authorities capable of providing assistance and identify the location of any abatement equipment held on site.

The existing Environmental Emergency/Spill Prevention and Response Plan shall be enhanced and will include provisions for:

- **Scenario planning:** including the identification of most likely incidents and events across the Mine and area occupied by expansion program facilities, assessment of risks and determination of suitable and sufficient preventive measures and response plans, and incident reaction procedures. Plans shall cover fire/explosion; air crash/vehicle collision; spills and leaks ;
- **Resources and capacity building**: including acquisition of adequate resources such as additional Fire/Spill/Medical emergency equipment, formation of incident response teams, provision of training, program of simulations/drills to test effectiveness of planned response measures, etc.;
- **Routine site inspections**: to check on adequacy/functionality of all detection/alarm systems and emergency equipment (fire fighting, spill kits, emergency evacuation routes, First Aid provision, etc);

- **Incident management/coordination**: including timely notification of Mine management, corporate functions and competent authorities; supervision of salvage/de-contamination/cleaning/waste management activities; and
- **Notification, investigation and reporting**: of all incidents and significant 'near misses' for both internal and external authorities and other stakeholders.

19 Preliminary Rehabilitation and Closure

19.1 Introduction

The existing operations at the Mine are supported by a Preliminary Reclamation and Closure Plan (RCP) (Scott Wilson, 2008d) as well as further commitments in the EIA for the West Branch Development (Scott Wilson, 2010a). As part of the Project, an inclusive preliminary RCP (URS Scott Wilson, 2011f) is being developed for the rehabilitation and closure of facilities associated with existing Mine operations and the Project.

This Section deals with rehabilitation and closure of Phase 1b Project components.

19.2 Background

The preparation of a preliminary RCP prior to initiation of the Project activities is an integral part of an EIA and an intrinsic factor in the development of the overall operations plan. By identifying the facilities that require decommissioning and the actions necessary to accomplish the successful closure of the site early in the planning stage, a clear definition of the closure process is determined.

The RCP also represents a base document that will be modified and updated as the cessation of operations approaches and detailed closure requirements are finalised. It identifies provisional end land uses for the Mine, together with estimated costs to achieve these objectives.

It is acknowledged that the Mauritanian Government requires a financial guarantee that will cover the costs to rehabilitate and close the Mine should TMLSA cease operations before the end of the planned Mine life. An indication of the costs of the proposed operational decommissioning is therefore set out at the end of this section, which will form the basis for the establishment of a financial guarantee (reclamation bond).

19.3 Rehabilitation and Closure Objectives

19.3.1 General

In line with Mauritanian legislation (notably Decree No. 2004-054) and in order to ensure the environmentally and physically stable and safe closure of the Mine a preliminary RCP is being prepared. The closure of each component of Phase 1b has been designed to accord with previous closure commitments in the Preliminary RCP (Scott Wilson, 2008d) and West Branch EIA (Scott Wilson, 2010a) for similar facilities.

Closure activities will be undertaken to enable TMLSA to obtain the necessary closure certificate (environmental acquittal) from the RIM. Closure of each component of the Mine has been designed with consideration of the following (see Section 19.3.2 to 19.3.8).

19.3.2 Worker and Public Health and Safety

The protection of worker and public health and safety is a core objective of the RCP, and this aspect of the detailed RCP will be developed two years prior to closure. TMLSA will undertake a risk assessment to identify potentially high-risk situations, which may occur on the Mine site during rehabilitation, and once rehabilitation has been completed. This process will include development of an emergency plan, including safety measures, which will detail the measures to be applied in the event of an accident.

Closure works will be designed to ensure that safety of workers, and similarly, the closure strategy will incorporate elements to eliminate, or as a minimum significantly reduce the risk to public safety associated with the Mine.

19.3.3 Physical Stability

Any structures that remain after the closure will be engineered to be physically stable and therefore not represent a risk to public health and safety. TMSLA will ensure, and document in the RCP that structures, if retained for a particular function (such as waste rock dump berms) are designed to continue that function after closure.

For example, where drainage flows are important, drains will be designed to remain operational, and all contours across the restored/reclaimed areas designed to minimise erosion and promote structural and geochemical stability.

19.3.4 Chemical Stability

The consequences of chemical instability and leaching of chemicals into the environment, from mining and processing activities, should not endanger public health and safety or lead to exceedances of the relevant water quality limits for surface and groundwater resources.

If necessary, the detailed RCP will identify the need for any specialist studies which may be necessary to inform the design of measures to ensure the protection of water resources.

19.3.5 Land Use

In the closed condition, the rehabilitated site will be compatible with the surrounding lands, to the extent that is both practical and economical. The acceptability of a RCP will involve a review of the naturally occurring physical hazards, level of environmental impact or benefit; and expected post-operational use of the mining affected area and the compatibility with the surrounding land.

19.3.6 Self-sustaining Ecosystem

The establishment of a self-sustaining ecosystem on mining impacted land is heavily dependent on site conditions. In addition there may be specific legislative requirements and/or controls. In general, the aim of the RCP is to re-establish an ecosystem which is similar to that which existed before mining related disturbance.

The pre-mining conditions at the Mine site are characterised by arid, low productivity landscape with sparse and limited vegetation. The potential to salvage any significant topsoil stockpiles during land clearance is limited, if any. However, if possible, topsoil will be collected where present to preserve the local flora seed bank.

19.3.7 Reclamation Maintenance

The requirement for maintenance of rehabilitated areas for a few of years is anticipated. Maintenance typically includes repairs that result from storms, reseeding, and normal maintenance of structures or facilities until management control can be transferred to the post mining land use, or a self-sustaining system is achieved.

19.3.8 Social Sustainability

The Mine should leave a positive legacy on surrounding communities, employees, suppliers and any other people associated with the operations, although in the case of this project there

are no communities near to it. Adverse effects on human life as a result of the Mine closure should be minimised, in terms of service provision, general environmental health and any safety hazards associated with the site.

19.4 Rehabilitation and Closure Strategy

19.4.1 General Strategy

Based on the stated objects the overall strategy for the closure of the Mine is:

- Identify, through consultation, infrastructure which can be retained and handed to third parties (e.g. airstrip/Government) for use;
- Removal as far as practicable, all Mine related installations, structures and infrastructure not identified for retention and hand over;
- Salvage for allocation to other operations, all equipment, mechanical and electrical plant, identified in the asset register as having a residual useful life;
- Removal from the Mine site as scrap if economically viable, following decontamination where needed, of all equipment, plant and structures not deemed suitable for future refurbishment and re-use;
- Closure design options which are practical and cost effective;
- Implement procedures which address the balance between affordability and long-term liabilities and responsibilities;
- Phased closure of the facility making allowance in the implementation timeframe for retention of facilities required to support the closure process and subsequent post closure monitoring activities;
- To restore the landscape to a state which is in-keeping with surrounding land uses, and to a condition which is safe and suitable for an alternative use through passive revegetation;
- To address adverse environmental impacts resulting from the site activities such as soil contamination, ground and surface water pollution and poor air quality;
- To minimise residual impacts requiring ongoing post closure monitoring of the facility; and
- To adequately address the negative social impacts resulting from closure and enhance any positive legacies which can benefit the communities affected by the closing down of the facility.

Section 19.4.2 to 19.4.6 outline rehabilitation and closure strategy for specific Phase 1b Project components.

19.4.2 Tailing Storage Facility and Residual Fluid Management

Phase 1b will involve the construction and operation of a new TSF 3 starter cell covering an approximate area of 77 ha. Ultimately the starter cell will form part of Cell 1 of the overall TSF (to be constructed in Phase 2) and the detailed design will include an element of planning for closure. The final design of closure-specific aspects will be undertaken towards the end of the Mine's operational life, or the operational life of each cell. Capping simulations may be required to determine the final optimum thickness of waste rock needed. However, for the purposes of planning and cost estimation the following management measures are assumed:

- Design of the TSF outer slope angles and final cap gradient, to ensure that they are resistant to erosion;
- All delivery and return pipes, and pumps and associated infrastructure (including power supplies) will be removed;
- If applicable, sealing of the decant;
- All water in the TSF managed in accordance with the fluid management plan;
- Final TSF drain down will be managed via passive evaporation with an evaporation pond constructed at time of site closure;
- If necessary, erosion control measures such as contour drains will be installed to transfer stormwater to the open pit and/or existing surface water channels (wadis);
- Capping of TSF surface with a suitable soil/rock thickness to prevent windblown tailings;
- Grading of capped TSF surface to allow natural run-off of storm water (possibly incorporating contour drains (not costed at this stage); and
- TSF3 cells will be utilised throughout operations and until final closure; and

19.4.3 Mine and Plant Facilities

Phase 1b will include a new power plant and various buildings (such as the accommodation camp). The following closure measures will be implemented for the Mine power plant structures, buildings and their foundations:

- Salvage all equipment of economic value;
- Demolition/dismantling of plant and accommodation facilities;
- Assessment of contaminated substrate (may require contaminated land investigation);
- Implementation of any necessary contaminated land remediation;
- Break up all foundation structures and coverage with approximately 0.5 meter of fill;
- Breaking/ripping of any hard-standing areas and compacted ground; and
- Re-grading of areas to establish suitable topography.

Special measures will be implemented, where necessary, to decontaminate any areas which could contain residual cyanide or other hazardous materials.

Except as identified in past EIAs for the water abstraction borefield, this closure approach does not include potential closure cost savings for alternative uses for infrastructure and buildings by potential stakeholders after closure. Such opportunities will be investigated during the operational life.

19.4.4 Waste Management Areas

In order to manage the potential closure issues associated with landfills the following measures will be implemented:

- Capping and re-profiling of the landfilled areas with at least 1 m of earth/rock;
- Re-grading of the area to blend with adjacent topography; and
- The re-profiled surface of landfill and associated areas will be treated in accordance with the Surface Management Plan.

19.4.5 Roads and Airstrip

For the purposes of the preliminary RCP, the following closure measures will be adopted for internal Mine roads and the proposed airstrip:

- Minor re-grading of roads, including removal of any safety berms, to blend in with local topography;
- Re-grading of any cuttings to ensure stable slope; and
- Reinstatement of any water course diversions to original flow patterns.

This closure approach does not include potential closure cost savings for alternative uses for roads and the proposed airstrip by the Government or other third parties after closure. Such opportunities will be investigated during the operational life.

19.4.6 Surface Management Plan and Revegetation

- Following the removal and/or demolition of all surface where necessary, specific aspects of the site will then be regraded to ensure:
- Landform fits in with surrounding topography;
- Drainage is not directed to erosion sensitive features (e.g. TSF impoundment walls); and
- Site drainage is routed to the open pit and/or existing surface water channels (wadis).

No significant seeding/revegetation is anticipated to restore the mine footprint to pre-mining conditions. At closure, a strategy will be implemented (via an updated RCP) to optimise conditions for the passive re-establishment of vegetation and subsequently native wildlife. The strategy will also ensure that invasive alien plant species are not introduced and, as required by IFC Performance Standard 6, no planting of non-native flora will be undertaken anywhere within the Mine.

19.5 Rehabilitation and Closure Schedule

The closure costs presented below are based on the closure and rehabilitation of all areas at the end of mine life. There may be scope for a proportion of these costs to be incorporated as normal operating costs during the life of mine, as facilities and infrastructure become redundant. The opportunities for progressive remediation and therefore reclamation will be exploited during operations at the site and the overall closure costs adjusted to reflect these actions.

Implementation of the RCP is anticipated to take approximately three years to complete. The decommissioning of individual items may be completed sooner, for example the decommissioning of the items of the process plant will take approximately 12 months.

19.6 Rehabilitation and Closure Costs

In line with Mauritanian legislation, an estimate has been provided of the costs associated with the decommissioning and rehabilitation of Phase 1b Project components.

These costs are indicative only and will be refined in more detail in the final RCP, submitted two years prior to mine closure. The total estimated cost of decommissioning and rehabilitating Phase 1b Project components is in the order of US$ 3,724,091 as summarised in Table 19-1.

Table 19-1: Rehabilitation and Closure Costs

Phase 1b Project Component	Area (ha)	Total Cost (US$)	Closure Strategy Summary
TSF3 starter cell	77	1,566,950	The TSF will be a permanent feature and will be capped with approximately 0.6 m of average fill based on the construction of approximate 2.5 m thick and 20 m wide access roads at 100 m intervals across to provide equipment access across the tailings surface. Tipped material will be pushed out into the spaces between the access roads and finally graded to achieve the necessary design profile. Design of the TSF outer slope angles and final cap gradient, to ensure that they are resistant to erosion.
Phase 1b power plant	0.45	5,546	This facility will be dismantled and removed for re-use or sale. Foundations will be removed to a depth of 500 mm and, if necessary, areas re-graded.
Waste management facility	0.4	4,9323	Compaction followed by capping with 500 mm depth rock fill cover.
Potable water treatment plant	0.03	6,223	This facility will be dismantled and removed for re-use or sale. Foundation will be removed to a depth of 500 mm and, if necessary, areas regraded.
Sewage treatment plant	0.25	3,371	This facility will be dismantled and removed for re-use or sale. Foundation will be removed to a depth of 500 mm and, if necessary, areas re-graded.
Proposed airstrip (includes hanger, fuel storage and terminal building)	22.66	526,064	Structures will be dismantled and removed for re-use or sale. Foundation will be removed to a depth of 500 mm. All area will be ripped and, if necessary, the area re-graded.
Fuel farm	0.5	6,166	Structures will be dismantled and removed for re-use or sale. Foundation will be removed to a depth of 500 mm. All area will be ripped and, if necessary, the area re-graded.
Phase 1b construction accommodation camp	57.71	1,566,365	Structures will be dismantled and removed for re-use or sale. Foundation will be removed to a depth of 500 mm. All area will be ripped and, if necessary, the area regraded.
Concrete batch plant (including mobile crusher and truck wash)	1.5	18,498	This facility will be dismantled and removed for re-use or sale. Foundation will be removed to a depth of 500 mm and, if necessary, areas regraded.
CIL Process Plant, Mill and Power Plant Foundations	22.2401	25,576	This facility will be dismantled and removed for re-use or sale. Foundation will be removed to a depth of 500 mm and, if necessary, areas regraded.
Total	**182.74**	**3,774,082**	

19.7 Rehabilitation and Closure Monitoring

Appropriate management and monitoring activities during, and after closure, will be carried out to ensure that the environment is not impacted in a negative way during the implementation of the RCP.

The main environmental activities and potential risks associated with closure activities are linked to TSF dewatering and dump leach rinsing and CIL drain down.

Post closure monitoring will be focused on those activities associated with monitoring of closed pit lake and groundwater and primary activities associated with residual fluid management and routine inspections on the continued reclamation success.

Water rebound and quality will also be monitored in the open pits.

Tasiast will implement a program of post-closure environmental inspection and monitoring. The overall aim of the monitoring will be to confirm that the works undertaken with respect to environmental and public safety protection during the closure and reclamation have been effective. The monitoring will also provide an early warning system to identify any unforeseen issues associated with key environmental receptors after closure.

The monitoring will assess the progress of mine reclamation and verify that the various components of the closed mine are not adversely impacting adjacent drainage ways and groundwater, and do not pose a potential health risk and/or danger to the public. In some cases these monitoring activities may be a continuation of those already being implemented at the site during operations, for example, groundwater monitoring.

The reclamation period is estimated to require 3 years post closure followed by 2 years of post reclamation monitoring. This post-closure monitoring period will be reviewed during the mine life and updated in the detailed RCP prior to its implementation.

20 Consultation

20.1 Pre-consultation Meetings

The process of public consultation for Phase 1b commenced with a ToR meeting held on the 24 March 2011 to present the ToR to the relevant Ministries, including MPEM, MESD and MWS, and obtain any comments to be addressed at the subsequent submission of this EIA report.

Following incorporation of the comments from the authorities, the ToR for Phase 1b was formally approved in May 2011.

20.2 Consultation

Following approval of the ToR, a **sensitisation campaign** was undertaken to raise stakeholder awareness on the wider expansion programme and on the specific components of Phase 1b and to formally invite them to the public meeting, originally scheduled for 15th May 2011 at the 'Gare du Nord' (i.e. the Total service station on the Nouakchott-Nouâdhibou N2 highway south of the access road junction).

In addition, meetings were convened with **local administrative** officers of both the Inchiri and Dakhlet- Nouâdhibou Wilayas at Akjoujt on 10 May 2011 (separate meetings with the Wali and then with the Hakem and representatives of various local services). Meetings were also held at Nouâdhibou on 12 May 2011 (with the Administrative Wali and then the Economic Development Wali). The objectives of these meetings were to inform the participants, issue formal invites and listen to any immediate feedback regarding the Project and the public consultation process. See Section 11.3.2 for comments raised during these meetings.

The **public consultation meeting** at the Gare du Nord on 15 May 2011 was cancelled by local administrative officers and rearranged for the 18 May 2011 at El Asma (on highway from Nouakchott to Akjoujt). The meeting was chaired by the Inchiri Wali and Hakem of the Moughataa of Akjoujt (see Photographs 21-1 to 21-3).

The purpose of the various public consultation meetings was to allow stakeholders the opportunity to offer their comments and suggestions regarding the Project and its various impacts, both verbally and in writing. Written comments were entered into the formal register which included the Hakem's stamp. A record of proceedings was made by a team of scribes and is presented in Table 20-1. A copy of the original Register and a translation of the comments are included in Appendix 5.

The public meeting was well attended with 128 stakeholders and members of the press were also present. In addition to representatives from Kinross, the participants included:

- **Ministry of Environment and Sustainable Development:** including the Director of Environmental Control; Inspector and Regional Delegate from the Minister Delegate to the Prime Minister in charge of the Environment and Sustainable Development;
- **Officials:** the Hakem of the Moughataa of Akjoujt; the Head of the Bennichab District; and the Commander of the Bennichab Brigade and Police Force;
- **Elected officials:** The Mayor of Bennichab; the mayor of the commune of Akjoujt; the senator of Inchiri; and the national senator, environment section;
- **Other:** journalists, various NGO's, including women's cooperatives; and

- **General members of the public:** from towns in the Commune of Bennichab, the Moughataa of Akjoujt, the Wilaya of Inchiri, the Wilaya of Dakhlet Nouâdhibou, the Commune of Mamghar and the Commune of Boulanouar, university graduates and job seekers.

20.3 Issues and Concerns Raised During Consultation

A number of comments regarding Phase 1b of the Project were raised by the stakeholders attending the public consultation meeting. Where appropriate the comments relating to Phase 1b of the Project have been addressed in the relevant Section of this EIA. Certain issues raised during the public consultation focussed on issues wider than Phase 1b of the Project. These issues will be dealt with either through future EIA's for the Project, namely Phase 2 or Phase 3 or through TMLSA's own "Site Responsibility Plan" which focuses on community development.

Table 20-1 outlines the key themes and issues reflected in the comments raised and where these issues have been addressed in this EIA or alternatively through TMLSA/Kinross own policies.

Table 20-1: Key stakeholder comments raised during public consultation

Subject	Comments	Relevant Section of Report
Water	Water resources: • Potential pollution of groundwater; and • Depletion of groundwater resources, including Bennichab and Boulanouar aquifers.	Section 6 – Surface water and groundwater
	Water provision: • Provision of additional water supplies for local community; • Provision of boreholes and/or water supply stations for local community;	Section 11 – Socio-economics; and Section 20.5 – Social initiatives
Air quality	• Workers and local community are exposed to dust resulting from mining operations.	Section 7 – Air quality
Social initiatives	• Lack of infrastructure investment in surrounding villages and towns; • Development of sustainable business initiatives for women; • Request Kinross provide finance for a radio network for region; • Assistance for persons affected by flood.	Section 20.5 – Social initiatives
Health	• Workers and local community are potentially exposed to toxic emissions resulting from mining operations.	Section 7 – Air quality
	• Provision of health care facilities for works and local community; • Currently there is only one doctor located at the Mine.	Section 11 – Socio-economics
Archaeology	• Request an archaeological study is undertaken for the Mine area.	Section 12- Archaeology and cultural heritage
Transport	• Provision of transportation for local community, such as a bus service;	Section 20.5 – Social initiatives

Subject	Comments	Relevant Section of Report
	• Develop of road between Bennichab and El Gaiche; • Development of access to remote areas; • Maintenance of and removal of sand from roads.	
Waste	• Provisions for waste removal within local community; • Provision for waste treatment at the Mine.	Section 15 – waste management
Employment	• Employment for local persons, for young persons and persons who speak Arabic; • Local contractors should be employed to carry out work on the Mine rather than international companies; • Need for transport to Mine for potential employees	Section 11 – Socio-economics
Education	• Provision of schools and training facilities in surrounding area.	Section 20.5 – Social initiatives
Agriculture	• Quarries and borrow pits prevent rain water flowing downstream through the wadis.	Section 6– Surface and Groundwater
	• Lack of access to pastoral land for livestock due to Mine perimeter fence	Section 9 – Soils and land Use
	• Request revegetation area to prevent spreading of dunes and to mitigate dust • Death of livestock due to lack of water resources; • Development market gardening scheme for local community.	Section 20.5 – Social initiatives
Management and Reporting	• Request rigorous environmental management of operations and reporting thereof; • Cyanide certification	Section 18- Environmental management
	• Creation of a support fund for environmental liabilities remaining after Mine closure	Section 19 – Preliminary rehabilitation and closure
Consultation	• Local community is willing to cooperate with Kinross • Request and annual stakeholder meeting is held to discuss the Mines operations; • Request stakeholder involvement in monitoring performance of Mine operations.	Section 20 - Consultation

20.4 Mitigation Measures

All the comments raised during the public consultation have been taken into consideration and incorporated into the EIA process where appropriate.

A number of issues and concerns raised are not specific to Phase 1b and are therefore not directly applicable to this EIA. They were, however, taken on board by Kinross/TMLSA and will be taken into consideration where appropriate in the overall environmental and social management of TMLSA's activities and/or the EIA studies for subsequent phases of the

Project, particularly in regards to the Phase 2 developments which will examine the wider impacts of the expansion programme.

However, the following information confirms the Mine's intentions on two key stakeholder concerns:

- **Cyanide certification:** Kinross/TMLSA shall seek certification against the International Cyanide Code which sets out specific requirements for personnel training, the design of facilities, preparedness for potential emergency situations and consultation with communities. Certification means that Kinross/TMLSA will have to clearly demonstrate compliance to those requirements during external audits by qualified independent specialists. Certification is likely planned within one year after Project commissioning is complete.
- **Extractive Industries Transparency Initiative:** Kinross/TMLSA supports the principles and criteria of the Extractive Industries Transparency Initiative (EITI), and will support the efforts of Mauritania to become compliant with the initiative. In addition, TMLSA shall define and implement an EITI Plan to ensure full and transparent disclosure of all payments made directly or indirectly to the government, public authorities or public officials throughout the lifetime of the Mine.

20.5 Social Initiatives

In addition to the social impact mitigation measures described in Section 11, TMLSA will pursue community support strategies aimed to enhance local participation in the socio-economic benefits of the Project. These programs will be continuously updated as part of the Site Responsibility Planning process, taking into account the results of ongoing field studies and public consultation, based on the following key components:

- **Local Content Policies:** implementation of transparent recruitment policies, procurement policies that encourage the use of local suppliers where appropriate, and the workforce Mauritanisation are critical to establishing strong community relations;
- **Community Engagement:** the community relations team will be engaged within the local communities to facilitate open communication about the project and about community issues; and
- **Community Investment:** Tasiast will look for opportunities to enable long-term benefits that are self-sustaining and avoid actions that create dependency or replace government services or programs. Tasiast will pursue programs that encourage equity participation by community partners and will participate in forums where the results of this investment can be discussed with stakeholders in an open and informed manner.

21 Timeline

Once the Phase 1b EIA has been approved and the permit has been issued by the MESD, the physical construction of the Project components will commence. This will be approximately a 16 month construction period as summarised in Figure 3-3 and Table 21-1.

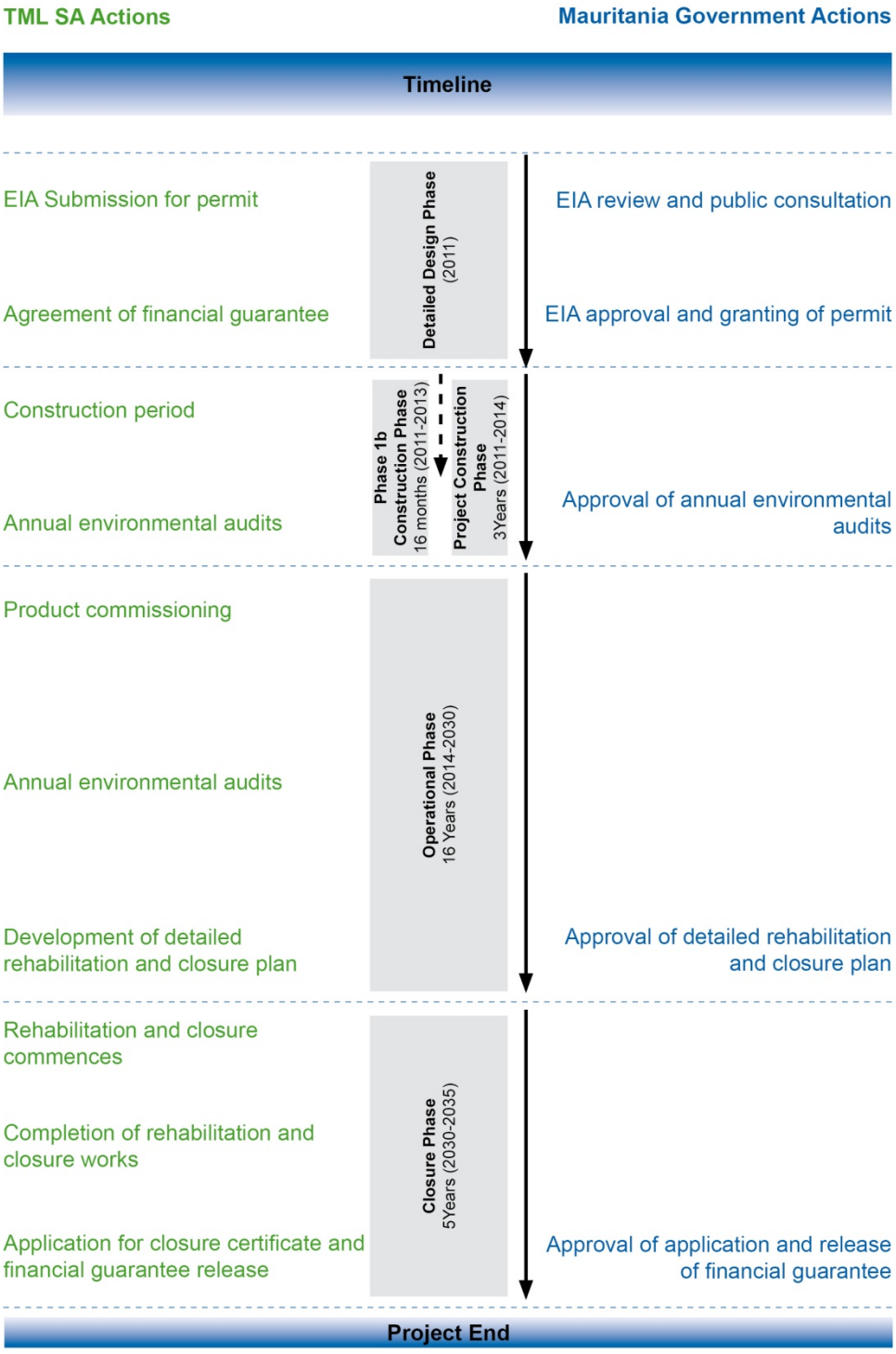
The overall Project will have a 16 year life; although there is potential to further extend the mine life. It is expected the Project will be fully commissioned by early 2014.

Each Phase of the Project will be subject to EIA processes and any cumulative impacts will be assessed and mitigation actions will be incorporated into and implemented via the Mine's existing EMS (Scott Wilson, 2010b). As required by Mauritanian legislation, annual environmental audits will be submitted to the Government after the first year of construction for the duration of the operational life of the Project.

Following the operational period (approximately 2031), the Project will enter its closure phase where operations and infrastructure will be decommissioned in accordance with the agreed Closure and Rehabilitation Plan (Decree No. 2004-054). Once the closure phase is completed TMLSA will submit an application to Government for release of the Financial Guarantee.

Table 21-1 illustrates the timeline of the Project and TMLSA and the Authorities roles.

Table 21-1: Project Timeline



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Phase 1b Environmental Impact Assessment – Photographs

Phase 1b Environmental Impact Assessment – Figures

Appendix 1 – Phase 1b Environmental Impact Assessment Terms of Reference

Appendix 2 – Detailed Noise Impact Assessment

Appendix 3 – Soil Sample Results

Appendix 4 – Phase 1b Project Component Mitigation and Monitoring Requirements

Appendix 5 – Public Consultation Register

Appendix 6 – Public Consultation Comments