Tasiast Mauritanie Limited SA
Tasiast Gold Mine Expansion Project
Phase 2: On-Site Mine, Process and Infrastructure

Environmental Impact Assessment
Final
30 March 2012

Prepared for
Revision Schedule

**Phase 2 Environmental Impact Assessment**
30 March 2012
Final

<table>
<thead>
<tr>
<th>Rev</th>
<th>Date</th>
<th>Details</th>
<th>Prepared by</th>
<th>Reviewed by</th>
<th>Approved by</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>21/12/2011</td>
<td>Draft for review</td>
<td>Reine Loader Environmental Consultant</td>
<td>Julie Raynor Associate Fraser Paterson Associate</td>
<td>Russell Foxwell Associate</td>
</tr>
<tr>
<td>02</td>
<td>01/03/2012</td>
<td>Draft for translation</td>
<td>Reine Loader Environmental Consultant</td>
<td>Julie Raynor Associate Fraser Paterson Associate</td>
<td>Russell Foxwell Associate</td>
</tr>
<tr>
<td>03</td>
<td>30/03/2012</td>
<td>FINAL</td>
<td>Reine Loader Environmental Consultant</td>
<td>Fraser Paterson Associate</td>
<td>Russell Foxwell Associate</td>
</tr>
</tbody>
</table>
Limitations

URS Infrastructure & Environment UK Limited ("URS") (formerly URS Scott Wilson Ltd) has prepared this Report for the use of Tasiast Mauritanie Limited SA ("Client") in accordance with the Agreement under which our services were performed. No other warranty, expressed or implied, is made as to the professional advice included in this Report or any other services provided by URS.

Notwithstanding anything to the contrary, URS acknowledge that the Report may be disclosed by the Client to any third party, including members of the public for the specific purposes which have been advised to URS. URS shall not have any liability to any third parties for the unauthorised copying and any subsequent reliance on this Report.

The conclusions and recommendations contained in this Report are based upon information provided by others and upon the assumption that all relevant information has been provided by those parties from whom it has been requested and that such information is accurate. Information issued and provided to URS as provided above has not been independently verified by URS, unless otherwise stated in the Report.

The methodology adopted and the sources of information used by URS in providing its services are outlined in this Report. The work described in this Report was undertaken between September 2011 and March 2012 and is based on the conditions encountered and the information available during the said period of time.

Where assessments of works or costs identified in this Report are made, such assessments are based upon the information available at the time and where appropriate are subject to further investigations or information which may become available.

Certain statements made in the Report that are not historical facts may constitute estimates, projections or other forward-looking statements and even though they are based on reasonable assumptions as of the date of the Report, such forward-looking statements by their nature involve risks and uncertainties that could cause actual results to differ materially from the results predicted. URS specifically does not guarantee or warrant any estimate or projections contained in this Report.
# Table of Contents

1 **Introduction** ................................................................. 20  
1.1 Background ................................................................. 20  
1.2 The Project ................................................................. 20  
1.3 Approach to Permitting ................................................. 21  
1.4 Phase 2 Reporting ....................................................... 23  

2 **Legislation and Policy Framework** ................................. 25  
2.1 Introduction ............................................................... 25  
2.2 National ................................................................. 25  
2.3 International Standards ............................................... 33

3 **The Project – Phase 2** .................................................. 38  
3.1 Overview of Existing Mine Operations ............................... 38  
3.2 Project Components - Phase 2 ...................................... 40

4 **Project Setting** ............................................................ 68  
4.1 Mining in Mauritania .................................................... 68  
4.2 Location ................................................................. 68  
4.3 Baseline Conditions ................................................... 69

5 **Impact Assessment Methodology** .................................... 72  
5.1 Introduction .............................................................. 72  
5.2 Terms of Reference .................................................... 72  
5.3 Environmental Impact Assessment ................................. 72

6 **Surface Water and Groundwater** .................................... 78  
6.1 Methodology ............................................................ 78  
6.2 Baseline Conditions .................................................... 80  
6.3 Potential Impacts ....................................................... 89  
6.4 Mitigation Measures ................................................... 97  
6.5 Cumulative Impacts .................................................... 98  
6.6 Evaluation of Mitigated Impacts ................................. 98  
6.7 Summary ................................................................. 101

7 **Air Quality** ................................................................. 102  
7.1 Introduction .............................................................. 102  
7.2 Methodology ............................................................ 103  
7.3 Baseline Conditions .................................................... 109  
7.4 Baseline Air Quality Survey ........................................ 110  
7.5 Hydrogen Cyanide Gas Detection ............................... 111  
7.6 Potential Impacts ....................................................... 112
12  Archaeology and Cultural Heritage ........................................... 219
  12.1 Methodology ........................................................................... 219
  12.2 Principles of Archaeological Mitigation .................................... 225
  12.3 Baseline Conditions ................................................................. 226
  12.4 Potential Impacts ................................................................. 233
  12.5 Mitigation and Monitoring Measures ....................................... 240
  12.6 Cumulative Impacts ................................................................. 250
  12.7 Evaluation of Mitigated Impacts ............................................. 250
  12.8 Summary .................................................................................. 252

13  Landscape and Visual ................................................................. 255
  13.1 Methodology ........................................................................... 255
  13.2 Baseline Conditions ................................................................. 256
  13.3 Potential Impacts ................................................................. 258
  13.4 Mitigation Measures ............................................................... 261
  13.5 Cumulative Impacts ................................................................. 262
  13.6 Evaluation of Mitigated Impacts ............................................. 262
  13.7 Summary .................................................................................. 263

14  Traffic and Transport ................................................................. 264
  14.1 Methodology ........................................................................... 264
  14.2 Baseline Conditions ................................................................. 264
  14.3 Potential Impacts ................................................................. 268
  14.4 Mitigation Measures ............................................................... 272
  14.5 Cumulative Impacts ................................................................. 274
  14.6 Evaluation of Mitigated Impacts ............................................. 275
  14.7 Summary .................................................................................. 277

15  Waste Management ................................................................. 278
  15.1 Methodology ........................................................................... 278
  15.2 Baseline Conditions ................................................................. 280
  15.3 Potential Impacts ................................................................. 282
  15.4 Mitigation Measures ............................................................... 284
  15.5 Cumulative Impacts ................................................................. 287
  15.6 Evaluation of Mitigated Impacts ............................................. 287
  15.7 Summary .................................................................................. 289

16  Climate Change ......................................................................... 291
  16.1 Background ........................................................................... 291
  16.2 Methodology ........................................................................... 291
  16.3 Sources of Impact from Phase 2 ........................................... 293
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.4</td>
<td>Results</td>
<td>295</td>
</tr>
<tr>
<td>16.5</td>
<td>Mitigation Measures</td>
<td>298</td>
</tr>
<tr>
<td>16.6</td>
<td>Evaluation of Mitigated Impacts</td>
<td>299</td>
</tr>
<tr>
<td>16.7</td>
<td>Summary</td>
<td>299</td>
</tr>
<tr>
<td>17</td>
<td>Analysis of Alternatives</td>
<td>300</td>
</tr>
<tr>
<td>17.1</td>
<td>The Zero Option</td>
<td>300</td>
</tr>
<tr>
<td>17.2</td>
<td>Project Components - Phase 2</td>
<td>300</td>
</tr>
<tr>
<td>18</td>
<td>Environmental Management</td>
<td>305</td>
</tr>
<tr>
<td>18.1</td>
<td>Introduction</td>
<td>305</td>
</tr>
<tr>
<td>18.2</td>
<td>Environmental and Social Management Programme</td>
<td>307</td>
</tr>
<tr>
<td>18.3</td>
<td>Monitoring Programme</td>
<td>327</td>
</tr>
<tr>
<td>18.4</td>
<td>Emergency Response Planning</td>
<td>333</td>
</tr>
<tr>
<td>19</td>
<td>Preliminary Rehabilitation and Closure</td>
<td>335</td>
</tr>
<tr>
<td>19.1</td>
<td>Background</td>
<td>335</td>
</tr>
<tr>
<td>19.2</td>
<td>General Rehabilitation and Closure Objectives</td>
<td>335</td>
</tr>
<tr>
<td>19.3</td>
<td>Rehabilitation and Closure Strategy</td>
<td>337</td>
</tr>
<tr>
<td>19.4</td>
<td>Environmental Management, Monitoring and Maintenance</td>
<td>340</td>
</tr>
<tr>
<td>19.5</td>
<td>Rehabilitation and Closure Costs</td>
<td>341</td>
</tr>
<tr>
<td>20</td>
<td>Stakeholder Engagement</td>
<td>344</td>
</tr>
<tr>
<td>20.1</td>
<td>Consultation Requirements</td>
<td>344</td>
</tr>
<tr>
<td>20.2</td>
<td>Project Consultation Process</td>
<td>345</td>
</tr>
<tr>
<td>20.3</td>
<td>Comments Raised During Consultation</td>
<td>350</td>
</tr>
<tr>
<td>21</td>
<td>Timeline</td>
<td>354</td>
</tr>
<tr>
<td>22</td>
<td>References</td>
<td>358</td>
</tr>
</tbody>
</table>
List of Tables

Table 1-1: Approach to Permitting
Table 2-1: Summary of Relevant Mauritanian Legislation and Guidelines
Table 2-2: International Environmental Agreements Relevant to Mauritania
Table 2-3: International Social and Labour Conventions
Table 2-4: Kinross Guiding Principles
Table 3-1: Permitted EIAs for Existing Operations
Table 3-2: Terminology for the Project
Table 3-3: Summarised Mine Production Schedule by Processing Technique
Table 3-4: Estimated Total Materials by Lithological Unit and Process Method (approximate)
Table 3-5: Estimated Mining Equipment Requirements
Table 3-6: Total Cyanide Concentration in Process Circuit Liquids
Table 3-7: Reagent storage and delivery
Table 3-8: Rehabilitation and Closure Strategy Summary
Table 5-1: Level and Significance of Impacts
Table 5-2: Standard Assessment Terminology
Table 6-1: Average Monthly Rainfall and Evaporation
Table 6-2: Probable Maximum Effective Rainfall for Different Return Periods
Table 6-3: Lithological distribution of samples determined to be Potential Acid Forming (PAF), Uncertain (UC) and Non-Acid Forming materials. N is number of samples tested
Table 6-4: Summary of Net Neutralizing Potential and Neutralizing Potential Ratio by Lithology
Table 6-5: Mine Site Baseline Water Quality Analyses
Table 6-6: Borehole Water Quality Logging
Table 6-7: Design and Operational Measures to Protect and Conserve Water
Table 6-8: Summary of Potential Residual Impacts\(^1\) - Surface Water and Groundwater
Table 7-1: List of Discrete Receptors
Table 7-2: Environmental Assessment Level Criteria
Table 7-3: Magnitude of Impact Descriptors
Table 7-4: Level and Significance of Impacts at Accommodation Camp and Land Outside of Mine Site
Table 7-5: Baseline Nitrogen Dioxide Concentrations for Period 03/03/2011 to 06/10/2011.
Table 7-6: Baseline Sulphur Dioxide Concentrations for Period 03/03/2011 to 06/10/2011.
Table 7-7: Baseline Ozone Concentrations for Period 03/03/2011 to 06/10/2011.
Table 7-8: Magnitude of Simple Cycle Plant Emissions Impacts – Natural Gas Fuel
Table 7-9: Magnitude of Simple Cycle Plant Emissions Impacts – Diesel Fuel
Table 7-10: Magnitude of Simple Cycle Plant Emissions Impacts – LCO Fuel
Table 7-11: Magnitude of Simple Cycle Plant Emissions Impacts - HFO Fuel
Table 7-12: Summary of predicted residual impacts for Construction Phase Scenario
Table 7-13: Impact of Vehicle Exhaust Emissions on Annual Mean Concentrations of Nitrogen Dioxide and PM$_{10}$ (Construction)
Table 7-14: Magnitude of Combined Cycle Plant Emissions Impacts – Natural Gas Fuel
Table 7-15: Magnitude of Combined Cycle Plant Emissions Impacts – Diesel Fuel
Table 7-16: Magnitude of Combined Cycle Plant Emissions Impacts – LCO Fuel
Table 7-17: Magnitude of Combined Cycle Plant Emissions Impacts - HFO Fuel
Table 7-18: Summary of predicted residual impacts for Operational Phase Scenario
Table 7-19: Magnitude of Reciprocating Engine Power Plant Emissions Impacts - HFO Fuel
Table 7-20: Summary of predicted residual impacts for Operational Phase Reciprocating Engine Option Scenario
Table 7-21: Impact of Vehicle Exhaust Emissions on Annual Mean Concentrations of Nitrogen Dioxide and PM$_{10}$ (Post-Construction Operation)
Table 7-22: Recommended Monitoring
Table 7-23: Summary of potential residual impacts$^1$ - Air Quality
Table 8-1: IFC Noise Level Guidelines
Table 8-2: Significance of Noise Impacts
Table 8-3: Predicted Façade Noise Levels
Table 8-4: Numbers of Truck Pass-Bys/Day (Construction)
Table 8-5: Calculated Maximum Free-Field Operational Noise Levels
Table 8-6: Numbers of Truck Pass-Bys / Day (Post-Construction Operation)
Table 8-7: Summary of Potential Residual Impacts1 - Noise and Vibration
Table 9-1: Summary of Potential Residual Impacts¹ - Soils and Land Use

Table 10-1: Summary of the ecological investigations undertaken to date at the Mine

Table 10-2: Summary of Potential Residual Impacts¹ - Biodiversity

Table 11-1: Relevant MDG Indicators for Mauritania – Including Past Performance and Future Targets

Table 11-2: Health Facilities and Health Professionals

Table 11-3: Reported Daily Household Expenditure Per Capita (Zones A-D)

Table 11-4: Summary of population at the regional level

Table 11-5: Surveyed Population within each Zone (A, B, C and D)

Table 11-6: Employment Data

Table 11-7: Number and Type of IGAs within Zones A-D

Table 11-8: Breakdown of Mauritanian Workforce at the Mine by Wilaya

Table 11-9: Education Data

Table 11-10: Access to water and electricity

Table 11-11: Embedded Mitigation Measures Identified Through Kinross Best-Practice Management Standards

Table 11-12: Community Engagement Measures

Table 11-13: Community Investment Projects- Benefit Footprint Initiatives

Table 11-14: Community Investment Projects –Social Development Initiatives

Table 11-15: Summary of Potential Residual Impacts¹ - Socio-Economics

Table 12-1: Overview of archaeological survey stages and sites identified within the Mine site

Table 12-2: Factors in the Assessment of the Magnitude of Impact (Archaeology/Cultural Heritage)

Table 12-3: Factors for assessing the value of archaeological receptors

Table 12-4: Criteria used to determine Significance of Effects (Archaeology/Cultural Heritage effects)

Table 12-5: Significance of Environmental Effects (Archaeology/Cultural Heritage)

Table 12-6: Archaeological/historical periods in north western Mauritania

Table 12-7: Summary of Neolithic occupation sites on ogolian dunes within the Mine site, indicating cultural material identified on each site. All sites are of high value

Table 12-8: Summary of value of Protohistoric tombs within Mine site ([ ]=tomb groups)

Table 12-9: Anticipated construction impacts – direct, indirect and temporary
Table 12-10: Summary of Phase 2 direct and indirect impacts on archaeological sites. Direct impacts are indicated in black and indirect impacts in italic and grey type

Table 12-11: Proposed Mitigation for Waste Rock Dumps
Table 12-12: Proposed Mitigation for the Expanded Open Pit
Table 12-13: Proposed Mitigation for Heap Leach Facility
Table 12-14: Proposed Mitigation for the Accommodation Camp
Table 12-15: Proposed Mitigation for TSF 3 Cell 1 and 2
Table 12-16: Proposed Mitigation for TSF 3/ Heap Leach Expansion Area
Table 12-17: Proposed Mitigation for the Expanded Waste Management Facility
Table 12-18: Proposed Mitigation Ancillary Facilities
Table 12-19: Summary of Potential Residual Impacts – Archaeology and Cultural Heritage

Table 13-1: Visual Sensitivity
Table 13-2: Potential Visual Impacts during Construction and Operation
Table 13-3: Potential Visual Impacts Post Closure
Table 13-4: Summary of Potential Residual Impacts1 – Landscape and Visual

Table 14-1: Existing Off-site Vehicles Movements
Table 14-2: Estimated Bus Trip’s Generated by Local Construction Workers
Table 14-3: Phase 2 Peak Vehicle Generation
Table 14-4: Summary of Potential Residual Impacts1 – Traffic

Table 15-1: Waste Arisings – Operation Phase
Table 15-2: Operation Phase Mitigation Measures
Table 15-3: Closure Phase Mitigation Measures
Table 15-4: Summary of potential residual impacts1 – Waste Management

Table 16-1: Annual Fuel Use of On-site Production Vehicles
Table 16-2: Existing Mine/Phase 1 - Summary of GHG Emissions
Table 16-3: Phase 2 Emissions (CCPP - Diesel fuel scenario)
Table 16-4: Phase 2 Emissions (CCPP - HFO fuel scenario)
Table 16-5: Phase 2 Emissions (CCPP - LCO fuel scenario)
Table 16-6: Phase 2 Emissions (CCPP - natural gas fuel scenario)
Table 16-7: Phase 2 Emissions (Reciprocating engine power plant HFO fuel scenario)

Table 16-8: CO2e Emissions Summary by Scenario

Table 16-9: Summary of Potential Residual Impacts1 – Climate Change

Table 18-1: Action Plan for Integration of Phase 2 Environmental Management Plan into the EMS/EMP for the Mine

Table 18-2: Summary of Phase 2 Project Components in Relation to the Existing Tasiast EMP

Table 18-3: Environmental Commitments Register

Table 18-4 Social Commitments Register

Table 18-5: Outline environmental and social monitoring programme incorporating existing mining operations and proposed Phase 2 developments

Table 19-1: Rehabilitation and Closure Costs for Phase 2 Project Components

Table 20-1: Formal Stakeholder Consultation Meetings

Table 20-2: Key stakeholder comments raised during public consultation
**List of Photographs**

Photograph 3-1: Existing open pit series

Photograph 3-2: Mining within existing open pit

Photograph 3-3: Existing CIL process plant

Photograph 3-4: Existing CIL process plant, power plant, fuel storage, offices and warehouse facilities

Photograph 3-5: Existing dump leach facility

Photograph 3-6: Existing tailing storage facility 2

Photograph 3-7: Existing HFO power plant

Photograph 3-8: Existing accommodation camp

Photograph 3-9: Existing well at borefield

Photograph 3-10: Borefield pumping station (located along access road)

Photograph 3-11: Access road connecting the Nouakchott–Nouâdhibou N2 highway to the Mine site

Photograph 10-1: Typical stony soil habitat and Fagonia dominated plant community

Photograph 10-2: Sandy accumulations in wadi habitat with Acacia

Photograph 10-3: Mobile dune habitats (near to perimeter fence)

Photograph 10-4: Mine site office lagoon/processing plant sewage lagoon

Photograph 10-5: Spotted sandgrouse coming in to drink at Mine site water body

Photograph 10-6: Spotted sandgrouse drinking at Mine offices/process plant sewage lagoon

Photograph 10-7: Acomys mouse from small mammal trap located at Survey point 136

Photograph 10-8: Mammal and snake tracks near to Survey Point 89

Photograph 10-9: Mammal and snake tracks near to Survey Point 89

Photograph 10-10: Mine site office lagoon/processing plant sewage lagoon

Photograph 12-1: TE02 & TE03 pair of Protohistoric tombs

Photograph 12-2: TE04 Protohistoric tomb

Photograph 12-3: TE06 pair of Muslim tombs

Photograph 12-4: TE22 Protohistoric tomb

Photograph 12-5: TE23 Protohistoric tomb

Photograph 12-6: TE24 Muslim tomb with Protohistoric tomb adjacent in distance

Photograph 12-7: TE28 Neolithic dune top occupation site

Photograph 12-8: TE33 Neolithic dune top occupation site

Photograph 12-9: TE32 Neolithic dune top occupation site

Photograph 12-10: TE34 Neolithic dune top occupation site

Photograph 12-11: TE36 with TE37 in distance. Neolithic dune top occupation sites

Photograph 12-12: TE39 Protohistoric tomb

Photograph 12-13: TE43 Protohistoric tomb
Photograph 12-14: TE45 Protohistoric tomb
Photograph 12-15: TE51 Muslim tomb
Photograph 12-16: TE52 Protohistoric tomb
Photograph 12-17: TE55 possible Protohistoric tomb
Photograph 12-18: TE56 Muslim tomb
Photograph 12-19: TE57 Protohistoric tomb
Photograph 12-20: TE58 Possible Protohistoric tomb
Photograph 12-21: TE59 Protohistoric tomb with Protohistoric antenna tomb WB08 in distance on ridge
Photograph 13-1: View of Mine from access road
Photograph 13-2: View of Mine from access road and fence line
Photograph 13-3: View of waste rock dump from within Mine site
Photograph 13-4: View of accommodation camp from within Mine site
Photograph 13-5: View from Mine showing typical landscape
Photograph 13-6: View from Mine showing typical landscape
Photograph 13-7: View from Mine showing typical landscape
Photograph 14-1: N2 highway Nouakchott dual carriageway section
Photograph 14-2: N2 highway Single Carriageway
Photograph 14-3: N2 highway and Mine access road junction
List of Figures

Figure 1-1: Mine Location Plan
Figure 3-1: Existing Mine Site Layout
Figure 3-2: Existing and Phase 1 Mine Site Layout
Figure 3-3: Phase 2 Mine Site Layout (including existing and Phase 1 components)
Figure 3-4: Construction Timeframes
Figure 3-5: Summarised Estimated Total Material to be Mined
Figure 3-6: Estimated Construction Workforce Requirements
Figure 3-7: Estimated Operational Workforce Requirements
Figure 3-8: Approximate Number of Light Vehicles required for the Project
Figure 5-1: Mauritanian EIA Permitting Process
Figure 6-1: Mine Site Geology, Topography and Surface water Layout
Figure 6-2: Existing and Proposed Environmental Monitoring Borehole Locations
Figure 6-3: Range of Permeability
Figure 6-4: Environmental Monitoring Borehole Water Levels
Figure 7-1: Existing and Proposed Power Plant
Figure 7-2: Annual Mean NO2 Impact for Simple Cycle Power Plant
Figure 7-3: Hourly Mean NO2 Impacts for Simple Cycle Power Plant
Figure 7-4: Annual Mean PM10 Impacts for Simple Cycle Power Plant
Figure 7-5: 24-Hour Mean PM10 Impacts for Simple Cycle Power Plant
Figure 7-6: 24-Hour Mean SO2 Impacts for Simple Cycle Power Plant
Figure 7-7: Annual Mean NO2 Impacts for Combined Cycle Power Plant
Figure 7-8: Hourly Mean NO2 Impacts for Combined Cycle Power Plant
Figure 7-9: Annual Mean PM10 Impacts for Combined Cycle Power Plant
Figure 7-10: 24-Hour Mean PM10 Impacts for Combined Cycle Power Plant
Figure 7-11: 24-Hour Mean SO2 Impacts for Combined Cycle Power Plant
Figure 7-12: Long Term Impacts for the Reciprocating Engine Option with HFO Fuel
Figure 7-13: Short Term Impacts for the Reciprocating Engine Option with HFO Fuel
Figure 8-1: Calculated Noise Level Contours - Existing
Figure 8-2: Calculated Noise Level Contours - 2016
Figure 8-3: Calculated Noise Level Contours - 2022
Figure 8-4: Calculated Noise Level Contours - 2016 Minus Existing
Figure 8-5: Calculated Noise Level Contours - 2022 Minus Existing
Figure 9-1: Soil Sample Locations
Figure 10-1: Habitat Map and Location of Standing water Features
Figure 10-2: Tree Cover
Figure 10-3: Plant Diversity
Figure 10-4: Mine Site Other Faunal Records
Figure 11-1: Socio-Economic Survey Areas
Figure 11-2: Mauritania’s Population Pyramid
Figure 11-3 Sectors of Employment in Mauritania
Figure 11-4: Sources of Lighting
Figure 11-5: Type of dwelling
Figure 11-6: Perceived Impacts on National and Local Economy
Figure 11-7: Perceived Impacts on Human Health, Livestock Health and the Environment
Figure 12-1: Baseline Archaeological Sites
Figure 14-1: Mine Access Road Traffic Count Summary
Figure 14-2: Gamel Abdul Nasser Avenue / N2 Highway Junction
Figure 14-3: Gamel Abdul Nasser Signalised Junction Traffic Count Summary
Figure 14-4: Gamel Abdul Nasser / Port Access Road Junction
Figure 14-5: Gamel Abdul Nasser / Port Access Traffic Count
Figure 18-1: Environmental and social management process
Figure 20-1: Grievance Mechanism Procedure
Figure 21-1: Project Timeline
List of Appendices

Appendix 1: Phase 2 – Terms of Reference Report
Appendix 2: Air Quality
Appendix 3: Noise and Vibration
Appendix 4: Soil Sample Analysis Results
Appendix 5: Ecological Survey Results
Appendix 6: Bird Survey Results
Appendix 7: Socio-Economic Baseline Results
Appendix 8: Mitigation Measures per Phase 2 Project Components
Appendix 9: Public Consultation Meeting Minutes
### List of Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>Percentage</td>
</tr>
<tr>
<td>µS/cm</td>
<td>Electrical Conductivity</td>
</tr>
<tr>
<td>ABA</td>
<td>Acid Base Accounting</td>
</tr>
<tr>
<td>ACP</td>
<td>African, Caribbean And Pacific</td>
</tr>
<tr>
<td>ADR</td>
<td>Adsorption, Desorption, Regeneration</td>
</tr>
<tr>
<td>AH</td>
<td>Archaeology And Cultural Heritage</td>
</tr>
<tr>
<td>AIDS</td>
<td>Acquired Immune Deficiency Syndrome</td>
</tr>
<tr>
<td>AP</td>
<td>Acidification Potential</td>
</tr>
<tr>
<td>AQ</td>
<td>Air Quality</td>
</tr>
<tr>
<td>ARD</td>
<td>Acid Rock Drainage</td>
</tr>
<tr>
<td>BEAS</td>
<td>Bureau D’études Et Analyses Statistiques</td>
</tr>
<tr>
<td>BIF</td>
<td>Banded Iron Formation</td>
</tr>
<tr>
<td>BIM</td>
<td>Banded Iron Magnetite</td>
</tr>
<tr>
<td>BP</td>
<td>Before Present</td>
</tr>
<tr>
<td>BS</td>
<td>British Standards</td>
</tr>
<tr>
<td>Bt</td>
<td>Billion Tonnes</td>
</tr>
<tr>
<td>CA</td>
<td>Countryside Agency</td>
</tr>
<tr>
<td>CC</td>
<td>Climate Change</td>
</tr>
<tr>
<td>CCPP</td>
<td>Combined Cycle Power Plant</td>
</tr>
<tr>
<td>CDP</td>
<td>Carbon Disclosure Project</td>
</tr>
<tr>
<td>CEET</td>
<td>Carbon Emissions Estimation Tool</td>
</tr>
<tr>
<td>CF</td>
<td>Chance Find</td>
</tr>
<tr>
<td>CFP</td>
<td>Chance Find Procedures</td>
</tr>
<tr>
<td>CHMP</td>
<td>Cultural Heritage Management Plan</td>
</tr>
<tr>
<td>CIL</td>
<td>Carbon-In-Leach</td>
</tr>
<tr>
<td>CND</td>
<td>Cyanide Destruction Circuit</td>
</tr>
<tr>
<td>CNRE</td>
<td>Centre National Des Ressources En Eau</td>
</tr>
<tr>
<td>CR</td>
<td>Community Relations</td>
</tr>
<tr>
<td>CRO</td>
<td>Community Relations Officers</td>
</tr>
<tr>
<td>days/a</td>
<td>Days Per Annum</td>
</tr>
<tr>
<td>dB</td>
<td>Decibel</td>
</tr>
<tr>
<td>DEC</td>
<td>Department Of Environmental Control</td>
</tr>
<tr>
<td>DIV</td>
<td>Dutch Intervention Value (Guideline Values For Soil Contamination)</td>
</tr>
<tr>
<td>E</td>
<td>Ecology</td>
</tr>
<tr>
<td>EAL</td>
<td>Environmental Assessment Levels</td>
</tr>
<tr>
<td>EDC</td>
<td>Environmental Design Criteria</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Definition</td>
</tr>
<tr>
<td>--------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>EHS</td>
<td>Environmental, Health, And Safety</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
</tr>
<tr>
<td>EIN</td>
<td>Environmental Impact Notice</td>
</tr>
<tr>
<td>EMP</td>
<td>Environmental Management Plan</td>
</tr>
<tr>
<td>EMS</td>
<td>Environmental Management System</td>
</tr>
<tr>
<td>ESMP</td>
<td>Environmental Management Programme</td>
</tr>
<tr>
<td>ENG</td>
<td>Energy</td>
</tr>
<tr>
<td>EPC</td>
<td>Engineering, Procurement And Construction</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>FAO</td>
<td>Food And Agriculture Organisation</td>
</tr>
<tr>
<td>FVC</td>
<td>Felsic Volcanic Rock</td>
</tr>
<tr>
<td>GARD</td>
<td>Global Acid Rock Drainage</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GHG</td>
<td>Green House Gas</td>
</tr>
<tr>
<td>GLP</td>
<td>Good International Industry Practice</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic Information System</td>
</tr>
<tr>
<td>GLVIA</td>
<td>Guidelines For Landscape And Visual Impact Assessment</td>
</tr>
<tr>
<td>GNI</td>
<td>Gross National Income</td>
</tr>
<tr>
<td>GPS</td>
<td>Geographical Positioning System</td>
</tr>
<tr>
<td>GST</td>
<td>Green Schist</td>
</tr>
<tr>
<td>GTG</td>
<td>Combustion Gas Turbine Generator</td>
</tr>
<tr>
<td>GW</td>
<td>Groundwater</td>
</tr>
<tr>
<td>H&amp;S</td>
<td>Health And Safety</td>
</tr>
<tr>
<td>Ha</td>
<td>Hectares</td>
</tr>
<tr>
<td>HCN</td>
<td>Hydrogen Cyanide Gas</td>
</tr>
<tr>
<td>HDPE</td>
<td>High-Density Polyethylene</td>
</tr>
<tr>
<td>HFC</td>
<td>Hydrofluorocarbons</td>
</tr>
<tr>
<td>HFO</td>
<td>Heavy Fuel Oil</td>
</tr>
<tr>
<td>HGV</td>
<td>Heavy Goods Vehicle</td>
</tr>
<tr>
<td>HIV</td>
<td>Human Immunodeficiency Virus</td>
</tr>
<tr>
<td>HR</td>
<td>Human Resources</td>
</tr>
<tr>
<td>HRSG</td>
<td>Heat Recovery System Generator</td>
</tr>
<tr>
<td>IBA</td>
<td>Important Bird Areas</td>
</tr>
<tr>
<td>ICMC</td>
<td>International Cyanide Management Code</td>
</tr>
<tr>
<td>ICSI</td>
<td>International Cyanide Management Institute</td>
</tr>
<tr>
<td>ICOMOS</td>
<td>International Charter For The Conservation And Restoration Of Monuments And Sites.</td>
</tr>
<tr>
<td>IEMA</td>
<td>Institute Of Environmental Management And Assessment</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Definition</td>
</tr>
<tr>
<td>--------------</td>
<td>------------</td>
</tr>
<tr>
<td>IFC</td>
<td>International Finance Corporation</td>
</tr>
<tr>
<td>IGA</td>
<td>Income Generating Activities</td>
</tr>
<tr>
<td>ILO</td>
<td>International Labour Organisation</td>
</tr>
<tr>
<td>IPCC</td>
<td>International Panel On Climate Change</td>
</tr>
<tr>
<td>IUCN</td>
<td>International Union For Conservation Of Nature</td>
</tr>
<tr>
<td>Km</td>
<td>Kilometre</td>
</tr>
<tr>
<td>km²</td>
<td>Square Kilometre</td>
</tr>
<tr>
<td>kV</td>
<td>Kilovolt</td>
</tr>
<tr>
<td>L/day</td>
<td>Litres Per Day</td>
</tr>
<tr>
<td>LAeq</td>
<td>Average Sound Level (= Equivalent continuous A-weighted sound pressure level)</td>
</tr>
<tr>
<td>LCO</td>
<td>Light Crude Oil</td>
</tr>
<tr>
<td>LI</td>
<td>Landscape Institute</td>
</tr>
<tr>
<td>LNG</td>
<td>Liquefied Natural Gas</td>
</tr>
<tr>
<td>LPG</td>
<td>Liquefied Petroleum Gas</td>
</tr>
<tr>
<td>LV</td>
<td>Landscape And Visual</td>
</tr>
<tr>
<td>LVIA</td>
<td>Landscape And Visual Impact Assessment</td>
</tr>
<tr>
<td>LWA</td>
<td>Weighted Sound Power Level</td>
</tr>
<tr>
<td>m</td>
<td>Metre</td>
</tr>
<tr>
<td>m³/day</td>
<td>Cubic Metres Per Day</td>
</tr>
<tr>
<td>Masl</td>
<td>Meters Above Sea Level</td>
</tr>
<tr>
<td>MCM</td>
<td>Mauritania Copper Mines</td>
</tr>
<tr>
<td>MDG</td>
<td>Millennium Development Goal</td>
</tr>
<tr>
<td>MDO</td>
<td>Dolerite</td>
</tr>
<tr>
<td>MEND</td>
<td>Canadian Mine Environment Neutral Drainage Program</td>
</tr>
<tr>
<td>MESD</td>
<td>Delegated Ministry Of Environment And Sustainable Development (Ministère Délégué Auprès Du Premier Ministre Chargé De l’Environnement Et Du Développement Durable)</td>
</tr>
<tr>
<td>Mg/l</td>
<td>Milligrams Per Litre</td>
</tr>
<tr>
<td>MGO</td>
<td>Gabbro</td>
</tr>
<tr>
<td>MHS</td>
<td>Materials Handling And Storage</td>
</tr>
<tr>
<td>MLA</td>
<td>Mining License Area</td>
</tr>
<tr>
<td>mm</td>
<td>Millimetre</td>
</tr>
<tr>
<td>mm/month</td>
<td>Millimetre Per Month</td>
</tr>
<tr>
<td>mm/a</td>
<td>Millimetre Per Year</td>
</tr>
<tr>
<td>Mm³</td>
<td>Million Cubic Metres</td>
</tr>
<tr>
<td>MPEM</td>
<td>Ministry Of Petroleum, Energy And Mines (Ministère du Pétrole, de l’Énergie et des Mines)</td>
</tr>
<tr>
<td>MSDS</td>
<td>Material Safety Data Sheets</td>
</tr>
<tr>
<td>Mt</td>
<td>Million Tonnes</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Definition</td>
</tr>
<tr>
<td>--------------</td>
<td>------------</td>
</tr>
<tr>
<td>Mt/a</td>
<td>Million Tonnes Per Annum</td>
</tr>
<tr>
<td>MW</td>
<td>Mega Watt</td>
</tr>
<tr>
<td>MWe</td>
<td>Megawatts Electric</td>
</tr>
<tr>
<td>MWS</td>
<td>Ministry Of Water And Sanitation (Ministère de l’Hydraulique et de l’Assainissement)</td>
</tr>
<tr>
<td>N2</td>
<td>Nouâdhíbou- Nouakchott N2 Highway</td>
</tr>
<tr>
<td>NAF</td>
<td>Non-Acid Forming</td>
</tr>
<tr>
<td>NAPA</td>
<td>National Action Plan For Adaptation To Climate Change</td>
</tr>
<tr>
<td>NEAP</td>
<td>National Environmental Action Plan</td>
</tr>
<tr>
<td>NG</td>
<td>Natural Gas</td>
</tr>
<tr>
<td>NGO</td>
<td>Non Government Organisation</td>
</tr>
<tr>
<td>NNP</td>
<td>Net Neutralisation Potential</td>
</tr>
<tr>
<td>No.</td>
<td>Number</td>
</tr>
<tr>
<td>NP</td>
<td>Neutralisation Potential</td>
</tr>
<tr>
<td>NPR</td>
<td>Neutralisation Potential Ratio</td>
</tr>
<tr>
<td>NSO</td>
<td>Office National De La Statistique</td>
</tr>
<tr>
<td>NTS</td>
<td>Non-Technical Summary</td>
</tr>
<tr>
<td>NV</td>
<td>Noise And Vibration</td>
</tr>
<tr>
<td>OD</td>
<td>Over-Dimensional</td>
</tr>
<tr>
<td>OHS</td>
<td>Operational Health And Safety</td>
</tr>
<tr>
<td>OMS</td>
<td>Operating, Maintenance And Surveillance</td>
</tr>
<tr>
<td>ONG-AFE</td>
<td>ONG Agir En Faveur De l’Environnement</td>
</tr>
<tr>
<td>OP</td>
<td>Open Pit</td>
</tr>
<tr>
<td>PAF</td>
<td>Potentially Acid Forming</td>
</tr>
<tr>
<td>PAN-LCD</td>
<td>National Action Plan For Desertification</td>
</tr>
<tr>
<td>PCDP</td>
<td>Public Consultation And Disclosure Plan</td>
</tr>
<tr>
<td>PDALM</td>
<td>Plan Directeur d’Aménagement Du Littoral Mauritanien</td>
</tr>
<tr>
<td>PF</td>
<td>Processing Facilities</td>
</tr>
<tr>
<td>PM</td>
<td>Particulate Matter</td>
</tr>
<tr>
<td>PNBA</td>
<td>Parc National Banc D’Arguin</td>
</tr>
<tr>
<td>PPE</td>
<td>Personal Protective Equipment</td>
</tr>
<tr>
<td>PRISM</td>
<td>Project For Institutional Strengthening Of The Mining Sector</td>
</tr>
<tr>
<td>RCP</td>
<td>Rehabilitation And Closure Plan</td>
</tr>
<tr>
<td>RO</td>
<td>Reverse Osmosis</td>
</tr>
<tr>
<td>ROM</td>
<td>Run Of Mine</td>
</tr>
<tr>
<td>SAG</td>
<td>Semi Autogenous Grinding</td>
</tr>
<tr>
<td>SE</td>
<td>Socio-Economics</td>
</tr>
<tr>
<td>SF₆</td>
<td>Sulphur Hexafluoride</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Definition</td>
</tr>
<tr>
<td>--------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>SHT</td>
<td>Schist</td>
</tr>
<tr>
<td>SIA</td>
<td>Social Impact Assessment</td>
</tr>
<tr>
<td>SL</td>
<td>Soils and Land Use</td>
</tr>
<tr>
<td>SNH</td>
<td>Scottish Natural Heritage</td>
</tr>
<tr>
<td>SNIM</td>
<td>Société Nationale Industrielle et Minière</td>
</tr>
<tr>
<td>SP</td>
<td>Social Programme</td>
</tr>
<tr>
<td>SRP</td>
<td>Site Responsibility Plan</td>
</tr>
<tr>
<td>STD</td>
<td>Sexually Transmitted Diseases</td>
</tr>
<tr>
<td>STG</td>
<td>Steam Turbine Generators</td>
</tr>
<tr>
<td>SUV</td>
<td>Sports Utility Vehicle</td>
</tr>
<tr>
<td>SVC</td>
<td>Epiclastics</td>
</tr>
<tr>
<td>SW</td>
<td>Surface Water</td>
</tr>
<tr>
<td>T</td>
<td>Traffic</td>
</tr>
<tr>
<td>t/day</td>
<td>Tonnes Per Day</td>
</tr>
<tr>
<td>TMLSA</td>
<td>Tasiast Mauritanie Limited Sa</td>
</tr>
<tr>
<td>ToR</td>
<td>Terms Of Reference</td>
</tr>
<tr>
<td>TSF</td>
<td>Tailings Storage Facility</td>
</tr>
<tr>
<td>UGMTM</td>
<td>General Union Of Mauritanian Employees</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>UN</td>
<td>United Nations</td>
</tr>
<tr>
<td>UNESCO</td>
<td>United Nations Educational, Scientific And Cultural Organisation</td>
</tr>
<tr>
<td>W</td>
<td>Waste</td>
</tr>
<tr>
<td>WAD</td>
<td>Weak Acid Dissociable</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organisation</td>
</tr>
<tr>
<td>WM</td>
<td>Waste Management</td>
</tr>
<tr>
<td>WMF</td>
<td>Waste Management Facility</td>
</tr>
<tr>
<td>WMP</td>
<td>Waste Management Plan</td>
</tr>
<tr>
<td>WRD</td>
<td>Waste Rock Dumps</td>
</tr>
<tr>
<td>WS</td>
<td>Workshops</td>
</tr>
</tbody>
</table>
1 Introduction

1.1 Background

The Tasiast Gold Mine (the Mine) is an operational gold mine, situated in the Inchiri Wilaya of north eastern Mauritania (Figure 1-1).

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 tonnes per day (t/day). 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 approximately 9,000 t/day.

However, as a consequence 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 completed an internal mine scoping study to expand operations at the Mine. The proposed Project will increase the amount of rock material being mined from the open pit. The mill processing rate is expected to increase from the current rate of 9,000 t/day to 70,000 – 80,000 t/day. In addition, the Project may include a 45,000 – 60,000 t/day crushed heap leach process for low grade non-oxidized ore. Based upon the internal mine scoping study, the existing open pits will be expanded into one overall pit and there will be significant new infrastructure including a mill, a Carbon-in-Leach (CIL) process plant, heap and dump leach facilities, 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 fuel farms. An initial new power plant will be installed as part of 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, either a separate, off-site power plant option or the alternative of a power transmission line from the Mine site will be developed to supply power for a sea water abstraction and supply system being considered in Phase 3.

Increased water demands will be required for the Project’s construction activities, ongoing interim operations and expanded operational capacity. The increased water demand for construction and ongoing interim operations will be met through the temporary (approximately four years) expansion of the existing borefield (permitted in Phase 1). To support this temporary expansion, additional wells will be developed within and adjacent to the existing borefield and a new water supply pipeline will 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 abstraction and supply system is developed; the Phase 3 Environmental Impact Assessment (EIA) will inform the selection of the preferred options to abstract seawater and meet power demands.
To improve accessibility to the Mine, an upgrade to the existing 60 km access road and development of a new airstrip has been permitted as part of Phase 1. There will also be development of new ancillary facilities such as, but not limited to, maintenance workshops, sewage and waste management facilities, accommodation camps, offices, warehouse facilities and other similar supporting infrastructure.

Construction of Phase 2 components may be staged, commencing in 2012/2013. Project commissioning is expected to commence in 2015. Based upon current estimates it is anticipated that the Mine will continue to operate for approximately 16 years.

Further to the internal mine scoping study, a feasibility study is currently being developed for the Project and is scheduled for completion in 2013. Phase 2 Project components and their specific capabilities will be refined as part of the final feasibility and detailed design process.

Kinross has commissioned URS to undertake the EIA requirements for the Project.

1.3 Approach to Permitting

In order to achieve the Project’s goal for commissioning to commence in 2015, it has been 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 for each of the Project components.

Each phase has been, or will be, subject to the Mauritanian requirements for EIA.

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 Coordination Committee has been established between Kinross/TMLSA and several key Ministries to facilitate Project implementation.

The Project has been divided into two distinct areas to provide clarity for permitting purposes:

- **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. As part of national permitting 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 URS Scott Wilson 2011a, b, c); and

- **Off-site:** areas outside of the Mine (as defined above). These areas have not previously been subject to EIA for mining-related operations.

The various Project Phases, permitting requirements and defined areas are summarised in Table 1-1: Approach to Permitting below. The EIA reporting for Phase 1 (Phases 1a(i), 1a(ii) and 1b) has been completed and approved.
Table 1-1: Approach to Permitting

<table>
<thead>
<tr>
<th>Project Phase</th>
<th>Location</th>
<th>Overview</th>
<th>Permitting Requirement &amp; Status</th>
</tr>
</thead>
</table>
| 1a(i)         | On-site  | Supporting infrastructure and preliminary upgrades  
  • Access road upgrade  
  • Borrow pits and mobile crusher  
  • Increase in borefield water abstraction to 17,000 m³/day  
  • New water pipeline  | EIN  
  (Approved) |
| 1a(ii)        | On-site  | Supporting infrastructure and preliminary upgrades  
  • Additional accommodation (500 beds)  
  • New warehouse and office facilities  
  • Expanded fuel farm  | EIN  
  (Approved) |
| 1b            | On-site  | Supporting infrastructure and preliminary upgrades  
  • New TSF 3 (starter cell)  
  • Foundation works for new CIL process plant, mill and new power plant  
  • Power plant expansion  
  • New fuel farm  
  • Additional accommodation (6,000 beds)  
  • New airstrip  
  • Temporary increase in borefield abstraction to 30,000 m³/day  | EIA  
  (Approved) |
| 2             | On-site  | Main infrastructure developments (on-site)  
  • Expanded open pit  
  • New CIL process plant and mill  
  • New heap and dump leach facilities  
  • New TSF 3 (Cells 1, 2 and expansion area)  
  • New waste rock dumps  
  • New power plant and distribution system  
  • New ancillary facilities (such as office, warehouses, workshops, storage areas, training campus, fuel facilities, waste management facilities and water treatment facilities) and infrastructure as required for on-going operations.  
  • Additional accommodation (1,500 beds)  
  • New internal roads  | EIA  
  (Submitted) |
| 3             | Off-site | Main infrastructure developments (off-site)  
  • Sea water abstraction system  
  • Sea water pipeline (approx. 150 km)  
  • Access road from N2 highway to sea water abstraction point and along sea water pipeline  
  • Power generation and distribution at abstraction point or a transmission line from the Mine to the abstraction point  
  • Off-Site ancillary facilities, such as offices and accommodation  | EIA  
  (In preparation) |

1 The list of project components for Phases 2 and 3 is indicative and not exhaustive. Phase 2 components are outlined in Section 3 of this report.
1.4 Phase 2 Reporting

1.4.1 Scope of Report

The Phase 2 Project components are all located within the existing Mine site perimeter fence. This is a defined area within which all of the existing mining related activities (mining, processing and waste disposal) and associated infrastructure are already located (See Figure 3-1).

For the purposes of the assessment for Phase 2, it is assumed that the entire area within the Mine site perimeter fence (12,300 ha) will be required for the expanded Mine operations. To support this approach, baseline surveys have been undertaken over this whole area and the assessment has been undertaken accordingly.

The Phase 2 EIA comprises three reports, namely:

- **Terms of Reference (ToR) Report**: The ToR Report provided an overview of the proposed Phase 2, the potentially significant environmental issues and the approach for the EIA, including baseline study requirements. The ToR was submitted to the MPEM and approved on 4 December 2011. A copy of the ToR report is presented in Appendix 1;

- **EIA Report**: The EIA Report documents the full assessment process and its conclusions in accordance with the ToR Report; and

- **EIA Non-Technical Summary (NTS)**: The NTS 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 Phase 2 of the Project, which is available in French and English. The EIA NTS is provided as a separate document in French, Arabic and English.

Any cumulative impacts arising from Phase 2 have been assessed and mitigation actions will be incorporated into and implemented as set out in Section 18.

1.4.2 Reporting Standards

The EIA for Phase 2 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 which define the required EIA reporting format (see Section 1.4.3 below).

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

Full details of reporting standards for the EIA are presented in Section 2 of this report.

1.4.3 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 Mauritanian 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 2**; an outline of current mining operations and the proposed Phase 2 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, identification of the important issues and an assessment of potential impacts to stakeholders and the environment, proposed mitigation measures and residual impacts;
  - Section 6: Surface Water and Groundwater,
  - Section 7: Air Quality,
  - Section 8: Noise and Vibration,
  - Section 9: Soils and Land Use,
  - Section 10: Ecology and Biodiversity,
  - Section 11: Socio-Economic,
  - Section 12: Archaeology and Cultural Heritage,
  - Section 13: Landscape and Visual,
  - Section 14: Traffic,
  - Section 15: Waste Management,
  - Section 16: Climate Change.

- **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, feedback from stakeholders and community social initiatives;

- **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 International Finance Corporation (IFC) Performance Standards and Environmental Health and Safety (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/Tasiast Mauritanie Limited SA (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 2 of the Project, international protocols, agreements and treaties to which Mauritania subscribes and the key national regulatory authorities.

2.2.1 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 Directorate of Mines, 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.

- **Delegated 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 Environmental Impact Assessment (EIA) and Environmental Management Plans (EMPs) 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.).

### 2.2.2 National Legislative Framework

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

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 March 2012, that are relevant to the Project and the Phase 2 EIA is presented in Table 2-1.

<table>
<thead>
<tr>
<th>Legislation</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mining</strong></td>
<td></td>
</tr>
</tbody>
</table>
| 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. |
| 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. |
<table>
<thead>
<tr>
<th>Legislation</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decree No. 2007-105 modifying and supplementing certain provisions of Decree No. 2004-094 (13 April 2007)</td>
<td>Modifications to Decree No. 2004-094 of 24 November 2004 relating to EIA including; project categorisation, content; and timeline for approval.</td>
</tr>
<tr>
<td>Law No. 2007-055 abrogating and replacing Law no. 97-007 of 20 January 1997 relating to the Forestry Code.</td>
<td>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.</td>
</tr>
<tr>
<td>Decree 2009-104 applying Law 2007-055 abrogating and replacing Law no. 097-007 relating to the Forestry Code</td>
<td>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.</td>
</tr>
<tr>
<td>Law No. 2000-024 concerning the PNBA</td>
<td>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.</td>
</tr>
<tr>
<td>Hunting Code No. 1997-006 (20 January 1997)</td>
<td>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.</td>
</tr>
<tr>
<td>Guide to carrying out an Environmental Impact Assessment, Mining Sector, November 2006</td>
<td>Provides a guideline on the content and impact assessment techniques for an EIA for a mining operation.</td>
</tr>
<tr>
<td>Guide to carrying out a Notice of Environmental Impact, Mining Sector, November 2006</td>
<td>Provides a guideline on undertaking an EIA, a less rigorous impact assessment process for a smaller mining operation.</td>
</tr>
<tr>
<td>Guide to preparing an Environmental Management System, Mining Sector, November 2006</td>
<td>Provides a guideline on the process of developing an Environmental Management System (EMS) for a mining operation.</td>
</tr>
<tr>
<td>Guide to the preparation of site rehabilitation document, Mining Sector, November 2006</td>
<td>Provides a guideline on the process of developing a site rehabilitation plan for a mining operation.</td>
</tr>
<tr>
<td>Cultural Heritage</td>
<td></td>
</tr>
<tr>
<td>Decree 2009-188 on the Office National des Musées (ONM) (5 March 2009)</td>
<td>This law creates the Office National des Musées (National Museums Organisation) which succeeds the Musée National (National Museum). Its main aims are to create and manage museums throughout the country, contribute to heritage outreach and education through exhibitions etc., and to enrich museum collections.</td>
</tr>
<tr>
<td>Legislation</td>
<td>Summary</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Law No. 99-013, relating to the Mining Code (23 June 1999)</td>
<td>Paragraph 1 stipulates that research work or exploitation must respect the regulations and obligations relating to the health and safety of personnel, safety and public health, and the protection of the cultural heritage.</td>
</tr>
<tr>
<td><strong>Water</strong></td>
<td></td>
</tr>
<tr>
<td>The Water Code No. 2005-030 (2 February 2005)</td>
<td>Defines the legal regime for continental surface and groundwater (excluding seawater), provisions include:</td>
</tr>
<tr>
<td></td>
<td>• Legal and property rights framework for water use;</td>
</tr>
<tr>
<td></td>
<td>• Protection of existing water resources and search for new resources;</td>
</tr>
<tr>
<td></td>
<td>• Protection of water resources from any form of pollution;</td>
</tr>
<tr>
<td></td>
<td>• Reduction of water waste and over use;</td>
</tr>
<tr>
<td></td>
<td>• Ensuring the equitable allocation of water resources to all users.</td>
</tr>
<tr>
<td>Decree No. 2007-047 regarding the creation of strategic water resource zones</td>
<td>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 (arête).</td>
</tr>
<tr>
<td><strong>Social</strong></td>
<td></td>
</tr>
<tr>
<td>The Estate and Land Organisation Ruling No. 83-127 (5 June 1983)</td>
<td>Provides the framework conditions for land granting and acquisition in rural and urban areas.</td>
</tr>
<tr>
<td>The Electricity Act No. 2001-019, 25 January 2001</td>
<td>Supports the private sector for both electricity production and distribution.</td>
</tr>
<tr>
<td>Pastoral Code No. 2000-044 (26 July 2000)</td>
<td>Defines the rights of pastors (nomads) to use natural resources.</td>
</tr>
<tr>
<td>Decree No. 2004-024 Implementing the Pastoral Code</td>
<td>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).</td>
</tr>
</tbody>
</table>
2.2.3 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 identifies the relevant international environmental and social development agreements to which Mauritania is a party. Mauritania is also a signatory to a range of labour and human rights conventions which are summarised in Table 2-3.

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 Mauritania’s 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 Decentralisation and Local Governance;
- Mauritanian Coastal Management Plan (PDALM); and
- Strategic Framework to Combat Poverty (such as, Cadre Stratégique de Lutte contre la Pauvreté, 2011-2015).

### Table 2-2: International Environmental Agreements Relevant to Mauritania

<table>
<thead>
<tr>
<th>Issue</th>
<th>Convention and Objective</th>
<th>Mauritanian Status</th>
<th>Date of Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>Constitution of the Food and Agriculture Organisation (FAO) of the United Nations</td>
<td>Multilateral</td>
<td>16/10/1945</td>
</tr>
<tr>
<td></td>
<td>Objective: To tackle world poverty and hunger and to promote primarily agriculture and</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>sustainable rural development.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biodiversity</td>
<td>International Plant Protection Convention - New revised text approved by Resolution</td>
<td>Multilateral</td>
<td>07/11/1997</td>
</tr>
<tr>
<td></td>
<td>12/97 of the 29th Session of the FAO Conference in November 1997 - Declaration</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Objective: To prevent the spread and introduction of pests of plants and plant products and to promote</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Issue</td>
<td>Convention and Objective</td>
<td>Mauritanian Status</td>
<td>Date of Signature</td>
</tr>
<tr>
<td>-------</td>
<td>--------------------------</td>
<td>-------------------</td>
<td>------------------</td>
</tr>
</tbody>
</table>
| Crime and Corruption | 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 |
| | 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 proper management of public affairs and public property. | Multilateral | 31/10/2003 |
| | 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 |
| Cultural Heritage | UNESCO Convention on Cultural Property  
Objective: Prohibits and prevents the illicit import, export and transfer of ownership of cultural property and aims to discourage the pillage of archaeological sites and cultural heritage by controlling international trade in looted antiquities through import controls and other measures. | Multilateral | 27/04/1977 |
| | UNESCO Convention concerning the Protection of the World Cultural and Natural Heritage  
Objective: To ensure that effective and active measures are taken for the protection, conservation and presentation of the "cultural and natural heritage" on its territories. | Multilateral | 02/03/1981 |
| | UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage  
Objective: To safeguard and ensure respect for the | Multilateral | 15/11/2006 |
<table>
<thead>
<tr>
<th>Issue</th>
<th>Convention and Objective</th>
<th>Mauritanian Status</th>
<th>Date of Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>world’s Intangible Cultural Heritage, including raising awareness of the importance of intangible heritage and encouraging international cooperation and assistance.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
|       | Cotonou Agreement (African, Caribbean and Pacific Group of States & EU)  
Objective: Integrate the cultural dimension at all levels of development cooperation; recognising, preserving and promoting cultural values and heritage and identities to enable inter-cultural dialogue; supporting the development of capacity in this sector; and developing cultural industries and enhancing market access opportunities for cultural goods and services. | Multilateral       | 2000              |
| 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 economic growth 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        |
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        |
| Ozone   | Amendment to the Montreal Protocol on substances that deplete the ozone layer, adopted at the ninth | Multilateral       | 17/09/1997        |
### Table 2-3: International Social and Labour Conventions

<table>
<thead>
<tr>
<th>Issue</th>
<th>Convention</th>
<th>Ratification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>International Labour Organisation (ILO) Convention No. 89 on Women’s Rights and Working Conditions</td>
<td>1963</td>
</tr>
<tr>
<td><strong>Rights of Children</strong></td>
<td>Additional Protocol on Sale of Children and Child Abuse</td>
<td>2004</td>
</tr>
<tr>
<td></td>
<td>Minimum Age Convention</td>
<td>2001</td>
</tr>
<tr>
<td></td>
<td>Worst Forms of Child Labour Convention</td>
<td>2001</td>
</tr>
<tr>
<td></td>
<td>ILO Convention No. 90 on Child Rights and Working Conditions</td>
<td>1963</td>
</tr>
<tr>
<td></td>
<td>ILO Convention No. 182 on Child Working Conditions</td>
<td>1963</td>
</tr>
<tr>
<td></td>
<td>Night Work of Young Persons Convention</td>
<td>1963</td>
</tr>
<tr>
<td></td>
<td>Night Work of Young Persons Convention</td>
<td>1961</td>
</tr>
<tr>
<td><strong>Slavery</strong></td>
<td>United Nations Convention on People Trafficking</td>
<td>1986</td>
</tr>
<tr>
<td><strong>Human Rights</strong></td>
<td>United Nations Convention on Torture, Cruel, Inhuman or Degrading Treatment</td>
<td>2004</td>
</tr>
<tr>
<td></td>
<td>Right to Organise and Collective Bargaining Convention</td>
<td>2001</td>
</tr>
<tr>
<td></td>
<td>Equal Remuneration Convention</td>
<td>2001</td>
</tr>
<tr>
<td></td>
<td>Abolition of Forced Labour Convention</td>
<td>1997</td>
</tr>
<tr>
<td></td>
<td>Discrimination (Employment and Occupation) Convention</td>
<td>1963</td>
</tr>
<tr>
<td></td>
<td>Equality of Treatment Convention</td>
<td>1968</td>
</tr>
</tbody>
</table>
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.

Mauritanian 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 reasonably feasible – 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 Guidelines2 - 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 Phase 2 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.

---

2 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](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](http://www.ifc.org/ifcext/sustainability.nsf/Content/EHSGuidelines).
Their general contents are 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.

- **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 marginalised 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 recently published its revised Performance Standards which contain some enhanced requirements for the 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. The new requirements will be applied with effect from new EIA studies launched after 1 January 2012 for projects directly funded by the IFC and adherents to the Equator Principles.
As the EIA process for the Project commenced before the latest versions of the revised Performance Standards were published, the 2006 versions are still being used where relevant in this EIA. However, the revised Performance Standards are being considered and, where relevant, certain elements are being actively addressed in the assessment and reference is 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, operation and decommissioning.

The detail in these standards is generally derived from globally recognised sources (such as the WHO) 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”.

There is some flexibility in regard to both their application to existing facilities and 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 are 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 and some of the possible future options under consideration. The following briefly summarises the key EHS Sector Guidelines relevant to this phase of the Project:

- **IFC EHS Sector Guidelines – Mining**: Provides a description of sector activities and the 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 sector activities and the management techniques for the abstraction, treatment and discharge of water in regards to process, drinking and sanitation uses.

- **IFC EHS Sector Guidelines – Thermal power**: Provides a description of sector activities and the management techniques for all types of thermal power generation > 50 MW, including standards for ambient air quality, emissions limits and effluents.
2.3.3 TMLSA Policies

Kinross recognises the moral and business imperative to be a responsible corporate citizen and has defined the Ten Guiding Principles that reflect its core values which are central to how it conducts its business. The Ten Guiding Principles, which TMLSA will apply, are outlined in Table 2-4.

Following the Mine’s 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.

Table 2-4: Kinross Guiding Principles

<table>
<thead>
<tr>
<th>The Kinross Guiding Principles</th>
</tr>
</thead>
<tbody>
<tr>
<td>We put people first and our number one priority is the safety of every employee</td>
</tr>
<tr>
<td>We maintain the highest standards of corporate governance, ethics and honesty in all of our dealings, and operate in compliance with the law, wherever we work</td>
</tr>
<tr>
<td>We promote an ongoing dialogue and engagement with stakeholders in the communities where we operate, maintained in a spirit of transparency and good faith</td>
</tr>
<tr>
<td>We exercise utmost vigilance in protecting the environment and seek ways to minimise our environmental footprint wherever we operate. We will always meet and, where possible, exceed regulatory requirements in our environmental performance</td>
</tr>
<tr>
<td>We consider all aspects of an operation or new project – including social, environmental, and post-closure issues – when making our investment decisions</td>
</tr>
<tr>
<td>We conduct all of our activities in accordance with accepted standards in the protection and promotion of human rights. We respect the cultural and historical perspectives and rights of those affected by our operations, in particular indigenous peoples</td>
</tr>
<tr>
<td>We provide a rewarding and meaningful livelihood to our employees and strive to be an employer of choice</td>
</tr>
<tr>
<td>We seek to maximise employment, business and economic opportunities for local communities from our existing operations and new projects</td>
</tr>
<tr>
<td>We provide lasting benefits to the communities where we work by supporting sustainable initiatives to develop their social, economic and institutional fabric. We recognise that every community is unique, and we work with our community partners to ensure that our support matches their priorities</td>
</tr>
<tr>
<td>We maintain an active engagement and dialogue with our global industry peers, associations, governments and civil society on CSR best practices and evolving global standards</td>
</tr>
</tbody>
</table>

TMLSA is required by the parent Company to comply with the Kinross Principles, over-arching Policies and Corporate Responsibility Management System, which includes a Site Responsibility Plan and an Environmental and Health and Safety Management System (see Section 18 for further details). Accordingly, the Project has been designed to comply with overarching Kinross Standards.
2.3.4 International Cyanide Management Code

Kinross is a signatory of the International Cyanide Management Code (ICMC) for the Manufacture, Transport and Use of Cyanide in the Production of Gold. This is a voluntary program for gold mining companies. Therefore, to comply with Kinross safety standards and industry best practice, TMLSA will voluntarily seek cyanide certification for the Project against the code after construction of the Project is complete. The code sets out specific requirements of personnel training, the design of facilities, preparedness for potential emergency situations and consultation with communities on the management of cyanide, tailings and leach solutions. Once certified, operations will be subject to regular audits by independent third parties.
3 The Project – Phase 2

The Project involves the expansion of mining, processing and ancillary facilities at the Mine to enable exploitation of additional gold resources and extend the life of the mine by approximately 16 years. The Project is being undertaken in three phases as outlined in Table 3-1. This Environmental Impact Assessment (EIA) report assesses the potential impacts of Phase 2 of the Project.

This Section presents; an overview of the existing operational Mine, a detailed description is provided of the proposed Phase 2 Project components and where relevant, reference to the permitted Phase 1 Project components, for which construction has already commenced, and Phase 3 components which are to be assessed in a separate EIA.

3.1 Overview of Existing Mine Operations

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. In September 2010, Kinross completed acquisition of the Mine as part of its combination with Red Back Mining Inc. All mining, processing and management of the Mine is undertaken by Tasiast Mauritanie Limited SA (TMLSA), a subsidiary of Kinross.

Since operations commenced at the Mine, exploration activities have been ongoing and further EIAs have been undertaken to permit the existing operations, infrastructure and ancillary facilities. Previous permitted EIAs which apply to the existing operations are outlined in Table 3-1. Table 1-1 delineates the phased approach to this Project and identifies the permitted activities for Phase 1.

<table>
<thead>
<tr>
<th>Permitted EIA</th>
<th>Year</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tasiast Gold Mine</td>
<td>2004</td>
<td>SNC Lavalin 2004</td>
</tr>
<tr>
<td>Tasiast Gold Project, Environmental Impact Study</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Addendum I of IV (Non-Technical Summary)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Addendum II of IV (Tailing Storage Facility (TSF) &amp; Access Road Environmental Impact Review)</td>
<td>2008</td>
<td>Scott Wilson 2008a, b, c and d</td>
</tr>
<tr>
<td>• Addendum III of IV (Environmental Management Plan (EMP))</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Addendum IV of IV (Preliminary Rehabilitation and Closure Plan)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tasiast Gold Project, EIA for New Developments</td>
<td>2009</td>
<td>Scott Wilson 2009a</td>
</tr>
<tr>
<td>Tasiast Gold Mine, Exploration Programme Environmental Impact Notice (EIN)</td>
<td>2009</td>
<td>Scott Wilson 2009b</td>
</tr>
<tr>
<td>Tasiast Gold Mine, West Branch Development EIA</td>
<td>2010</td>
<td>Scott Wilson 2010a</td>
</tr>
</tbody>
</table>

The Mine presently comprises three geographical areas: the operational Mine site, the existing borefield for water supply and the access road corridor. It is illustrated in Photographs 3-1 to 3-11 and Figure 3-1 to Figure 3-2.

The Mine site is surrounded by a perimeter fence and covers an area of approximately 12,300 ha. All mining and processing operations, together with the ancillary facilities, are located within the perimeter fence.
Ore bearing rock is mined from a series of open pits using conventional “excavator, shovel and truck” techniques (see Photographs 3-1 to 3-2). Once the ore bearing and sub-economic rock have been separated using selective mining techniques, the rock is delivered to either the Run of Mine (ROM) stockpiles, dump leach facilities for processing or waste rock dumps for disposal. Sub-economic rock, mined from the open pits and which cannot economically be processed, is deposited on the waste rock dumps in operation at the Mine.

Two conventional processing techniques are presently utilised for ore extraction. High grade ore is crushed and ground in the mill, and then treated in the Carbon in Leach (CIL) process plant (see Photograph 3-3). On commissioning, the nominal milling rate was 3,200 t/day; however as a result of recent permitted activities, the Mine currently operates at a nominal milling rate of 9,000 t/day. Low grade ore is treated in one of the two dump leach facilities, which include leach pads and ponds (see Photograph 3-5). The Piment dump leach facility consists of one lined leach pad with 12 sections and processes approximately 4.5 Mt/a. The West Branch dump leach facility consists of one lined leach pad with six to eight sections and is designed to process approximately 25 Mt over its life time.

There are currently two Tailings Storage Facilities (TSFs) on-site (see Photograph 3-6). TSF 1 has reached capacity and is in the process of being formally closed. TSF 2 is active, and tailings from CIL process are currently disposed of in TSF 2. As part of Phase 1b a new TSF 3 starter cell was permitted, the construction of which will allow TSF 2 to be decommissioned.

To supply the necessary electrical power for the operation a combination of Heavy Fuel Oil (HFO) and diesel generators are utilised to provide a total of 20.1 MW of power at the Mine site (see Photograph 3-7). To support the Project’s construction activities and ongoing operations, a further 30 MW of power generation capacity was permitted under Phase 1b of the Project, thus increasing the permitted power plant capacity to approximately 50 MW. Fuel requirements for power plant and vehicles are stored in bunded fuel tanks, adjacent to the power plant. Additional fuel farms were permitted under Phase 1a(ii) and Phase 1b to support the expanded power facilities and mine fleet. The borefield’s power requirements are supplied by 1.95 MW diesel generators located at the borefield.

To support the mining operations a series of offices, warehouses, workshops, laboratories, a medical clinic, waste and water management facilities are located on-site (see Photograph 3-4). These ancillary facilities provide essential space for the management, storage and maintenance of mining equipment and operations. As part of Phase 1a(i) and 1b of the Project additional offices, warehouses, sewage and potable water treatment facilities were permitted for development. In addition, the existing waste management facility will be closed and new waste management facilities (permitted under Phase 1b) will be developed.

All (operational) workers are accommodated in the on-site accommodation camp (see Photograph 3-8). The accommodation camp is composed of single storey modular buildings which provide approximately 8,000 beds (2,500 beds are existing and 6,500 beds were permitted under Phase 1a(i) and 1b)) and associated facilities for workers. Associated facilities include; recreational facilities, gymnasium, two football fields, mosque, laundry, kitchens, dining rooms, shop, sewage treatment systems and other support facilities.

The Mine’s operational and domestic water requirements are extracted, via boreholes, from the brackish aquifer located 60 km west of the Mine site (see Photographs 3-9 to 3-10). The existing daily water requirement for operations is approximately 14,000 m³/day; however this will temporarily increase to 30,000 m³/day, as permitted in Phase 1b, until the proposed sea water supply system is operational, which is to be assessed and permitted in Phase 3. The
borefield water is pumped to the Mine site via three pipelines which run parallel to the access road, from the 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 for domestic use. 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.

The Mine site is accessed from the main Nouakchott – Nouâdhibou N2 highway by a 60 km two-lane unsealed access road (see Photograph 3-11). As part of the Project (permitted under Phase 1a(i)) the access road will be upgraded to a hard surfaced access road. In addition, an unsealed airstrip is located within the Mine site. As the Mine expands, the existing airstrip may be closed and a new air strip developed as part of the Project (permitted under Phase 1b). A light aircraft is used for the transport of personnel to and from Nouakchott.

3.2 Project Components - Phase 2

3.2.1 Overview

Phase 2 comprises the development of the main “on-site” mining, processing and supporting facilities to enable the proposed expansion. It supplements the existing infrastructure and is facilitated by Phase 1 (1a(i), 1a(ii) and 1b), which involved the development of supporting infrastructure and preliminary upgrades (see Table 1-1).

All of the Phase 2 components are to be located within the existing Mine site perimeter fence. Figure 3-3 shows the conceptual layout of the proposed Project components, together with buffer zones (to allow for further expansion and footprint adjustments within the detailed design) and linking by a series of internal roads.

The Project planning process considered various alternatives including mine plans, processing techniques, processing capacities and power requirements. For the purposes of the EIA, the Project components and footprint selected are those which result in a very conservative approach to impact assessment. As such, the assessment has been carried out on the basis that the entire area within the Mine site perimeter fence (12,300 hectares) will be required for the expanded Mine operations. Phase 2 Project components and their specific capacities will be refined as part of the final feasibility and detailed design process.

The Project will enable approximately 530 Mt of ore bearing rock and 2.7 Bt of sub economic material to be mined over a period of approximately 16 years. In summary, the Phase 2 Project components are:

- **Expanded open pit**: Amalgamation of the existing open pits to form one expanded open pit, approximately 10-13 km long, 2 km wide and 700 m deep;
- **CIL process plant and mill**: New facility to process 60,000 t/day to 70,000 t/day concurrently with existing CIL plant (approximately 9,000 t/day);
- **Dump leach facility**: Additional dump leach facilities to process approximately 59 Mt of uncrushed low grade ore through leaching;
- **Heap leach facility**: New facility to process 15 Mt/a to 20 Mt/a of crushed low grade unoxidized ore through leaching and the leach pads will accommodate approximately 197 Mt of ore;
- **Waste rock dumps**: Development of four additional waste rock dumps;
• **TSF 3**: New lined facility to accommodate approximately 276 Mt of tailings;

**Power plant (120 MWe to 160 MWe)**: A new power plant (either gas turbine technology combined cycle or reciprocating engine technology) will provide all of the Mine’s power demands;

**Power distribution systems**: New 33 kV outdoor switchyard to receive power generated on-site and transfer it to overhead and underground power lines distributing power to all on-site operations;

**Ancillary facilities**: and
- Offices (including training and development campus),
- Workshops,
- Warehouses,
- Fuelling stations,
- Accommodation camp expansion,
- Health, first aid and emergency response facilities,
- Waste management facility expansion,
- Raw water storage pond,
- RO facility,
- Drainage and stormwater management system expansion,
- Internal access roads, and
- Other support facilities.

The Phase 2 components are described in detail in Sections 3.2.2 to 3.2.9. Figure 3-3 illustrates the location of the footprint areas within which the relevant Phase 2 Project components will be constructed, Figure 3-4 illustrates the proposed construction timeframes.

The Phase 2 Project components have been designed in accordance the Project Environmental Design Criteria (EDC) (Hatch, 2011a). The EDC are derived from Mauritanian legislation, IFC/World Bank guidelines, Kinross Standards and recognised best practice in the mining industry, such as the Cyanide Code.

The terminology to be used in the assessment of Phase 2 Project components is summarised in Table 3-2 below.

**Table 3-2: Terminology for the Project**

<table>
<thead>
<tr>
<th>Terminology</th>
<th>Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access Road</td>
<td>60 km existing two-lane unsealed road, which connects the main Nouakchott–Nouâdhîbou road to the Mine.</td>
</tr>
<tr>
<td>Borefield</td>
<td>The borefield is 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.</td>
</tr>
<tr>
<td>Mine site</td>
<td>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,</td>
</tr>
</tbody>
</table>
### Terminology

<table>
<thead>
<tr>
<th>Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>accommodation facilities and the air strip.</td>
</tr>
<tr>
<td>The Mine site, access road and borefield.</td>
</tr>
<tr>
<td>Within the Mine (which comprises the areas of</td>
</tr>
<tr>
<td>the Mine site, access road and borefield).</td>
</tr>
<tr>
<td>Outside of the Mine.</td>
</tr>
</tbody>
</table>

### 3.2.2 Mining

#### 3.2.2.1 Ore Body Geology

The Tasiast ore deposits within the El Ghaïcha concession area are aligned along a more than 10 km, north-trending corridor with the Piment deposits to the north and West Branch deposits to the south (URS Scott Wilson 2011j). The open pit will amalgamate the existing pits into one overall pit, with potential satellite pits north and south, and will be approximately 10-13 km long, 2 km wide and 700 m deep. Locally at the Mine, the succession comprises mafic to felsic volcanic sequences, iron-rich formations and clastic units that have been metamorphosed from mid Greenschist to lower amphibolite facies. Recognised units which make up the ore body geology include:

- Greenschist (IVC and SHT);
- Mafic to intermediate meta-volcanic rocks (IVC);
- Plagioclase-biotite-schist (SHT);
- Felsite (FVC);
- Banded magnetite formation (BIM/BIF); and
- Epiclastics (SVC) Mafic dikes (MDO/MGD).

The ore body can be separated into near-surface weathered oxide and underlying unweathered strata. The oxide zone is characterised by leaching of quartz, carbonate veins and sulphides, calcrite precipitation and enrichment in iron hydroxides caused by meteoric water. These lithological conditions were created by late-stage geological processes, not recent environmental factors. It has been stated that there is no well-defined transition zone as the strongly weathered upper portion of the deposit grades into fresh rock, but it generally extends variably from 10 to 50 meters below ground surface (mbgs).

Gold occurs as primarily microscopic grains. When observed in a hand specimen, grains are commonly spatially associated with hairline fractures in quartz veins and margins of sulphide minerals. Gold hosted in carbonate veins is rarely observed. The majority of the quartz veins containing coarse visible gold cut the foliation at a slightly oblique angle and mainly dip gently to the east. Visible gold observed in veins cutting foliation at a high angle is rarely noted. The majority of gold grains occur along the margin of the gangue and ore minerals, with 98% of the calculated volume/mass of the grains occurring in liberated and partially liberated forms. By volume/mass calculations, the majority (greater than 70%) of the volume is associated with the coarser (plus 75 µm) size fraction. Encapsulated gold grains were rarely observed and
dominantly of a very fine grain size. Semi-quantitative scanning electron microscopy analysis of gold grains indicated low silver (less than 15%) and trace iron (less than 3%) content.

3.2.2.2 Open Pit

The Tasiast gold deposit, which is hosted within the greenstone belt, is mined by conventional open cast mining techniques in two areas; Piment and West Branch, as shown on Figure 3-1.

Currently there is a series of open pits covering approximately 82 ha. The Piment deposits are located to the north of the ore body and West Branch deposits are located to the south.

The Project proposes to continue to use surface mining techniques to mine approximately 530 Mt of ore; which will comprises approximately 20% oxide and 80% fresh ore respectively.

Ore will be mined from both the existing Piment and West Branch open pits and surrounding areas such that the existing series of open pits will be amalgamated into one overall expanded open pit. Ultimately, the expanded pit will be approximately 10 km to 13 km long, 2 km wide and 700 m deep. Bench heights and cut backs within the pit may vary during the life of the Mine, but are planned to be 15 m to 20 m and 50 m to 100 m respectively.

Internal pit haul roads will be upgraded and widened as necessary to allow two-way traffic to enter and exit the expanded open pit. Haul roads will be classified as either temporary or permanent, depending on their locations, and will be constructed from sub-economic rock. For the Piment and West Branch pits, the single lane road width will be approximately 20 m wide and ramp sections will be approximately 35 m wide to allow two-way traffic. Haul road development and road design optimisations will continue thereafter throughout the life of the Mine.

Once ore extraction is completed in the central area of the pit, it is planned to build a “land bridge” across the central pit area utilising sub-economic material. This will enable access across the pit, thereby minimising travel and haulage distances and enabling construction of various infrastructure such as the placement of the long term tailings pipeline from the existing CIL process plant to the new TSF 3.

Estimates of material quantities from the pit, at the time of preparation of this EIA, are 530 Mt of ore and 2.7 Bt of sub economic material. A number parameters such as gold price, metallurgy, processing techniques and capacities, gold recovery, stripping ratio and costs determine the mineable reserves and resources, the ultimate pit configuration and mine plan. Given these parameters are subject to change over the mine life, so will the ultimate pit configuration and mine plan. For EIA purposes, the open pit footprint (Figure 3-3) utilised ensures a conservative assessment of impacts.

It is planned to continue processing the mined ore using CIL and dump leach techniques. However, some of the low grade fresh ore may be processed using heap leaching, which requires crushing the ore followed by processing on leach pads similar to the existing dump leach facilities (see Section 3.2.3). Table 3-3, Table 3-4 and Figure 3-5 present a summarised mining production schedule, a summary of the open pit lithology and ore and sub-economic rock tonnages, and the estimated material to be mined annually.
### Table 3-3: Summarised Mine Production Schedule by Processing Technique

<table>
<thead>
<tr>
<th>Process Method</th>
<th>Approximate Process Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIL Throughput</td>
<td>29 Mt/a</td>
</tr>
<tr>
<td>Dump Leach Production</td>
<td>59 Mt over life of mine</td>
</tr>
<tr>
<td>Heap Leach Production</td>
<td>15 Mt/a to 22 Mt/a</td>
</tr>
</tbody>
</table>

### Table 3-4: Estimated Total Materials by Lithological Unit and Process Method (approximate)

<table>
<thead>
<tr>
<th>Description</th>
<th>CIL Ore</th>
<th>Dump Leach Ore</th>
<th>Heap Leach Ore</th>
<th>Sub-economic rock</th>
<th>Total</th>
<th>% Total Ore</th>
<th>% Total Waste</th>
<th>% Total Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volcanic sediment</td>
<td>57 Mt</td>
<td>21 Mt</td>
<td>53 Mt</td>
<td>760 Mt</td>
<td>891 Mt</td>
<td>25</td>
<td>28</td>
<td>27</td>
</tr>
<tr>
<td>Greenschist</td>
<td>121 Mt</td>
<td>5.5 Mt</td>
<td>26 Mt</td>
<td>420 Mt</td>
<td>572.5 Mt</td>
<td>27</td>
<td>15</td>
<td>19</td>
</tr>
<tr>
<td>Banded magnetite formation</td>
<td>55 Mt</td>
<td>17.5 Mt</td>
<td>37 Mt</td>
<td>955 Mt</td>
<td>1064.5 Mt</td>
<td>20</td>
<td>36</td>
<td>31</td>
</tr>
<tr>
<td>Felsic volcanic rock</td>
<td>37 Mt</td>
<td>13 Mt</td>
<td>75 Mt</td>
<td>495 Mt</td>
<td>620 Mt</td>
<td>25</td>
<td>18</td>
<td>20</td>
</tr>
<tr>
<td>Dolerite</td>
<td>6 Mt</td>
<td>2 Mt</td>
<td>6 Mt</td>
<td>70 Mt</td>
<td>84 Mt</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>TOTAL</td>
<td>276 Mt</td>
<td>59 Mt</td>
<td>197 Mt</td>
<td>2.7 Bt</td>
<td>3.2 Bt</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

### Figure 3-5: Summarised Estimated Total Material to be Mined

Groundwater levels around the pit will be lowered as the pit is deepened, to ensure stability of pit slopes. Horizontal drains at the toe of select benches and subvertical drains toward the base...
will be used as necessary and the water from these will be allowed to drain into the pit. The permeability of the ground is very low and the limited quantity of drainage water produced is expected to evaporate. As a result of the high rate of evaporation and low rainfall there are no permanent watercourses on-site or within the vicinity. Rainfall and groundwater pit inflows will also evaporate or be pumped away and the water used for dust suppression or disposed of in the TSF.

Under average annual conditions the groundwater inflows to the West Branch pit are estimated to be in the region of 1400 m³/day and surface water inflows around 1,000 m³/day. Over the expanded pit area of 13 km², the groundwater inflow will be greater and the surface water inflow is estimated at 3,200 m³/day. Surface water inflows will be very variable, depending on the duration and magnitude of rainfall events.

Ephemeral water runoff from the larger pit watershed upstream will be diverted (Figure 6-1). Significant changes to the runoff characteristics downstream and also pit inundation by runoff will therefore be minimised.

Following closure, water will no longer be pumped from the pit. A balance between groundwater and surface water inflows and evaporation will be allowed to develop. Some water will be present in the base, as observed in existing pits.

### 3.2.2.3 Mining Method and Mine Fleet

The same conventional “excavator, shovel and truck” techniques, which are currently practiced and permitted, will be employed for selective mining and bulk mining at the expanded Piment and West Branch areas. The rock (both oxide and fresh) will require blasting. It is anticipated that blasting will occur daily. Selective mining techniques will be used to separate the broken ore and sub-economic rock which will be loaded by diggers into mine haul trucks. The rock will then be delivered to the Run of Mine (ROM) stockpiles, dump leach or heap leach facilities for processing, or to the waste rock dumps for disposal.

Mining will continue as per existing operations and run 24 hrs/day, 365 days/a. It is estimated that there is potential for five days lost per year due to rainfall events.

To facilitate the significant increase in mining volumes, it will be necessary to increase the existing mining fleet. The type and timing of fleet sizes may vary however. Table 3-5 summarises the estimated equipment requirements for drilling, loading, hauling and support services and the estimated annual fuel and explosive consumption levels.

<table>
<thead>
<tr>
<th>Estimated Mining Equipments, Fuel and Explosive Requirements</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2011</td>
</tr>
<tr>
<td>Trucks</td>
<td>33</td>
</tr>
<tr>
<td>Loading Units</td>
<td>7</td>
</tr>
<tr>
<td>Track Dozers</td>
<td>5</td>
</tr>
<tr>
<td>Graders</td>
<td>6</td>
</tr>
<tr>
<td>Wheel Dozers</td>
<td>3</td>
</tr>
</tbody>
</table>
### Estimated Mining Equipments, Fuel and Explosive Requirements

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
<th>2016</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front End Loaders</td>
<td>2</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Water Trucks</td>
<td>3</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Service Trucks</td>
<td>2</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Light Plant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>31</td>
<td>52</td>
<td>36</td>
</tr>
<tr>
<td>Drills</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>21</td>
<td>15</td>
</tr>
<tr>
<td>Fuel (litres)</td>
<td>12,469,192</td>
<td>89,692,972</td>
<td>108,033,819</td>
</tr>
<tr>
<td>Explosives (tonnes)</td>
<td>7,017</td>
<td>73,617</td>
<td>51,005</td>
</tr>
</tbody>
</table>

#### 3.2.3 Processing

The Project will utilise the same processing techniques that are currently employed at the Mine; CIL for high grade ore and dump leaching for low grade ore. A third process, heap leaching, may also be introduced and has been assessed in this EIA. The only material difference between heap leach and dump leach processing is the inclusion of primary crushing and additional secondary and tertiary crushing in heap leaching. Heap leaching will enable gold extraction from low grade ore that requires crushing prior to the leaching process and cannot be economically extracted using dump leach. These three processes are discussed below.

As discussed in Section 2, TMLSA intend to certify the operation to the International Cyanide Management Code (ICMC). All the processing facilities are therefore being designed to this standard.

#### 3.2.3.1 Carbon-in-Leach

The existing CIL process plant is located on the east side of the open pit and has a throughput of 9,000 t/day.

In order to process the increased volume of ore to be mined by the Project, a new mill and CIL plant will be developed on the (opposite) west side of the existing pit to supplement the existing facilities. There is insufficient space available to expand the existing plant, and locating the second plant in a new location will assist in minimising haulage distances. The new plant will be considerably larger than the existing plant, and will have the capacity to process 60,000 t/day to 70,000 t/day of ore. It is proposed that the existing and new plants will concurrently process ore from the Piment and West Branch areas of the open pit at a throughput of 2.7 Mt/a and 20 to 26 Mt/a respectively. In line with the existing plant, the new CIL process plant will operate 24 hrs/day, 365 day/a.

Although significantly larger, the new mill and plant is primarily the same technology as the existing plant and will utilise the same conventional gold cyanidation process. The only exceptions are the inclusion of Semi-Autogenous (SAG) Milling in the grinding process, and the installation of a cyanide destruction unit in the tailings process. In summary, the process will consist of:

- Crushing;
• Grinding;
• Gravity concentration;
• Thickening and leaching (leaching; followed by carbon in leach);
• Carbon elution;
• Electrowinning and refining; and
• Thickening and tailings cyanide destruction.

1) **Crushing:** ROM ore will be trucked and dumped into a 450 t capacity hopper at the primary crusher. Material that is up to 1,200 mm in size is crushed to a product size of 80% finer than 150 mm and then discharged onto a conveyor below. To suppress dust there will be a bag house at the primary crusher, a cover provided at the dump pocket and conveyor and water sprays at the transfer points.

Ore from the primary crusher will be transported by conveyors to a stockpile, which will supply the CIL process plant. The stockpile will have a capacity of approximately 30,000 t and will cover an area of 9,000 m. Dust will be controlled by enclosure within a geodesic dome and dust collectors in the reclaim tunnel, and around the feeders and conveyors.

2) **Grinding:** Ore will be fed from the stockpile into the grinding circuit at a rate of approximately 3,000 t/hr. Recycled process and raw water is added to the circuit and the ore will remain in slurry for the remainder of the process.

The grinding circuit consists of a 12.2 m diameter SAG mill followed by two in parallel 8.2 m diameter ball mills that will reduce the ore to a product size of 80% passing 90 microns. Unground material, such as pebbles, is removed at the SAG mill discharge using a screen and conveyed to a pebble crusher that reduces the size to -19 mm and discharges to a conveyor that feeds this material back to the SAG mill in a closed circuit.

Slurry from both the SAG and ball mills will be collected in a common pump box, and pumped to two sets of cyclones. The coarse underflow from the cyclones will return to the ball mill for further grinding, with part of this stream split to the gravity concentrators (see stage 3 below).

The cyclone overflow, at the design grind of 80% passing 90 microns, will be screened to remove any misplaced oversize material, and will then flow by gravity to a thickener (see stage 4 below).

3) **Gravity Concentration:** The gravity concentrators will use centrifugal force to recover free gold and other high density particles to a high grade stream, which will then be processed in an intensive leach reactor. The intensive leach unit will be located within its own containment area and fenced with restricted access. It will produce a concentrate of gold in solution that is transported to the existing ADR (Adsorption, Desorption, Regeneration) plant for electrowinning and smelting into gold bars.

4) **Thickening and Leaching:** Following grinding, the diluted slurry (cyclone underflow) is thickened to increase the density to approximately 50% mass, and the recovered water from the thickener overflow is returned to the grinding circuit. The thickener underflow is pumped to a series of ten 20 m diameter agitated (mixing) tanks where the gold will be leached with dilute cyanide solution. It is then fed into a series of eight 17.5 m diameter tanks where the slurry is contacted with activated carbon to recover the soluble gold. The combined residence of the leach and CIL will be approximately 24 hrs.
Cyanide is used to leach the gold and will be added to the first leach tank. Lime is also added for pH adjustment. All process areas will have containment where any spills flow to sump pumps and are returned back to the process stream.

As with the grinding circuit, the leach and CIL area will be completely contained, with the area designed to hold 110% of the largest tank (secondary containment) should slurry from this tank be released. The leach CIL area will lie within a concrete lined and walled area which provides secondary containment for any potential spills or leaks. The containment area will be equipped with safety showers and a cyanide gas (HCN) monitor. All pipes containing cyanide will be located above ground with appropriate secondary containment. All infrastructure and facilities will be designed and operated according to ICMC certification requirements.

Areas of the process plant with specific containment requirements, such as hydrochloric acid tanks, will be provided with separate containment.

5) **Carbon elution:** Loaded carbon from the CIL tanks will then be acid washed to remove limescale, eluted with hot caustic solution and regenerated prior to being added back into the CIL.

The acid wash process involves contacting the carbon with a 3% hydrochloric acid solution to remove any scale that forms on the carbon as a result of the lime that is present in the CIL. The acid wash area is kept separate (within its own bermed area) from all the cyanide areas to prevent any contact between the two solutions, which could result in the formation of HCN gas.

The elution process involves passing a solution of clean water and sodium hydroxide through the carbon at a temperature of 140ºC in an elution column. The elution column is pressurised to achieve the elevated temperature. HCN monitoring will be in place as required by the ICMC.

The resulting ‘pregnant’ gold solution (i.e. final product solution) from the elution process is sent for electrowinning and refining. The stripped carbon is reactivated in a rotary kiln and cooled for re-use in the CIL process.

The RO plant will be used to provide fresh water for carbon elution and reagent preparation (see also Section 3.2.6.9).

6) **Electrowinning and Refining:** The pregnant solution from the elution circuit will be pumped to the existing ADR for electrowinning and refining.

Gold will be recovered through electrolysis on cathodes. Once loaded with gold the cathodes will be cleaned and the sludge from the cathodes will be smelted into gold doré bars. The barren solution from the ADR plant will be returned to the carbon strip circuit. The pregnant solution line will include secondary containment within a lined ditch or channel.

Additional equipment such as tanks, pumps and electrowinning cells will be added to the existing ADR gold room to accommodate the increased gold production. This additional equipment will use similar processes and systems as currently utilised at the Mine for final gold recovery.

Following addition of equipment to service the gold from the new CIL plant, the ADR facility will be at full capacity so the potential inclusion of heap leaching may require further upgrading of the ADR, plus additional carbon columns and elution and carbon treatment.
areas, to facilitate the additional capacity. This additional equipment will use similar processes and systems as currently utilised at the Mine for final gold recovery.

7) **Thickening and Tailings Cyanide Destruction:** A thickener circuit is used after CIL to maximise internal water recovery and recover residual cyanide and lime. The overflow from the tailings thickener is pumped to the process water tank for reuse in the process. The underflow slurry from the thickener circuit is pumped to the cyanide destruction circuit.

The introduction of the cyanide destruction circuit (CND) is new to the process at the Mine, and it will be designed to treat tailings from both the existing and new CIL process plants. Any upgrades that may be required to bring the existing CIL process plant into alignment with the ICMC are not being assessed as part of this Phase 2 EIA.

The purpose of the CND is to reduce the concentration of cyanide prior to discharge of the tailings slurry to the TSF 3. Tailings will be pumped from the CND via an overland pipeline to TSF 3, where solids settle and decanted (reclaim) water is returned to the CIL process plant for re-use. The pipeline will be constructed in a lined ditch, which will be designed for sufficient capacity to contain a spill as per ICMC requirements.

The CND circuit treats the tailings by bringing it into contact with air, lime, copper sulphate and sulphur dioxide gas (produced in a sulphur burning unit). Cyanide content measured as CN WAD (weak acid dissociable cyanide) will be reduced to meet the ICMC level of < 50 ppm, although where possible this will be further reduced to a target level of 10 ppm.

The slurry will be sent to a dedicated treatment tank, where the new reagent makeup systems will service both processes. The existing plant tailings slurry will undergo CND treatment and be pumped to TSF 3 in the overland pipeline via the pit land bridge.

The estimated cyanide concentrations for the process liquid circuit are displayed in Table 3-6. $CN_{WAD}$ assay data is not currently available but it is believed that total $CN_{WAD}$ is close to total cyanide numbers.

<table>
<thead>
<tr>
<th>Process Liquid</th>
<th>Cyanide Concentration (ppm) $CN_T$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leach tails</td>
<td>150</td>
</tr>
<tr>
<td>CIL tails</td>
<td>150</td>
</tr>
<tr>
<td>Tails thickener underflow</td>
<td>100</td>
</tr>
<tr>
<td>Detox feed</td>
<td>50</td>
</tr>
<tr>
<td>Final tails</td>
<td>10</td>
</tr>
<tr>
<td>Process water</td>
<td>46</td>
</tr>
<tr>
<td>Reclaim water</td>
<td>2</td>
</tr>
</tbody>
</table>

3.2.3.2 Dump Leach

There are two dump leach facilities currently in operation at the Mine: the Piment and the West Branch dump leach facilities. The Piment dump leach facility is located west of the open pit, and has been in operation since 2009. The lined leach pad covers an area of approximately 76 ha and 4.5 Mt/a of ore bearing rock is processed. The West Branch dump leach facility is located west of the open pits and operations will commence in 2012. The lined leach pad
covers an area of approximately 80 ha and is designed to process approximately 25 Mt of low grade ore over its life.

It is proposed to develop additional dump leach pads and pond system adjacent to the existing Piment dump leach facility, as shown in Figure 3-3. These new dump leach facilities will cover an area of 40 ha and will process approximately 59 Mt of ore over their life.

The leaching process, which will be the same as the existing operations, is outlined below.

1) **Dumping:** Low grade ore-bearing rock will be transported from the open pit to the dump leach pads, which will be graded areas lined with a geosynthetic membrane (60 mils/1.5 mm thick). The ore will be dumped in approximate 10 m lifts (layers). Hydrated lime will be added to the ore during the dumping cycle to maintain appropriate alkalinity. The final dump height will not exceed 100 m.

2) **Leaching:** The dump will be irrigated with dilute cyanide solution through a surface network of pipes and sprinklers or other suitable solution application techniques. Solution percolating through the dump will collect at the base and will drain to a collection pond. Solution management will comprise three ponds containing barren (feed) solution and make-up water, intermediate leach solution and pregnant (final product) leach solution:

   **Barren Pond:** Raw water dosed with lime and cyanide solution will be pumped from the “barren pond” and used to irrigate the ore loaded onto the leach pad.

   **Irrigation Cycle 1:** The leach pads will be irrigated at a rate of approximately 10 l/hr/m². The leach solution will percolate through the ore bearing rock, dissolving the ore, and the leachate solution will be collected in the intermediate solution pond following the first irrigation cycle.

   **Intermediate Solution Pond:** The collected leach solution will be dosed with cyanide and lime to the required concentration, which will be achieved using stand-alone dosing silos. This solution will then pumped to the leach pads for the second irrigation cycle.

   **Irrigation Cycle 2:** As per irrigation cycle 1, the leach pad will be irrigated with the intermediate solution at a rate of approximately 10 l/h/m², percolating through the ore bearing rock and dissolving further ore. The leach solution will drain out of the pad and will be collected in the pregnant solution pond.

   **Pregnant Solution Pond:** The pregnant solution will be pumped to the ADR process plant for recovery.

3) **Gold recovery:** The new ADR treatment plant will treat pregnant solution pumped from the Piment, West Branch and the proposed dump and heap leach facilities.

   At the ADR plant, the pregnant solution will pass through a series of activated carbon columns which absorb the dissolved gold. The loaded carbon is then removed from the columns and acid washed with dilute hydrochloric acid. Gold is stripped out of the carbon in a pressurised carbon elution vessel and the resulting gold solution is sent for electrowinning and refining. After the gold sludge is drained, filtered, dried and mixed with fluxes and smelted to produce gold doré. The remaining barren solution will be pumped back to the barren solution pond.

   The leach pads will be constructed by clearing, grading and compacting the surface to obtain the ground bearing capacity and slopes towards one area of the leach pad. The base of the leach pad will be sealed with a synthetic liner of high-density polyethylene
(HDPE) to minimise seepage, and will be covered with approximately 600 mm of coarse sand or crushed rock to provide a drainage layer and liner protection. The ponds will be doubled lined with HDPE liner and contain leak detection equipment. They will be also sized to manage a 24 hr power outage (or alternatively a dedicated generator backup power will be provided) and a 100 year 24 hr rain event. Secondary containment will be provided for pipes containing dilute cyanide to meet ICMC design and operation requirements.

3.2.3.3 Heap Leach

Within the Project there are significant resources of low grade unoxidized primary ore which cannot be economically processed through the CIL process or dump leach facility due to recovery rates. Testing has indicated that heap leaching, i.e. a combination of fine crushing and leaching with dilute cyanide solution, may allow economical gold recovery rates.

The key difference between heap leaching and dump leaching is the crushing of the ore bearing rock prior to placement on the leach pads. Should heap leaching be applied, ore will be crushed by a new primary crusher, a 60 x 89 gyratory, located south of the proposed new CIL process plant. Ore bearing rock will be crushed to a nominal 150 mm and conveyed to the fine crushing plant by way of feeders and conveyor. Primary crushed material will be passed through a series of screening - secondary and tertiary crushing, followed by a second stage of screening, to produce a nominal 11 mm product suitable for the heap leaching stage. Dust collection will be accomplished by baghouse collectors at each crushing and screening stage and conveyor transfer points. The fine crushing plant will not be enclosed in a building; all ore transfer points will utilise dust collection systems to extract dust from the crushing, screening and ore transfer points.

The crushed product will be conveyed to the heap leach pad for loading and leaching. Loading and leaching of the crushed ore bearing rock will be undertaken by the process outlined for dump leach (Section 3.2.3.2).

It is anticipated that the heap leach facility will accommodate 15 Mt/a to 20 Mt/a of ore and will operate at a rate of 40,000 t/day to 60,000 t/day, which will be variable dependent on the mining activities. The footprint of the heap leach facility is anticipated to be 550 ha and the dump height will not exceed 100 m. An expansion area for heap leach has been included for potential future expansion and would be constructed to the same specification as the rest of the facility.

The heap leach pads, ponds and piping will be similar to the dump leach pads already constructed for the existing dump leaching operation. The only difference is that the heap leach facility will contain four ponds, the last of which will be used for emergency situations only. The facility will be designed and operated for ICMC compliance.

3.2.4 Rock Dumps and Tailings

The strategy for disposal of sub-economic rock (waste rock) and tailings takes into consideration the environmental impacts (including waste rock geochemistry) and economic factors for disposal of waste within the Mine site perimeter fence.

3.2.4.1 Sub-Economic Rock

During the Project life, the expanded open pit is expected to produce an estimated 2.7 Bt of sub-economic material. Some waste materials will be used for construction, such as the land
bridge across the open pit and for the embankment walls of TSF 3. Sub-economic rock which cannot be used in construction will be stored in waste rock dumps as per current practice. The results of the initial materials characterisation program indicate that the sub-economic rock will not be acid generating and Acid Rock Drainage (ARD) has therefore not been taken into consideration into the waste dump design.

It is proposed to continue to dispose sub-economic rock in the existing waste dumps that lie along both the east and west sides of the existing Piment Pit. However, due to the expanded Mine operations, it will be necessary to construct four new waste rock dumps. Two waste rock dumps will be constructed for the West Branch area and two smaller dumps for the Piment area. The waste rock dumps are to be constructed in close proximity to the open pit to minimise haulage distances, fugitive dust generation, fuel consumption and emissions over the life of the Mine. It is anticipated that several waste rock dumps will be under construction at any given time.

Waste rock dumps and low grade stockpiles will be constructed by end-dumping the material from the haul trucks and then by levelling with track-type bulldozers. Sub-economic rock will be dumped in a series of lifts which will be approximately 20 m high with 10 m berms on each lift and final design heights of approximately 100 m. As one lift of the waste rock dump approaches final limits (footprint) the next lift will commence. The dumps will have 40 m wide dual lane ramps with drainage ditches to allow the trucks to access the successive lifts.

Working areas will be sprayed with water or chemical binding agents as required to suppress wind generated dusts.

3.2.4.2 Tailings Storage Facility 3, Cells 1 and 2

There are currently two TSFs within the Mine site. TSF 1, located on the west side of the open pit, is a lined facility and has reached capacity; TSF 1 will be formally closed during the life of the Mine. The second, TSF 2, is located on the east side of the open pit and remains active. It consists of two paddocks and has an engineered compacted soil liner system. It has capacity for 21.8 Mt of tailings.

It is proposed that a third tailings storage facility, TSF 3, will be constructed to contain tailings from the expanded Mine operations. Once the Starter Cell for TSF 3 (permitted in Phase 1b) has been constructed, TSF 2 will be decommissioned. Any future modifications to TSF 2, if required, are outside the scope of this EIA and are not being assessed.

TSF 3 will be located on the west side of the open pit, north west of the proposed CIL process plant (as shown in Figure 3-3). TSF 3 will accommodate tailings from both the existing and proposed CIL process plants for the life of mine. The proposed tailings facility will comprise two main cells, Cells 1 and 2, as well as the Starter Cell. A further cell (Cell 3) has been included for potential future expansion and would be constructed to the same specification as the rest of the facility.

The Starter Cell has been designed to accommodate a total of 8 Mt of tailings from the existing CIL process plant (approximately 9,000 t/day) and has a life of approximately 2.5 years (this includes 1.5 years during Project construction and one year during Project operation). Cell 1 will retain tailings from years 1 to 8.5, while Cell 2 will retain tailings from years 8.5 to 16. An estimated 276 Mt of tailings will be produced over this 16 year period.
Construction and Operation

TSF 3 (Cells 1 and 2) will be constructed as a lined ring dyke facility, approximately square in shape and sharing common sides, with Cell 1 being constructed first. Each cell will cover an area of approximately 4 km². An access road will be constructed around the perimeter of TSF 3 to enable routine monitoring and maintenance. Preparation works for the facility will include stripping, proof rolling and placement of bedding material where required. Vegetation and surface materials will be pushed into stockpiles for loading and haulage to soils dumps to the east and west of TSF 3.

Following site preparation work, construction of the perimeter dykes will then be undertaken in a series of lifts until Cell 1 attains its maximum design elevation (approximately 40 m) in 2019. Construction of the Cell 2 perimeter dykes will commence prior to 2019 to allow seamless operations and transition of tailings deposition. This second cell will have a maximum design elevation of approximately 40 m.

Approximately 55 Mm³ of material will be required for the construction of Cells 1 and 2 perimeter dykes; the material will predominantly consist of inert sub-economic rock which will be placed in the dykes directly from the open pit.

The TSF will be lined with a 1.5 mm thick HDPE liner. The three Type A embankments will be constructed with the HDPE liner on their upstream face and across the basin of the facility. The fourth wall (type B embankment) will be constructed on top of the liner in order to allow drainage from tailings material into a lined drainage collection ditch that will be constructed along the outer perimeter of the eastern dyke.

Two lined seepage collection ponds will be constructed, one located adjacent to the TSF 3 Starter Cell and one located part way along the eastern side of Cell 2. The dimensions of the base of the ponds have been set for an area of 95 m².

Drainage collected in the ditch along the upstream toe of the perimeter dykes will be channelled towards the eastern drainage collection ditch, which in turn will drain towards the two lined seepage collection ponds. Drainage collected in these two lined seepage collection ponds will either be returned to the decant pond for recovery or redirected to the leach facility. The perimeter drainage system will comprise a longitudinal drain located along the upstream toe of the perimeter dykes. An under drainage system has been included in the tailings design to control the phreatic head over the liner. The proposed system will be largely constrained to the perimeter of the basin plus drainage through the eastern dike.

A nominal freeboard allowance of 1 m has been provided above the maximum anticipated tailings beach elevation along each perimeter dyke.

Prior to the tailings being pumped to TSF 3, the cyanide concentration will be reduced in the CND.

Tailings from both the existing and proposed CIL process plants will be routed (piped) to TSF 3. Tailings disposal into the facility 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. Monitoring of TSF 3 will be undertaken in accordance with an Operating, Maintenance and Surveillance (OMS) manual, which will be prepared prior to commissioning of the TSF and then updated periodically during its operation (see Section 18).
3.2.5 Power Supply

3.2.5.1 Power Plant

To supply the operational power requirements for the Project, it is proposed to construct a new power plant that will produce the total electrical power needs for the expanded Mine. The existing and Phase 1 heavy fuel oil (HFO) power plants will provide up to a total of 50 MW of power, but operations will cease once the Phase 2 power plant is operational and they will only be used as back-up power plants in emergency or repair situations.

The Project power demand is directly affected by the mine plan, processing techniques and capacities. The Project power demand will be refined as part of the final feasibility and detailed design process.

Based upon the power demand ranges currently envisioned for the project, two power plants have been selected for EIA analysis; a 120 MWe HFO reciprocating power plant and a multi-fuel 140-160 MWe gas turbine combined cycle power plant. Fuel specifications and air emissions limits have been based on IFC guidance related to power plant size and power generation equipment.

The reciprocating engine power plant option is based upon seven 17.1 MWe units. HFO fuel containing 2% or less sulphur and that the reciprocating engines will meet IFC guidance for other emission constituents.

The proposed 140 MWe to 160 MWe power plant will be a Combustion Gas Turbine Generator (GTG) based on Combined Cycle Power Plant (CCPP). The power plant will consist of four 43 MW multiple-fuelled GTG’s. Only three GTG will operate at once, the fourth GTG will be used as back-up (will operate less than 500 hrs per year). The GTGs will be connected with three downstream Heat Recovery System Generators (HRSG) which will feed one 60 MW Steam Turbine Generator (STG). General Electric 6B combustion turbines have been selected as the generators, as these will allow for a variety of fuels to be used for power generation.

Initially, the power plant will operate as single cycle power plant until the heat recovery plant is constructed. Once constructed, the facility will operate as a CCPP.

Power will initially be generated using diesel fuel, which will have 1% or less sulphur content. In order to maintain optionality during operations, alternative fuels may be used to generate electrical power. The impacts of utilising an alternative fuel to diesel are assessed in this EIA. Alternative fuels may include HFO, light crude oil (LCO) and natural gas.

Demineralised water will be injected into the GTG prior to combustion to produce high energy gas. The HRSG will capture the steam and the STG will then convert the high energy steam to electrical power.

The STG will use a sea water evaporation cooling tower and a surface condenser to condense the exhaust steam.

In order to meet international guidelines for emissions, the power plant will be provided with three bypass stacks and three primary stacks. The stack heights will be approximately 35 m to 70 m respectively, and will be confirmed in the detailed design. When the power plant is operating in single cycle mode, emissions will be from the bypass stack. Each HRSG stack will be fitted with a continuous emission monitoring system, designed to monitor NOx and temperature. In addition low NOx burners and wet low NOx combustion will be utilised to abate
emissions. Should post-combustion NOx removal be required, selective catalytic reduction technology will be applied.

Fuel for the power plant will be delivered to the Mine by an appropriate contractor, who will manage the bulk storage, delivery, on-site storage and removal of waste oils. Fuel storage facilities within the power plant site will have capacity for 30 days operational requirement. 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.

The power plant will be located on the west side of open pit, adjacent to the new CIL process plant. Power plant facilities will be accommodated in modular steel structures. All power generation operation will be controlled from a central control room.

If off-site power generation and power transmission becomes available in Mauritania and ample power load capacity is economically available, TMLSA will consider utilising this power for on-site activities.

3.2.5.2 Power Distribution Systems

Power generated on-site will be distributed via a new 33 kV outdoor switch yard, which has been designed to meet electrical loads of approximately 140 MWe to 160 MWe. The switch yard will consist of necessary switch gear, transformers and generators to transfer power to the relevant Mine facilities and infrastructure.

Transmission lines, from the switch yard, will either be buried or constructed over head depending on their location and associated mining activity. Distributed voltage may range from 33 kV to 230 V.

3.2.6 Ancillary Facilities

Ancillary facilities provide essential space for the management, storage and maintenance of mining equipment and operations.

Ancillary facilities are defined to include, offices, workshops, warehouses, storage areas, fuelling stations, fuel farms, accommodation camp, medical clinics, waste management facilities, water treatment facilities (such as raw water storage ponds, reverse osmosis plants, and drainage and stormwater management), internal roads and other ancillary facilities required to support the expanded mining operations (Kinross, 2011).

The location of ancillary facilities is shown on the site layout plan, Figure 3-3.

3.2.6.1 Offices

It is proposed to develop the following office facilities, which will supplement the existing office buildings. All the offices will be single storey prefabricated structures and provide appropriate facilities such as work stations, washrooms, potable water, power supply and fire safety equipment.

- **General Office Buildings:** This will include offices for management and administration, human resources, health, safety and environment, first aid and emergency response, logistics and engineering groups. These buildings will be located west of the new CIL process plant on the west side of the open pit.
• **Mine Office Buildings**: This will include offices for management, technical and administration groups. These buildings will be located adjacent to the Mine fleet workshop, on the east side of the open pit.

• **Plant Office Buildings**: This will include offices for the metallurgical laboratory, control room, engineering room and communication and IT room. These buildings will be located west of the new CIL process plant on the west side of the open pit.

• **Airport Security Office**: This will include a building to welcome and screen workers, visitors and x-ray luggage as they arrive and depart the Mine site. The office will be located at the intersection of the airport road and airport perimeter fence.

• **Training and Development Campus**: It is proposed to develop a campus in order to provide training and development facilities for workers. The campus will contain various buildings that will include workshops, warehouses, classrooms, offices, laboratories, library, printing room, prayer room, kitchen and dining facilities. The campus will be located on the west side of the open pit adjacent to the proposed general office buildings.

• **Guard House**: This will include a guard room and visitors screening area. These buildings will supplement the existing guard house facilities located adjacent to the existing CIL process plant. The new buildings will be located at the Mine site entrance along the access road.

• **Process Plant Gate House**: This will include an enclosed room and roofed area through which workers will enter the new CIL process plant area on the west side of the open pit.

• **Other Office Buildings**: These will include other office buildings required for on-going operations within the Mine site and will be located in areas outlined in Figure 3-3.

### 3.2.6.2 Workshops

It is proposed to develop the following workshops to accommodate the Mine's expanded mining equipment and vehicle fleet. All the workshops will be pre-engineered steel structures with a concrete base and provide appropriate facilities such as work stations, washrooms, potable water, drainage, containment of oils/lubricants/chemicals and fire safety equipment.

• **Plant Maintenance Workshop**: This will include various workshops (including welding, fabrication, mechanical, electrical, and hydraulic), storage areas, offices and amenities for plant maintenance. The workshop will be located north east of the new CIL process plant on the west side of the open pit.

• **Light Vehicle Workshop**: This will include offices, mechanic and electrical workshops, light vehicle maintenance bays, tyre changing bays, and tyre and light equipment storages areas. The workshop will be located on the east side of the open pit.

• **Welding and Tyre Repair Workshop**: This will include bays for welding, tyre repairs and storage facilities for parts and equipment. The workshop will be located within the general area of the Mine Fleet Shop and Light Vehicle Shop areas east of open pit.

• **Mine Fleet Shop**: A new mine fleet workshop was permitted under Phase 1a(ii) EIN and is located in the east side of open pit; as part of Phase 2 it is proposed to extend this workshop. The extension will include additional maintenance bays, a lube bay and tyre change facility.

• **Mine Fleet and Mobile Equipment Maintenance Workshop**: This will provide a workshop and maintenance bays for mine fleet and equipment maintenance as well as
storage/warehouse areas. In addition, the workshop will include a reception area, offices, a lunch room, a locker room, a prayer room and bathroom facilities. Construction of the workshop will be phased. The workshop will be a two storey building, located on the east side of the open pit.

- **Other Workshops**: This will include other workshops required for on-going operations within the Mine site and will be located in areas outlined in Figure 3-3.

### 3.2.6.3 Warehouses and Storage Facilities

It is proposed to develop the following warehouses and storage facilities to accommodate additional equipment, oils/lubricants, chemicals and explosives. All the facilities will be developed to ensure appropriate containment of oils/lubricants, chemicals and explosives.

- **Warehouse**: Two warehouses were permitted under Phase 1a(ii) EIN and are located on the west of the open pit; as part of Phase 2 it is proposed to develop additional warehouses. Similarly to the new permitted warehouses, the new warehouses will store spare parts and equipment required for the new CIL process plant.

- **Laydown Area**: This will provide storage for oil drums, mill liners and conveyer belts required for the new CIL process plant. The laydown area will be located on the west side of the open pit.

- **Reagent Storage Facility**: To supplement the existing reagent facility, a new reagent storage facility will be developed to store process reagents (such as Lime, Hydrochloric Acid, Sodium Metabisulphite, Flocculants, Anit-scalants, Sodium Hydroxide, Copper Sulphate, Sodium Cyanide, Sulphur, Carbon, and grinding balls). The area will provide sufficient storage capacity for non-hazardous and hazardous materials. The fenced reagent storage area will be located on the west side of the open pit, north of the proposed lay down area.

The cyanide storage area will be designed to fulfil the requirements of the ICMC and will have a reinforced concrete slab and containment walls serviced by a sump. The cyanide storage areas will be roofed with sufficient overhang to prevent stormwater entering the area to protect the reagent materials from any potential contamination.

Table 3-7 outlines the estimated storage arrangement for reagents the other reagents to be used on-site.

### Table 3-7: Reagent storage and delivery

<table>
<thead>
<tr>
<th>Reagent</th>
<th>Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anti-scalants</td>
<td>Two 1 tonne bags stacked on top of each other in a concrete bunded area, and the storage area will not be under cover.</td>
</tr>
<tr>
<td>Carbon</td>
<td>Two 500 kg bags stacked on top of each other, placed on pallets on compacted ground; the storage area will be under cover</td>
</tr>
<tr>
<td>Copper Sulphate</td>
<td>Two one tonne bags will be stacked on top of each other, placed on pallets in a concrete bunded area; the storage area will be under cover</td>
</tr>
<tr>
<td>Ferric Chloride</td>
<td>1,000 L totes will be stacked on top of each other in a concrete bunded area; the storage area will not be under cover</td>
</tr>
<tr>
<td>Reagent</td>
<td>Storage</td>
</tr>
<tr>
<td>----------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Flocculants</td>
<td>Two 750 kg bags will be stacked on top of each other in a concrete bunded area; the storage area will be under cover</td>
</tr>
<tr>
<td>Grinding Balls</td>
<td>Stored in metal drums without cover or under cover if delivered in 1 tonne bags</td>
</tr>
<tr>
<td>Hydrochloric Acid</td>
<td>1,000 L totes will be stacked two high in a bunded area. Storage will not be under cover</td>
</tr>
<tr>
<td>Lime</td>
<td>Two bags will be stacked on top of each other, placed on pallets on compacted ground; the storage area will be under cover</td>
</tr>
<tr>
<td>Sodium Cyanide</td>
<td>Three one tonne boxes will be stacked on top of each other in a concrete bunded area, which will be under cover</td>
</tr>
<tr>
<td>Sodium Hydroxide</td>
<td>Two one tonne bags will be stacked on top of each other, placed on pallets on compacted ground; the storage area will be under cover</td>
</tr>
<tr>
<td>Sodium Hypochloride</td>
<td>1,000 L totes will be stacked on top of each other in a concrete bunded area; the storage area will not be under cover</td>
</tr>
<tr>
<td>Sodium Metabisulphate</td>
<td>Two one tonne bags will be stacked on top of each other, placed on pallets on compacted ground; the storage area will be under cover.</td>
</tr>
<tr>
<td>Sulphur</td>
<td>Two 1 tonne bags will be stacked on top of each other, placed on pallets on compacted ground; the storage area will be under cover</td>
</tr>
</tbody>
</table>

Reagents will be stored and transported to the Mine site in accordance with the prescriptions of the appropriate IFC guidelines.

- **Explosives Storage Facility**: It is anticipated that additional storage capacity will be required due to the expansion of the mining operations. Two options are proposed to increase storage capacity on-site these are; to either expand the existing facility or to develop a new facility. Any expansion or relocation will be undertaken in accordance with the IFC guidelines and the US National Fire Protection Associate 495: Explosives Material Code in terms of distance from buildings, highways, etc. and with respect to separation of explosive materials and ignition sources.

### 3.2.6.4 Fuelling Stations

To accommodate the expanded Mine fleet, additional fuelling stations will be required for both light vehicles and mining fleet vehicles. Fuel storage tanks will be bunded to contain any spillages. Any spills or stormwater will be passed through oil separators before being disposed of to the stormwater pond to evaporate.

- **Light Vehicle Fuelling Station**: This will be located adjacent to the fuel farm serving the Phase 2 power plant on the west side of the open pit, so that no additional or separate storage tanks will be required. The fuelling station will be designed to accommodate one week’s fuel requirement for light vehicles.

- **Mine Fleet Fuelling Station**: This will be located on the ramp leading to the new CIL process plant primary crusher. The fuelling station will designed to store one day’s fuel supply for the Mine fleet.
3.2.6.5 Accommodation Camp

To provide sufficient accommodation for workers it is proposed to construct additional accommodation facilities comprising approximately 1,500 beds for construction and operation workers. This will provide a new total of 10,500 beds, with the inclusion of the existing facilities (2,500 beds) plus those permitted under Phase 1 (6,500 beds).

The final accommodation camp will house workers during the Project's construction and operation phase and is located on the east side of the open pit (see Figure 3-3). Once the Project is operational and the construction workforce is downsized, surplus sections of the accommodation camp will be refurbished and the supporting facilities will be retained for the permanent accommodation camp.

The additional accommodation (1,500 beds and facilities) will be composed of single storey modular elements. Dimensions of each block are approximately 60 m by 7 m. Depending on the categories of workers, each block will accommodate between 12 to 72 workers in single or double occupancy rooms. Washrooms and toilets will be provided and will be for either individual or collective use.

Supporting amenities 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; and
- Mosque to accommodate approximately 2,000 workers. It will include a male prayer room, female prayer room, ablutions, store, minaret and mihrab.

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 guards and appropriate security monitoring systems.

3.2.6.6 Health, First Aid and Emergency Response Facilities

A medical clinic is currently in operation at the Mine for three physicians and two nurses to provide medical advice and assistance to workers and local community. The clinic is open 24 hr/days, 365 days/a and is equipped with examination and monitoring rooms; there is an ambulance for emergency response.

Additional medical facilities will be developed to provide enhanced medical services to the Project's expanded workforce. Services to be provided by the proposed medical clinic include:

- Emergency response and stabilisation for emergencies;
- Evacuation of patient/s to appropriate facility should the medical needs of the patient/s exceed the on-site capabilities;
- Normal, routine consultations (primary care);
- Limited secondary care to initiate treatment or to stabilise the patient;
• Occupational health services including health screening, periodic medical examinations, exit and transfer medical examinations, health surveillance and health risk assessments (e.g. hearing conservation and respiratory programs, skin diseases and other risks associated with occupational illness); and

• Public health programs to promote health and educate workers.

This full scope of services will be delivered from the main medical facilities located in the accommodation camp plus from one or more satellite clinics located within the Mine site.

The main facility will be open for emergency care and response, taking care of admitted patients at all hours. Routine doctor consultations will be limited to pre-set office hours. After hours, a nurse will conduct triage and will call the doctor should there be a medical need or an emergency.

Local residents will be able to continue to utilise the existing medical clinic.

3.2.6.7 Waste Management Facility

In addition to the Waste Management Facility (WMF) permitted in Phase 1b, the following new facilities are proposed for development within the boundaries of the new WMF. Current Mine practice is to sort the waste at the existing WMF; however as part of the Project and development of the new WMF a source separation program will be introduced. This source separation system will minimise handling of the waste and ensure proper disposal of the waste as outlined below:

• An additional incinerator (five tonne), providing a total of three incinerators on-site for the construction phase of the Project. The incinerator will be housed in a separate facility with diesel fuel tank and electrical power. The incinerator will be capable of handling a range of wastes such as organic waste, workshop solid waste, food waste from dining room and kitchen, dewatered sewage sludge and medical waste. The incinerator will be batch incineration (operating temperature will be appropriate to the wastes being incinerated with a capacity of approximately of 5 t/day to 9 t/day) and designed to comply with IFC air emissions standards without air quality control systems or scrubbers.

• An open burning area for reagent boxes will be developed. The area will be fenced and will be located at sufficient distance to satisfy the appropriate fire regulations and good international practice. Prior to burning, the sodium cyanide reagent boxes will be decontaminated and then burned as is acceptable practice under the ICMC;

• Since the majority of sorting is intended to be done at source, the sorting area will be used to store “recyclable” materials (e.g. wood, steel, cable, drywall, etc.);

• A laydown area (50 m by 50 m) will be developed for large materials that cannot be stored in the sorting area but which can be resold; and

• A laydown area (100 m by 100 m) for steel equipment and metal waste from the maintenance shop will be developed.

3.2.6.8 Raw Water Storage Pond

Located near of the new CIL process plant, a raw water storage pond will be built to act as a local reservoir for sea water supply to the new processing plant and leach facilities.
Upon installation, the pond will initially be supplied with water from the existing borefield until the sea water supply system, proposed in Phase 3 of the Project, is operational.

In order to allow storage of three days' water supply of approximately 350,000 m³ of raw water, a HDPE liner will be installed along the bottom and sides of the pond to prevent seepage to the surrounding soils. The base of the pond will be covered with a sand bedding layer to protect the HDPE liner from perforations. There will be no covering over the top of the pond.

To prevent unwanted access to the pond and to minimise wind-blown sand impacting on the active storage capacity of the pond, material excavated from the pond footprint during construction may be used as a berm.

3.2.6.9 Reverse Osmosis Plant

In addition to the two Reverse Osmosis (RO) water treatment systems permitted in Phase 1b, an additional four RO trains and one RO water treatment system are proposed for Phase 2.

The RO trains will be capable of the following:

- Treatment of raw water from either a sea water 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 RO trains will be sized to approximately 32 m³/hr each. Additional RO trains may be required. These RO trains will be installed in the area of the existing plant on the eastern side of the open pit and will primarily supply desalinated water to process facilities and workers. The remaining two trains will be installed near the new raw water pond and will initially provide desalinated water for construction purposes. Following construction, one RO train will be moved from the eastern to the western side of open pit.

The RO water treatment system will provide demineralised water to the Phase 2 power plant. The system will be based on a two 100% dual pass RO system. This membrane based system requires a pre-treatment system consisting of multi-media filters and chemical treatment capacity.

3.2.6.10 Drainage and Stormwater Management System

The existing system will be expanded to accommodate the new facilities and infrastructure. Drainage and stormwater management can be divided into two categories:

- External drainage: This is defined as the runoff from upstream areas, the flow of which drains onto the Mine site. External drainage is considered clean water and will be diverted away from the Mine site via interceptor ditches that will direct the runoff to the surrounding environment, thus bypassing Project components such as the CIL process plant, WMF and accommodation camp. These ditches will be trapezoidal in shape and will be designed to handle a 24 hr, 100 year return storm event. The ditches will be located at selected areas along the Mine’s perimeter fence.
- Plant drainage: This is defined as the runoff which enters the Mine site. Plant drainage will be collected via ditches and swales located within the Mine site. Depending on the quality of
the collected water, it will either be contained and recycled or released to the environment. Ditches, swales, culverts and ponds within the plant site have been designed to handle a 24 hour, 25 year return storm event. New stormwater management ponds will be located on the western side of the open pit, adjacent to the Phase 2 power plant and processing facilities. These ponds will not be lined except for the CIL process plant containment pond which will be HDPE lined.

3.2.6.11 Internal Access Roads

To allow access to new infrastructure and facilities, additional internal access roads will be developed. Where possible, existing road alignments will be preserved and new roads will be designed and constructed the intention of minimising disturbance of the natural environment and the quantity of earthworks. Wherever practical, existing road alignments will be preserved.

3.2.7 Water Supply

There are no proposed amendments to the overall water supply for the mining operations in Phase 2. Water will continue to be provided by three pipelines from the borefield to the west of the Mine site at a rate of approximately 30,000 m³/day (permitted in Phase 1b). The water is saline in nature and is treated by RO plants as needed.

It is proposed that a sea water supply system be developed as part of Phase 3 of the Project in order to sustainably supply the Mine’s expanded water requirements. Total raw water demand for process and potable demands is anticipated to be approximately 70,000 to 110,000 m³/day.

Part of the raw water demand is required to meet potable water needs. RO will be used to produce fresh water. Concentrated brine is a bi-product of the RO process and will be used for dust suppression, in the process plants or disposed of into the TSFs as appropriate.

3.2.8 Access

There are no proposed amendments to the Mine’s access in Phase 2. The access road will continue to be maintained during the Project construction period, whereupon it will be upgraded to a hard surfaced access road (permitted in Phase 1a(i)). In addition, the existing airstrip may be closed as the Mine expands and a new air strip may be developed as part of the Project (permitted in Phase 1b).

3.2.9 Labour

To support the Mine’s expanded operations the labour force will increase in relation to the scale of the construction, operation and closure activities as summarised in Figure 3-7 and Figure 3-7.
Construction labour requirements are based upon several factors including labour productivity estimates, Project construction scope and the Project construction sequencing schedule for the Phase 2 Project components. The Project scope and construction sequencing schedule is subject to refinement and will be confirmed following completion of the feasibility study.

For construction, Mauritanian workers will work a 64 hrs/week schedule when on rotation and expatriates workers will work a six weeks on/two week off rotation until the end of their contract. Other workforce rotations may be considered during construction activities.

Figure 3-7: Estimated Operational Workforce Requirements
Operational labour requirements are based on a number of parameters including the mine plan, labour productivity and efficiency estimates, Phase 2 Project component sequencing and other factors that will be confirmed as part of the feasibility study. Workforce requirements will include contractors. For operations, it is envisioned that national workers will work a two weeks on/one week off rotation. It is possible that the rotation may change to a two weeks on/two week off schedule.

During rotation, all workers will be housed in the accommodation camp located on the Mine site.

Training and development of workers will be undertaken in order to:

- Develop the necessary skills of the national workforce in preparation for the expanded Mine operations. This will include expanding the skills and knowledge of the existing workers as well as future workers; and
- Transfer the knowledge and skills from expatriates to nationals.
Existing workers will benefit from career planning and both general and skills development training. This may include topics such as basic hygiene, basic finance, computer studies, language upgrading, basic work area responsibility/housekeeping, punctuality, working and cultural/social transition studies; Basic industrial skills training for any workers who do not yet meet the minimum skills requirement; technical trades top-up training and job-specific/plant-specific training; and supervisory skills and leadership techniques.

New workers will undergo mandatory general induction, mandatory general safety (eight hours) and, where appropriate, general supervisory training modules. Transitional training will also be given on topics such as basic hygiene, basic finance, computer studies, language upgrading, basic work area responsibility/housekeeping and punctuality. Thereafter, trades training apprenticeship programs will combine classroom training (12 weeks to 28 weeks depending upon trade) with hands-on training and practice under supervision (up to three years depending upon achievement of required competency levels).

In order to deliver this extensive, on-going training program, a professional team will be assembled and a Training and Development Campus will be established at the Mine (see Section 3.2.6.1).

### 3.2.10 Traffic and Transportation

A variety of transportation types and frequencies are required to transport equipment, materials, fuel and workers for the Mine’s existing operations. Presently equipment and materials required for the operation of the Mine are transported to the Mine site from the Nouakchott Port (approximately 18 vehicles per day) and fuel (for plant, vehicles and aeroplane) is transported from Nouâdhibou Port (approximately five to six vehicles per day and two per year for jet fuel). Equipment, materials and fuels are transported in vehicles along the Nouakchott – Nouâdhibou N2 highway.

During construction, equipment and materials required for the Project will be transported to the Mine site from the Nouâdhibou Port along the Nouakchott – Nouâdhibou N2 highway. Some of the components that are required during construction may exceed the vehicle size and load limits along roads in Nouâdhibou and some road modifications may be required. Potential road modifications are to be dealt with by a Construction Management Plan (see Sections 14 and 18) and are not assessed in this EIA. During this period, equipment and materials required for the on-going operations will continue to be transported to the Mine site from the Nouakchott Port (approximately 38 vehicles per day) and fuel from Nouâdhibou Port (approximately 42 vehicles per day).

Post construction, i.e. during the operational phase of the Project, equipment and materials required will continue to be transported, by vehicle, from Nouakchott Port (approximately 30 vehicles per day) and fuel from Nouâdhibou Port (approximately 42 vehicles per day and two per year for jet fuel).

Workers are currently provided with transportation around the Mine (either in pick-up trucks, SUV or buses depending on the grade of worker) and transportation to and from the Mine and Nouakchott according to their rotation. The anticipated number of light vehicles (pick-up trucks, SUV or buses) required for worker transportation is outlined in Figure 3-8.
In addition, it is anticipated that the number of bus trips required to transport workers to and from the Mine to Nouakchott will increase from two to three trips per day currently to approximately 31 trips per day during construction. It is anticipated that during operation, the number of bus trips required to transport workers to and from the Mine to Nouakchott will be approximately 18 trips per day.

3.2.11 Closure

The plans for closure of the Phase 2 components are outlined within the preliminary Reclamation and Closure Plan, which is presented in Section 19 of this EIA Report. Table 3-8 outlines general principles of rehabilitation and closure for components.

Table 3-8: Rehabilitation and Closure Strategy Summary

<table>
<thead>
<tr>
<th>Component</th>
<th>Closure Strategy Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expanded Open Pit</td>
<td>Open pit to be retained&lt;br&gt;Safety bunds to be retained / placed around perimeter with appropriate stormwater drainage</td>
</tr>
<tr>
<td>CIL Process Plant</td>
<td>Structures will be dismantled and removed for re-use or sale&lt;br&gt;Foundation will be broken up and covered to a depth of at least 500 mm&lt;br&gt;All areas will be ripped and, if necessary, the area re-graded</td>
</tr>
<tr>
<td>Dump and Heap Leach Facility</td>
<td>The leach facilities will be a permanent feature&lt;br&gt;Rinse with water to reduce residual cyanide concentration, downdrain will be collected and used in CIL process plant&lt;br&gt;Minimal profiling to establish safe slopes&lt;br&gt;Removal of all ponds and piping infrastructure&lt;br&gt;Routing of all run-off to existing surface water courses</td>
</tr>
<tr>
<td>Waste Rock Dumps</td>
<td>Waste rock dumps to be constructed to allow for natural rehabilitation</td>
</tr>
<tr>
<td>Component</td>
<td>Closure Strategy Summary</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>Waste rock dumps will be permanent features&lt;br&gt;Routing of all run-off to perimeter areas</td>
<td></td>
</tr>
<tr>
<td>The TSF will be a permanent feature and will be capped with approximately 0.6 m of fill&lt;br&gt;Downdrain managed by passive evaporation&lt;br&gt;Design of the TSF outer slope angles and final cap gradient, to ensure that they are resistant to erosion</td>
<td>TSF 3</td>
</tr>
<tr>
<td>This facility will be dismantled and removed for re-use or sale&lt;br&gt;Foundations will be broken up and covered to a depth of at least 500 mm&lt;br&gt;All areas will be ripped and, if necessary, the area re-graded</td>
<td>Power Plant and Power Distribution System</td>
</tr>
<tr>
<td>Structures will be dismantled and removed for re-use or sale&lt;br&gt;Foundation will be broken up and covered to a depth of at least 500 mm&lt;br&gt;All areas will be ripped and, if necessary, the area re-graded.</td>
<td>Ancillary facilities (such as, offices, workshops, warehouses, storage areas, fuelling facilities, accommodation camp, medical clinics, and water treatment)</td>
</tr>
<tr>
<td>Compaction followed by capping with at least 500 mm depth rockfill cover.</td>
<td>Waste Management Facility</td>
</tr>
<tr>
<td>System to be left in place</td>
<td>Drainage and Stormwater Management System</td>
</tr>
<tr>
<td>Used for initial TSF downdrain&lt;br&gt;Upon final closure, sediment will be removed, liners folded in an area fill and re-graded to local topography</td>
<td>Raw Water Storage Pond</td>
</tr>
<tr>
<td>Roads will be ripped up and, if necessary, re-graded to local topography</td>
<td>Internal Roads</td>
</tr>
</tbody>
</table>

Phase 2 Environmental Impact Assessment

March 2012
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 9% to 10% of the annual gross domestic product in 2008. Mauritania’s total exports were valued at approximately $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 Mauritania’s total exports.

The Ministry of Petroleum, Energy and Mines (MPEM) is the government agency responsible for regulating the mineral industry in Mauritania. It has been supported by several international projects (with the World Bank and the Extractive Industries Transparency Initiative) 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, (World Bank, Project, Project Summary, Mining Sector Capacity Building Project ID P057875).

Such initiatives have resulted in increasing foreign investment in Mauritania. 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 north west Africa and is bordered by Western Sahara and Algeria to the north, Mali to the east, Senegal to the south and the Atlantic Ocean to the west. The Mine is situated in the Inchiri Wilaya of north eastern Mauritania, approximately 300 km north of Nouakchott, 250 km south east of Nouâdhibou and 65 km east of the border of the Parc National du Banc d’Arguin (PNBA) (see Figure 1-1).

The nearest permanent community is Louik, which is located within the PNBA. 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 Baseline Conditions

To determine baseline conditions for the Mine, including the entire Mine site, access road and borefield, the following baseline surveys have been undertaken: air quality, ecology, groundwater, archaeology and cultural heritage, socio-economic and traffic.

Details of the methodologies and results of the baseline surveys, together with information gathered in a comprehensive data review, are presented in Sections 6 to 16 of this report. A brief overview is provided below of the Phase 2 Project setting.

4.3.1 Physical Environment

4.3.1.1 Climate

The climate is classified as an arid - desert climate. The average annual maximum temperature is above 45°C between the months of May and August; minimum temperatures can reach below 10°C in the months of December to January. Average annual precipitation at the Mine site is approximately 90 mm and usually occurs during the months of July to September. The average recorded monthly evaporation is approximately 320 mm/month (3840 mm/a).

4.3.1.2 Air Quality, Noise and Vibration

As a result of natural desert conditions and current mining operations, air quality at the Mine site is dominated by concentrations of both coarse dust particles and respirable particles (PM10). Sources of emission on-site include exhaust emissions from the Heavy Fuel Oil (HFO) power plant, mobile plant and road vehicles.

Baseline noise levels in the vicinity of the Mine site are dominated by the operation of the existing Mine. Noise impacts upon sensitive receptors (local communities and workers at the accommodation camp and offices) are low due to the remote location of the Mine site and the distance between sources of noise and receptors.

4.3.1.3 Soils and Land Use

The Mine site is generally flat, covered by skeletal soils, which generally comprise hard rock overlain with sand, and is affected by sand dunes. The soils are predominantly sand and gravel, comprising transported sediments with low agricultural potential.

A relatively small number of people reside on a permanent or temporary basis in the vicinity (approximately 30 km) of the Mine site, while the nearest towns are located approximately 100 km away. Land use is largely limited to grazing by small livestock herds owned by local residents and by larger herds of camels, sheep, goats and some cattle as transhumance movements pass through the area.

4.3.1.4 Surface Water and Groundwater

Surface Water

As a result of the high rate of evaporation and low rainfall there are no permanent watercourses on-site or within the local vicinity. However storms can produce ephemeral floods in wadis and across open ground.
Groundwater – Mine Site

There is no viable aquifer at the Mine site; the primary permeability of the rock is low, boreholes drilled at the Mine site yield little or no water and the groundwater has a high salt content and cannot be abstracted for any practical use. This saline water has high concentrations of chlorides and sulphates and contains heavy metals such as lead, chromium and nickel, making it unsuitable for industrial or potable use.

Groundwater at the Mine site is therefore not used for either the mining operations or for potable use. A series of 15 boreholes have been established at the Mine site and the water quality and groundwater levels are monitored quarterly. Groundwater levels are generally around 35 m to 40 m below ground level, but groundwater levels are slow to recover and some boreholes appear to be dry when first drilled.

4.3.2 Biological Environment

The habitat present within the Mine site is of a gravelly regs\textsuperscript{3} type, the typical habitat of much of the middle, north and north-east of Mauritania.

Vegetation cover is typically low and comprises relatively few plant species. The most common species recorded are herbaceous plants, particularly \textit{Fagonia oliveri}, \textit{Aerva javanica}, \textit{Aristida spp.}, \textit{Astragalus vogelli}, \textit{Chrozophora brochiana}, \textit{Citrullus colocynthis}, \textit{Corchorus depressus}, \textit{Farsetia ramosissima}, \textit{Hyoscyamus muticus}, \textit{Monsonia nivea}, \textit{Nucularia perrinii}, \textit{Panicum turgidum}, \textit{Pulicaria incisa}, \textit{Setzzenia lanata} and \textit{Stipagrostis pungens}.

Four woody species (trees and shrubs) were identified on-site; namely, \textit{Acacia ehrenbergiana}, \textit{Calotropis procera}, \textit{Capparis decidua}, \textit{Maerua crassifolia}. Three of the species identified are protected under national legislation due to their socio-economic importance.

The fauna (birds, mammals and invertebrate) recorded is similarly of relatively low diversity and none of the species recorded are officially classed as rare, threatened or protected apart from a single observation of a migratory Egyptian vulture using the Mine as a stopping off point.

4.3.3 Social-Economic Conditions

The Mine site is based in Inchiri Wilaya, a region covering 41,700 km\textsuperscript{2} (SNC Lavalin, 2004). The region has a very low population density, with approximately 9,936 (ONS, 2008) inhabitants (approximately 0.3\% of the total population of Mauritania). The Wilaya is administered from its capital, Akjoujt, where the majority of Inchiri’s population reside.

The nomadic way of life is a feature of Mauritanian culture; whilst this way of life is in decline a number of nomadic / semi-nomadic people 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, predominantly within three communities; Emkebden, Guelbdawass and Ntalve. Residents practice animal husbandry and other subsistence forms of livelihood. Similarly, at the junction of the Mine access road and the main Nouakchott-Nouâdhhibou N2 highway, a few families have set up structures and provide a range of services (such as an inn, restaurant, and shop) for travellers.

---

\textsuperscript{3} Regs are desert landform defined as broad plains covered with sand and gravel. Regs are the dominant landform in most of the Sahara.
In January 2012, the Mine employed about 3,300 workers of which approximately 80% are Mauritanian; 1,300 workers are engaged in construction and about 2,000 workers (approximately 85% Mauritanian) for ongoing operations. Workers are accommodated at the Mine site.

4.3.4 Archaeology and Cultural Heritage

The Mine area is characterised by three key types of archaeological sites: Neolithic settlements (c.6,000 – 2,800 Before Present (BP)) on old ogolian dunes, protohistoric tombs (c.2,500 BP – 1,000 AD) clustered on gravels and rocky ridges, and historic Muslim tombs (c.700 AD to present). A total of 74 sites were identified within the Mine site. All of the archaeological 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. There are no World Heritage sites or candidate sites within the Mine site.

Cultural heritage in Mauritania is the property of the State, and is protected by law (principally, Framework Law No. 2005-046 on the Protection of Tangible Cultural Heritage). Muslim tombs are protected by national/Islamic law and customary practice.
5 Impact Assessment Methodology

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 2 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 ToR process involved a preliminary review of the potential environmental and social impacts of the proposed Project components for Phase 2, including a site visit and review of existing data.

The ToR report, which presented the proposed approach for the EIA, was submitted to Ministry of Environment and Sustainable Development (MESD) in October 2011, and was approved on 4 December 2011. A copy of the approved ToR report for Phase 2 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 (Islamic Republic of Mauritania, November 2006). Under this legislation the Project is defined as Category A.

In line with Mauritanian Legislation Decree No. 2004-094 and No. 2007-105, the Project is classed as a Category A Project and is therefore undergoing the Mauritanian EIA permitting process which is illustrated in Figure 5-1.

The EIA also takes into consideration international best practice, in particular the International Finance Corporation (IFC) Performance Standards and the EU EIA Directive 85/337/EEC, as well as other relevant international protocols/agreements/treaties applicable to Mauritania (see Section 2).

With regard to the 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.
Figure 5-1: Mauritanian EIA Permitting Process
5.3.1 Consultation

Consultation (also referred to as stakeholder engagement) 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 Section 1 and Section 20. Regular consultation meetings have been held with the relevant Mauritanian authorities, including Ministry Petroleum, Energy and Mine (MPEM), MESD and Ministry of Water and Sanitation (MWS). In addition, a Project Coordination Committee has been established between Tasiast Mauritanie Limited SA (TMLSA)/Kinross and several key Ministries to facilitate Project implementation;

- **Stakeholders**: A series of public consultation meetings for Phase 2 have been held with stakeholders (at the Gare du Nord, Bennichab and Nouâdhhibou) and their comments are addressed in this EIA report (see Section 20); and

- **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 2 Project components are assessed. The establishment of the baseline conditions facilitates identification of potentially sensitive receptors (such as ecosystems and 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 2 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 16. The key stages are:

- **Existing baseline data**: Review of relevant published data, including previous EIAs for the Mine (SNC Lavalin, 2004, Scott Wilson, 2008a,b,c,d, 2009a, b and 2010a). Sources of baseline data and 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, or too narrow in scope) for the current EIA process, new baseline surveys were conducted and additional primary data collected. Phase 2 baseline surveys were undertaken for the transportation route and the entire area of the Mine site within the perimeter fence. This ensures baseline conditions were understood across the whole Mine site area where mining operation and activities are ongoing, areas where specific Project components are to be located and areas where future expansion of those components may occur. The surveys were undertaken from February 2011 through November 2011 and included; air quality, ecology, groundwater, archaeology and cultural heritage, socioeconomics and traffic. The methodologies and results of the baseline surveys, together with information gathered in the data review, are presented in Sections 6 to 16 of this Report; and

- **Geographic information system (GIS)**: Development of a GIS incorporating remotely sensed data (satellite imagery and aerial photography), topographical maps, secondary
5.3.3 Identification and Assessment of Impacts

For the Phase 2 EIA, it has been assumed that all the land within the perimeter fence may be required and therefore impacted by the Project and has been assessed accordingly. This approach allows for the footprints currently identified for the main Project components, as described in Section 3 of this Report, a buffer zone around the facility, areas for developing the internal road system and any further expansion of facilities that may become necessary.

Potential impacts (both beneficial and adverse) have been identified through a technical assessment of the predicted effects of the Phase 2 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 as outlined in the Project design criteria (Hatch, 2011a) 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 to the impact.

Phase 2 potential impacts have been assessed for the lifetime of the relevant Project components; this includes:

- **Construction**: Period during which Phase 2 Project components will be delivered to the Mine, erected and installed;
- **Operation**: Period during which the relevant Phase 2 Project components will be in-use at the Mine;
- **Closure**: Period when relevant Phase 2 Project components are decommissioned and the area is rehabilitated in line with an agreed rehabilitation and closure plan (see Section 19). Post closure no operations will be undertaken; however monitoring will be continued until final closure is approved by the relevant Authority.

Within this EIA, the following generic matrix is used to define the level of and significance of impacts:

**Table 5-1: Level and Significance of Impacts**

<table>
<thead>
<tr>
<th>Receptor sensitivity</th>
<th>Impact Magnitude</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Moderate</td>
<td>High/Moderate</td>
</tr>
<tr>
<td>Low</td>
<td>Moderate</td>
</tr>
<tr>
<td>Negligible</td>
<td>Moderate/Low</td>
</tr>
</tbody>
</table>
The ‘residual impact’, i.e. the impact remaining after mitigation, has been assessed using the terminology presented in Table 5-2.

In the event that the generic terminology adopted for this EIA is deemed unsuitable for whatever reason for the technical assessment of any subject under review, the technical chapter (e.g. Archaeology, Socio-economic) shall explain any specific variances from the standard methodology.

Table 5-2: Standard Assessment Terminology

<table>
<thead>
<tr>
<th>Nature of predicted impacts</th>
<th>Neutral</th>
<th>No overall environmental and/or social impact.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adverse</td>
<td>Negative environmental and/or social impact.</td>
<td></td>
</tr>
<tr>
<td>Beneficial</td>
<td>Positive environmental and/or social impact.</td>
<td></td>
</tr>
<tr>
<td>Direct</td>
<td>Direct environmental and/or social impacts are those that can be directly controlled to some degree. For example, through the application of design specifications, mitigation measures and/or operational management control. This definition assumes Project ‘control’ over its primary supply chains.</td>
<td></td>
</tr>
<tr>
<td>Indirect</td>
<td>Indirect environmental and/or social impacts are those that cannot be directly controlled to any degree, but which might be reasonably expected to exert some influence. This definition assumes a variable degree of Project influence over secondary supply chains and other third parties.</td>
<td></td>
</tr>
</tbody>
</table>

Where possible, the rating of impact significance, nature and duration is based upon quantitative criteria (such as, the IFC General EHS Guideline values) together with the use of value judgements and expert interpretations to establish to what extent an impact is environmentally or socially significant. In addition, performance against environmental quality standards or constituent control thresholds and compatibility with environmental policies is taken into account where appropriate (refer to Section 5.3).

5.3.4 Cumulative Impacts

As discussed in Section 1.3, the phased approach to the overall Project has been developed to accommodate Project activities being carried out at different locations (on-site and off-site), and to minimise the overlapping of construction activities and thus potential for cumulative impacts. Mauritanian legislation (Article 9, Decree 2007/105) states that "where the work is staggered..."
over time, the study or review corresponding to each of the operation’s phases must include an appreciation of the impacts of the whole program”.

While the potential for significant cumulative impacts arising from the Project phases is considered to be limited (because of the phased approach to construction and the spatial separation of Phase 3 components from Phase 1 and 2 components), an assessment of the cumulative impacts of each Project phase will be carried out on a discipline basis, per the disciplines covered in Sections 6 to 16. These are; surface and ground water, air quality, noise and vibration, soils and land use, ecology, socio economics, archaeology and cultural heritage, landscape and visual, waste management, climate change and traffic.

5.3.5 Mitigation

Mitigation measures are proposed to ensure that beneficial impacts are enhanced and adverse impacts are avoided, reduced, remediated (restored), compensated or offset as appropriate. Mitigation includes embedded measures / 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

This EIA report includes a preliminary EMP to integrate all aspects of mitigation, management, monitoring and institutional measures into a framework management plan for Phase 2 (Section 18).

Each successive phase of the Project is subject to distinct EIA processes and any cumulative impacts are being fully assessed at each phase. All proposed mitigation actions will be incorporated into and implemented via the Mine’s Corporate Responsibility Management Systems.

5.3.7 Rehabilitation and Closure Plan

The EIA includes a preliminary plan for rehabilitation and closure of Phase 2 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

This Section presents the methodology and baseline conditions used to assess the potential impacts on surface water and groundwater resulting from Phase 2. In addition, mitigation measures which aim to reduce, remediate or avoid potential impacts are proposed and the residual impacts (impacts after mitigation measures implemented) are assessed.

Many mitigation measures are already included in the design for the protection of water and to minimise the impact on the water environment. These measures are referred to as ‘embedded mitigation’ and reduce the potential impact magnitude.

Water is a precious resource in Mauritania. However there is no viable aquifer at the Mine site. Aquifers are defined as 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. 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.

The high rate of evaporation and low rainfall also means that there are no permanent natural watercourses in the vicinity of the Mine; however storms can produce ephemeral floods in wadis and across open ground. If surface water is referred to in this assessment it is in regard to temporary stormwater or runoff (not to the current, artificial water bodies such as the process ponds and sewage lagoons).

6.1 Methodology

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

The International Finance Corporation (IFC) Environmental, Health and Safety (EHS) Guidelines for Mining form the basis for design, assessment and mitigatory approach for surface water and groundwater. Although groundwater is of low value and surface water is ephemeral, the Mine design follows good practice. The key guidelines 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 on water users;
- Minimise the amount of make-up water to the extent practical; and
- Consider the potential impact to the water balance prior to commencing any dewatering activities.

Regarding water quality, stormwater flows are infrequent but the Project design and operational controls will ensure that runoff does not become contaminated. The following guidelines are of relevance:

- The quality and quantity of Mine effluent streams discharged to the environment, including stormwater that contacts Mine site components, should be managed and, if necessary, treated to meet the applicable effluent discharge guideline values and baseline (background) water quality targets; and
- 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:

- Separation of stormwater from process and sanitary wastewater streams in order to reduce the volume of wastewater to be managed;
- Collection and recycling of 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
- Minimising runoff from areas without potential sources of contamination to reduce the peak discharge rate.

Other management guidelines include:

- Water used for dust suppression must not reach surface waters; and
- Diversion of stormwater around active areas to avoid contact with disturbed areas.

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

There is no perennial surface water in the area so the surface water baseline relies mainly on topographic mapping. The area of the topographic catchment indicates the likely volumes of runoff following rainfall events.

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

- Topographic maps;
- Catchment areas; and
- Meteorological data.

For the groundwater baseline, boreholes were used to provide details on the geology and hydrogeology of the Mine site and pit. Extensive drilling has been carried out to define mineral reserves. Some of these boreholes had qualitative hydrogeological observations such as ‘wet samples’ or had struck water levels. This information was used to focus hydrogeological investigations in the West Branch area.

During 2008/2009, water level monitoring and dewatering observations were carried out at the Piment Nord pit and six groundwater monitoring wells were installed in 2009.

In addition, during 2011, hydrogeological information was collected as part of the geotechnical information for pit design. This included:

- Additional water level monitoring from existing open boreholes (to complement the 2008/09 data set);
- Airlift observations of ongoing exploration reversed circulation drilling, including quantifying flows and specifying final airlifting test at end of boreholes;
- Drilling and testing a 400 m vertical borehole through the hanging wall with airlifting and falling head permeability tests;
- Drilling and testing vertical and inclined hydrogeological boreholes to a depth of 200 m;
- Packer testing of ten inclined geotechnical boreholes using single or double wire line packers; and
- Installation and monitoring of 25 vibrating wire transducers in eight boreholes (three or four per borehole) to a maximum depth of 495 mbgl.
Details are contained in the hydrogeological baseline report of 2012 (URS, 2012a).

Nine additional boreholes were drilled around the Mine site in 2011 for baseline and future monitoring. The drilling contractor was ELMA Forages, a Mauritanian company. The boreholes were located in and around the Mine site to give good general coverage. Boreholes were located around facilities such as the Tailings Storage Facility (TSF) so that future water quality can be compared with baseline water quality. The depth of the monitoring boreholes was approximately 100 m; this was to ensure that the more weathered zones below the water table could be monitored.

Groundwater levels have been recorded at the original six environmental monitoring wells on the Mine site since March 2010. Monitoring continued at both these wells and the additional nine monitoring wells from April 2011. Water level data recorders were installed in all available monitoring wells.

Water samples were taken from monitoring wells and existing open pits. More than 80 samples were collected and the results of analyses were used to define the baseline for the Phase 1b assessment. Further sampling in September 2011 was used to strengthen the baseline water quality assessment for the Phase 2 EIA. Mauritanian workers are being trained in the use of specialist water monitoring and sampling equipment in order to facilitate the Mine’s long term groundwater monitoring programme.

The regional nature of surface water and groundwater flow means that the impacts are assessed not only at the Mine site but in the wider water basin/catchment area surrounding the Mine.

For surface water, the assessment takes into account potential impacts on temporary stormwater flows in the immediate upstream and downstream catchments as well as the Mine site.

The groundwater assessment uses a conceptual hydrogeological model that was developed following the geotechnical and hydrogeological investigations and subsequent monitoring. A flow balance model was created to assess the effects of rainfall and the relative balance between rain and evaporation. In addition, a numerical hydrogeological model was developed to simulate pit dewatering and changes in groundwater levels during operation and post closure.

6.2 Baseline Conditions

6.2.1 Climate

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

The area experiences very low rainfall with an annual precipitation of approximately 90 mm. This value has been updated since submission of the Phase 1b EIA. Rainfall usually occurs during the ‘hivernage’ which lasts from July to September. Average recorded monthly evaporation is approximately 320 mm/month (3925 mm/a) at ATAR station, which is located approximately 265 km east of the Mine. This station was selected because of its location and long term weather records.

Table 6-1 shows the range of monthly average rainfall and evaporation for ATAR station for the period 1973 to 2009.
Rainfall is very variable. The random nature of rainfall can be expressed in terms of a return period in years or probability of an event. Individual rainfall events can be considerably more than the monthly average rainfall. The probable maximum effective 24 hour rainfall for different return periods is given in Table 6-2. The average climatic conditions and the probable maximum rainfall are used in the assessment of water flows into the open pit.

Table 6-1: Average Monthly Rainfall and Evaporation

<table>
<thead>
<tr>
<th>Month</th>
<th>Average Rainfall (mm)</th>
<th>Average Evaporation (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>1.6</td>
<td>153</td>
</tr>
<tr>
<td>February</td>
<td>2.1</td>
<td>202</td>
</tr>
<tr>
<td>March</td>
<td>1</td>
<td>309</td>
</tr>
<tr>
<td>April</td>
<td>0.3</td>
<td>385</td>
</tr>
<tr>
<td>May</td>
<td>0.93</td>
<td>491</td>
</tr>
<tr>
<td>June</td>
<td>4.2</td>
<td>504</td>
</tr>
<tr>
<td>July</td>
<td>6.8</td>
<td>513</td>
</tr>
<tr>
<td>August</td>
<td>27.1</td>
<td>431</td>
</tr>
<tr>
<td>September</td>
<td>29.7</td>
<td>346</td>
</tr>
<tr>
<td>October</td>
<td>9.1</td>
<td>262</td>
</tr>
<tr>
<td>November</td>
<td>4.5</td>
<td>180</td>
</tr>
<tr>
<td>December</td>
<td>3.6</td>
<td>149</td>
</tr>
</tbody>
</table>

Table 6-2: Probable Maximum Effective Rainfall for Different Return Periods

<table>
<thead>
<tr>
<th>Return Period (years)</th>
<th>1000</th>
<th>500</th>
<th>100</th>
<th>50</th>
<th>20</th>
<th>5</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max Effective Rainfall (mm) (24 hour)</td>
<td>118.3</td>
<td>107.6</td>
<td>82.7</td>
<td>71.9</td>
<td>57.5</td>
<td>34.8</td>
<td>17.3</td>
</tr>
</tbody>
</table>

6.2.2 Surface Water Courses

The high rate of evaporation and low rainfall means that there are no permanent natural watercourses in the vicinity of the Mine; however storms can produce ephemeral floods in wadis and across open ground.

The topography of the region is shown in Figure 6-1 (République Islamique de Mauritanie, Carte Géographique à 1/200,000, Chami 2005). 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 approximately 120 m above sea level. On the basis of the regional mapping, the catchment area is approximately coincident with the Mine site. Drainage is towards the Mine site from the catchment 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 km²; the proposed Mine open pit and process plant occupy an area of approximately 133 km².
Drainage patterns give an indication of the permeability of the ground and likelihood of infiltration of rainfall. The permeability is likely to be lower where there are more drainage routes. Due to the geology and climate the majority of rainfall runs off and evaporates, there is little evidence of infiltration at the Mine site.

6.2.3 Geology

Two principal mineralised zones have been identified within the Mining Licence Area (MLA); these are the Piment and the West Branch zones.

The Piment zone is situated along the east limb of an interpreted broad, regional antiform that is cored by 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, which 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 the previous operators;
- Late cross-cutting mafic (dolerite-gabbro) dykes (MGO-MDO); and
- 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 mine lease area (MLA) but, at West Branch, it averages about 50 m below ground surface in the west, and 45 m and 46 m in the centre and west respectively.

6.2.4 Acid Rock Drainage

The potential for formation of Acid Rock Drainage (ARD) was evaluated in a screening study undertaken in 2011 (URS Scott Wilson, 2011j). Leachate testing was also undertaken to assess metal leaching potential.

The IFC EHS guidelines for Mining describe ARD as acid formation that occurs when potentially acid generating materials in excess of acid neutralizing minerals oxidize in an environment containing oxygen and water. The major acid generation process would arise from iron sulphide (pyrite or pyrrhotite) oxidation, and the main neutralisation reaction would be via the dissolution of calcite. The acidic conditions which result can dissolve and release metals
from their matrices which then may be mobilised in surface and groundwater systems. ARD issues can apply to sub-economic rock, tailing materials and any exposed rock surfaces such as road cuts and pit walls.

The risk of ARD is dependent on whether the Neutralising Potential (NP) of the rock exceeds the Acid Generation Potential and also on climatic and hydrological conditions.

The climate in Mauritania reduces the risk of ARD, if generated, from having an impact. Waste rock piles will remain largely dry and flushing of potential contaminants from the surfaces of waste rock dumps will not take place on a regular basis. Furthermore, there is no permanent surface water and groundwater is considered to be of low value at the Mine site.

The assessment of ARD potential has been based on ARD and leachate analytical analyses of 154 samples. The samples were collected from exploration drilling core from different lithologies. The number of samples from each lithology was based on the volumes of rock to be mined.

The assessment of the potential for ARD generation was undertaken in broad accordance with published guidelines (e.g. the International Network for Acid Prevention’s Global Acid Rock Drainage (GARD) Guide and the Canadian Mine Environment Neutral Drainage (MEND) Program).

Data from Acid Base Accounting (ABA) and Net Acid Generation test work was used for the estimation of the Acidification Potential (AP) and Neutralisation Potential (NP) of waste rock samples. These results were then used to determine Net Neutralisation Potential (NNP = NP-AP) and the Neutralisation Potential Ratio (NPR = NP/AP).

Where neutralisation is greater than acid forming potential the likelihood of acid forming and ARD is less. The following criteria were used:

- Non-Acid Forming (NAF): NNP >20 and NPR > 2
- Uncertain (UC): 0<NNP<20 and 1<NPR<2
- Potentially Acid Forming (PAF): NNP< 0 and NPR <1

Table 6-3 summarises the results and shows that, of the 154 samples submitted for static ARD characterisation tests, 91.6% were estimated to be Non-Acid Forming. Where materials were identified as Potentially Acid Forming (PAF), the magnitude of acid generation was comparatively low. The combined results in Table 6-4 show the average and median NNP to be more than 20 kg CaCO3/t and NPR more than 2. Both values are indicative of non acid forming conditions.
Table 6-3: Lithological distribution of samples determined to be Potential Acid Forming (PAF), Uncertain (UC) and Non-Acid Forming materials. N is number of samples tested

<table>
<thead>
<tr>
<th>Code</th>
<th>Lithology</th>
<th>n</th>
<th>%</th>
<th>n (%)</th>
<th>n</th>
<th>(%)</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GST</td>
<td>Greenschist</td>
<td>42</td>
<td>27.3</td>
<td>2</td>
<td>4.8</td>
<td>1</td>
<td>2.4</td>
</tr>
<tr>
<td>SVC</td>
<td>Volcanoclastic Sediment</td>
<td>34</td>
<td>22.1</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>BIM</td>
<td>Banded Iron Formation</td>
<td>33</td>
<td>21.4</td>
<td>1</td>
<td>3.0</td>
<td>2</td>
<td>6.1</td>
</tr>
<tr>
<td>FVC</td>
<td>Felsic Volcanic Rock</td>
<td>28</td>
<td>18.2</td>
<td>6</td>
<td>21.4</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>QVN</td>
<td>Quartz Viens</td>
<td>5</td>
<td>3.2</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Rsp</td>
<td>Saprolite</td>
<td>3</td>
<td>1.9</td>
<td>0</td>
<td>0.0</td>
<td>1</td>
<td>33.3</td>
</tr>
<tr>
<td>MGO</td>
<td>Gabbro</td>
<td>3</td>
<td>1.9</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>MDO</td>
<td>Dolerite</td>
<td>3</td>
<td>1.9</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>SHT</td>
<td>SCHIST</td>
<td>3</td>
<td>1.9</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>154</td>
<td>100</td>
<td>9</td>
<td>5.8</td>
<td>4</td>
<td>2.6</td>
</tr>
</tbody>
</table>

Table 6-4: Summary of Net Neutralizing Potential and Neutralizing Potential Ratio by Lithology

<table>
<thead>
<tr>
<th>Lithology</th>
<th>Ore</th>
<th>Waste</th>
<th>Total</th>
<th>NNP²</th>
<th>NPR³</th>
<th>NNP²</th>
<th>NPR³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greenschist</td>
<td>27.1</td>
<td>15.4</td>
<td>18.6</td>
<td>48.8</td>
<td>24.2</td>
<td>26</td>
<td>8.055</td>
</tr>
<tr>
<td>Volcanoclastic Sediment</td>
<td>24.8</td>
<td>28.1</td>
<td>27.2</td>
<td>38</td>
<td>28.6</td>
<td>24.2</td>
<td>9.845</td>
</tr>
<tr>
<td>Banded Iron Formation</td>
<td>20.2</td>
<td>35.5</td>
<td>31.3</td>
<td>79.7</td>
<td>69.8</td>
<td>60.8</td>
<td>27.8</td>
</tr>
<tr>
<td>Felsic Volcanic Rock</td>
<td>25.1</td>
<td>18.4</td>
<td>20.2</td>
<td>44</td>
<td>31.4</td>
<td>39.8</td>
<td>14.65</td>
</tr>
<tr>
<td>Quartz Veins</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>87</td>
<td>146</td>
<td>46.2</td>
<td>80.5</td>
</tr>
<tr>
<td>Saprolite</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>71.6</td>
<td>15</td>
<td>52.5</td>
<td>7.62</td>
</tr>
<tr>
<td>Gabbro</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>116</td>
<td>43.9</td>
<td>90.5</td>
<td>55.25</td>
</tr>
<tr>
<td>Dolerite</td>
<td>2.8</td>
<td>2.6</td>
<td>2.6</td>
<td>90.8</td>
<td>36.7</td>
<td>107</td>
<td>33.2</td>
</tr>
<tr>
<td>SCHIST</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>34.3</td>
<td>57</td>
<td>32.7</td>
<td>62.2</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>610.2</td>
<td>452.6</td>
<td>480</td>
<td>299.1</td>
</tr>
<tr>
<td>Weighted Average Waste</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>56.9</td>
<td>43.3</td>
<td>42.4</td>
<td>17.4</td>
</tr>
</tbody>
</table>

1. Preliminary Open Pit Model TMLSA Sept. 2011, $1,200 gold price, including potential heap leach for fresh rock
2. Net Neutralizing Potential (kg CaCO₃/t)
3. Neutralization Potential Ratio:
   Non-Acid Forming (NAF): NNP >20 and NPR > 2
Uncertain (UC): $0 < \text{NNP} < 20$ and $1 < \text{NPR} < 2$
Potentially Acid Forming (PAF): $\text{NNP} < 0$ and $\text{NPR} < 1$

Leachate testing demonstrated that, with the proviso that waste rock dumps remain at around neutral pH, no potential toxic metal leaching is anticipated. The release of oxyanions (arsenate, vanadate, molybdate and tungstate) may result in marginally elevated solution concentrations at around neutral pH. However, most oxyanion datasets tend to illustrate release dominated by FVC, SVC and GST lithologies and may be a consequence of sample bias due to greater frequency of data-points for these rock types.

The study concluded that there is sufficient buffering capacity to counter balance the Potentially Acid Forming and Uncertain (UC) materials. The above results, coupled with the favourable ARD climate, water regime at the Mine site and a Materials Management Plan (that will be developed for implementation), indicate low potential for ARD or metal leaching to develop.

6.2.5 Hydrogeology

Hydrogeological investigations were carried out at the Mine site as part of the geotechnical investigations for pit slope design (URS, 2012a). The primary permeability of the rock was found to be low and any groundwater flow that does occur will be through fractures, primarily through fracture zones. 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 60 m. Above this, permeability was calculated to lie in the range $10^{-6}$ 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 in the weathered rock and shown by nearby boreholes to be localised features. Figure 6-3 illustrates the range of permeabilities with depth.

Groundwater levels are recorded continuously at 13 monitoring wells (November 2011) and quality is monitored at the Mine site on a roughly quarterly basis. Groundwater levels and quality results from those wells are discussed in the following sections:

6.2.5.1 Groundwater levels

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

Groundwater levels at the Mine site are approximately 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 95 m below ground level have been recorded in some boreholes shortly after they had been drilled. Boreholes drilled in 2011, for example, were found to be dry initially with water levels recovering slowly with time to within 30 to 40 m in some areas. Earlier boreholes also show a slow rise in level and may still be stabilising. This slow response is attributed to low permeability (there were major rainfall events in September and October 2010 but there does not appear to be a measurable response to those events). 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 6-4. Significant fluctuations during the latter part of 2011 are in response to pumping and sampling carried out at the time.

On the basis of existing monitoring well 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; they contain water in the base between 10 m to 25 m lower than surrounding groundwater levels and this may be a controlling factor in the apparent groundwater flow direction.

6.2.5.2 Groundwater quality

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

Ambient groundwater samples are collected quarterly from monitoring wells around the Mine site. A summary of groundwater quality is included in Table 6-5 for all monitoring wells between March 2010 and September 2011. Comparison with World Health Organisation (WHO) guidelines for drinking water quality shows that the ambient water is high in total dissolved solids and is brackish to saline. The dominant ion is chloride, with an average of around 15,000 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 3500 mg/l compared to a drinking water standard of 500mg/l. The comparison with drinking water quality does not imply that groundwater should meet drinking water standards, but is a useful comparison standard and demonstrates that the groundwater is not potable due to naturally high concentrations of dissolved solids.

There have been some occurrences of metals in the ambient groundwater exceeding drinking water standards as shown by the maximum values in Table but average values in samples taken from monitoring wells beyond the zone of mineralisation do not, to date, indicate high concentrations of most metals.

With respect to IFC EHS Guidelines for Mining, these are applicable for site runoff and treated effluent discharges to surface waters. There is no permanent surface water but the standards provide a useful reference. The comparison with effluent standards does not imply that groundwater should meet these standards. Total cyanide and mercury have exceeded guideline values at a few monitoring wells on some occasions, as shown by the maximum values. No substances have an average above IFC EHS 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. 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 additional sampling since submission of the Phase 1b EIA was used to define this baseline for the expanded Mine operations in Phase 2.
### Table 6-5: Mine Site Baseline Water Quality Analyses

<table>
<thead>
<tr>
<th>Determinands</th>
<th>Units</th>
<th>WHO Guidelines for Drinking Water Quality</th>
<th>IFC EHS Mining Guidelines: Effluent*</th>
<th>Max.</th>
<th>Min.</th>
<th>Average</th>
<th>No. of Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>pH Units</td>
<td>6 to 9</td>
<td></td>
<td>8.18</td>
<td>6.71</td>
<td>7.35</td>
<td>85</td>
</tr>
<tr>
<td>Conductivity @ 20 deg.C</td>
<td>µs/cm</td>
<td></td>
<td></td>
<td>65900</td>
<td>10900</td>
<td>40880</td>
<td>85</td>
</tr>
<tr>
<td>Redox potential</td>
<td>mV</td>
<td></td>
<td></td>
<td>492.00</td>
<td>58.00</td>
<td>189.27</td>
<td>67</td>
</tr>
<tr>
<td>Dissolved solids, Total (meter)</td>
<td>mg/l</td>
<td>1000***</td>
<td></td>
<td>62300</td>
<td>3278</td>
<td>29219</td>
<td>79</td>
</tr>
<tr>
<td>Suspended solids, Volatile</td>
<td>mg/l</td>
<td></td>
<td></td>
<td>185</td>
<td>6</td>
<td>45</td>
<td>47</td>
</tr>
<tr>
<td>Total Suspended Solids</td>
<td>mg/l</td>
<td>50</td>
<td></td>
<td>402</td>
<td>6</td>
<td>164</td>
<td>37</td>
</tr>
<tr>
<td>Organic Carbon, Total</td>
<td>mg/l</td>
<td></td>
<td></td>
<td>14.88</td>
<td>1.60</td>
<td>5.44</td>
<td>62</td>
</tr>
<tr>
<td>Dissolved Organic Carbon</td>
<td>mg/l</td>
<td></td>
<td></td>
<td>14.17</td>
<td>1.81</td>
<td>6.40</td>
<td>37</td>
</tr>
<tr>
<td>Acidity as HCl</td>
<td>mg/l</td>
<td>25.00</td>
<td></td>
<td>19.75</td>
<td>4.87</td>
<td>14.17</td>
<td>47</td>
</tr>
<tr>
<td>Acidity (w)</td>
<td>mg/l CaCO₃</td>
<td>40.00</td>
<td></td>
<td>24.86</td>
<td>15</td>
<td>14.00</td>
<td>37</td>
</tr>
<tr>
<td>Faecal Coliforms</td>
<td></td>
<td>2</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td>Calcium (diss.filt)</td>
<td>mg/l</td>
<td>7390</td>
<td></td>
<td>0.012</td>
<td>2032</td>
<td>701</td>
<td>80</td>
</tr>
<tr>
<td>Hardness, Total as CaCO₃</td>
<td>mg/l</td>
<td>20322</td>
<td></td>
<td>8248</td>
<td>1</td>
<td>8248</td>
<td>67</td>
</tr>
<tr>
<td>Magnesium (diss.filt)</td>
<td>mg/l</td>
<td>1685</td>
<td></td>
<td>0.036</td>
<td>701</td>
<td>0.036</td>
<td>80</td>
</tr>
<tr>
<td>Sodium (diss.filt)</td>
<td>mg/l</td>
<td>200***</td>
<td></td>
<td>9440</td>
<td>0.08</td>
<td>9440</td>
<td>80</td>
</tr>
<tr>
<td>Potassium (diss.filt)</td>
<td>mg/l</td>
<td>393</td>
<td></td>
<td>97</td>
<td>2.34</td>
<td>97.00</td>
<td>80</td>
</tr>
<tr>
<td>Alkalinity, Total as CaCO₃</td>
<td>mg/l</td>
<td>390</td>
<td></td>
<td>185</td>
<td>20</td>
<td>185</td>
<td>67</td>
</tr>
<tr>
<td>Alkalinity, Carbonate as CaCO₃</td>
<td>mg/l</td>
<td>60</td>
<td></td>
<td>8</td>
<td>2</td>
<td>8</td>
<td>67</td>
</tr>
<tr>
<td>Chloride</td>
<td>mg/l</td>
<td>250***</td>
<td></td>
<td>14699</td>
<td>4865</td>
<td>14699</td>
<td>80</td>
</tr>
<tr>
<td>Sulphate</td>
<td>mg/l</td>
<td>250***</td>
<td></td>
<td>3558</td>
<td>409</td>
<td>3558</td>
<td>80</td>
</tr>
<tr>
<td>Manganese (diss.filt)</td>
<td>µg/l</td>
<td>400</td>
<td></td>
<td>1055</td>
<td>0.162</td>
<td>1055</td>
<td>80</td>
</tr>
<tr>
<td>Phosphorus</td>
<td></td>
<td>5</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>19</td>
</tr>
<tr>
<td>Iron (tot.unfilt)</td>
<td>mg/l</td>
<td>2</td>
<td></td>
<td>10.00</td>
<td>0.02</td>
<td>0.86</td>
<td>60</td>
</tr>
<tr>
<td>Iron (dissolved)</td>
<td>µg/l</td>
<td>4481</td>
<td></td>
<td>195</td>
<td>10</td>
<td>195</td>
<td>57</td>
</tr>
<tr>
<td>Ammoniacal Nitrogen as N</td>
<td>mg/l as N</td>
<td>2.36</td>
<td></td>
<td>0.60</td>
<td>0.10</td>
<td>0.60</td>
<td>67</td>
</tr>
</tbody>
</table>
## Determinands

<table>
<thead>
<tr>
<th>Determinand</th>
<th>Units</th>
<th>WHO Guidelines for Drinking Water Quality</th>
<th>IFC EHS Mining Guidelines: Effluent*</th>
<th>Max.</th>
<th>Min.</th>
<th>Average</th>
<th>No. of Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammoniacal Nitrogen as NH3 mg/l</td>
<td></td>
<td>2.87</td>
<td>0.10</td>
<td>0.72</td>
<td>67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrite as N mg/l</td>
<td></td>
<td>5.0</td>
<td>0.1</td>
<td>1.1</td>
<td>57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrate as N mg/l</td>
<td>11.3**</td>
<td>1832</td>
<td>0.5</td>
<td>269</td>
<td>68</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cyanide, Total mg/l</td>
<td>0.07</td>
<td>6.26</td>
<td>0.005</td>
<td>0.27</td>
<td>85</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Cyanide, Free mg/l</td>
<td></td>
<td>0.1</td>
<td>0.002</td>
<td>0.017</td>
<td>80</td>
<td></td>
<td>80</td>
</tr>
<tr>
<td>Cyanide (WAD) mg/l</td>
<td></td>
<td>0.5</td>
<td>0.360</td>
<td>0.022</td>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cadmium (diss.filt) µg/l</td>
<td>3</td>
<td>50</td>
<td>10</td>
<td>2</td>
<td>75</td>
<td>68</td>
<td></td>
</tr>
<tr>
<td>Arsenic (diss.filt) µg/l</td>
<td>10</td>
<td>100</td>
<td>19</td>
<td>6</td>
<td>80</td>
<td></td>
<td>80</td>
</tr>
<tr>
<td>Aluminium (diss.filt) µg/l</td>
<td></td>
<td>263</td>
<td>2.90</td>
<td>24</td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copper (diss.filt) µg/l</td>
<td>2000</td>
<td>300</td>
<td>228</td>
<td>5</td>
<td>19</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Lead (diss.filt) µg/l</td>
<td>10</td>
<td>200</td>
<td>41.9</td>
<td>0.2</td>
<td>5.7</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Mercury (diss.filt) µg/l</td>
<td>6</td>
<td>2</td>
<td>15.49</td>
<td>0.35</td>
<td>85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nickel (diss.filt) µg/l</td>
<td>70</td>
<td>500</td>
<td>74.9</td>
<td>14.3</td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zinc (diss.filt) µg/l</td>
<td>500</td>
<td>3396.0</td>
<td>2.9</td>
<td>74.9</td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chromium (diss.filt) µg/l</td>
<td>50*</td>
<td>Total</td>
<td>20.00</td>
<td>6.4</td>
<td>74</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Concentration to be achieved without dilution at least 95 per cent of the time the unit is operating
** Short term exposure
*** May affect acceptability of drinking-water (taste). No health-based guideline value is proposed in drinking-water

Samples were also taken from existing pits. These show a wide range of electrical conductivity from approximately 5000 µS/cm at Piment south north, to more than 70,000 µS/cm at Piment north. Different pits are exposed to different localised hydrogeological conditions such as inflow of stormwater 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 6-6. The results also confirm the brackish nature of the groundwater at these depths.
Table 6-6: Borehole Water Quality Logging

<table>
<thead>
<tr>
<th>Depth</th>
<th>Date</th>
<th>Temp (deg C)</th>
<th>pH</th>
<th>EC (20) mS/cm</th>
<th>EC (25) mS/cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>265</td>
<td>08/04/2011</td>
<td>40.3</td>
<td>7.6</td>
<td>-</td>
<td>31.5</td>
</tr>
<tr>
<td>267</td>
<td>08/04/2011</td>
<td>39.5</td>
<td>7.64</td>
<td>-</td>
<td>33.9</td>
</tr>
<tr>
<td>291</td>
<td>09/04/2011</td>
<td>29.3</td>
<td>7.62</td>
<td>26.3</td>
<td>30</td>
</tr>
<tr>
<td>295</td>
<td>09/04/2011</td>
<td>29.3</td>
<td>7.65</td>
<td>28</td>
<td>31.2</td>
</tr>
<tr>
<td>320</td>
<td>09/04/2011</td>
<td>-</td>
<td>7.59</td>
<td>27.5</td>
<td>31.4</td>
</tr>
<tr>
<td>360</td>
<td>10/04/2011</td>
<td>37.9</td>
<td>7.41</td>
<td>27.5</td>
<td>30.6</td>
</tr>
<tr>
<td>373</td>
<td>11/04/2011</td>
<td>38.7</td>
<td>7.74</td>
<td>28.6</td>
<td>32.2</td>
</tr>
<tr>
<td>380</td>
<td>11/04/2011</td>
<td>38.9</td>
<td>7.64</td>
<td>29.6</td>
<td>33</td>
</tr>
<tr>
<td>390</td>
<td>11/04/2011</td>
<td>36.6</td>
<td>7.83</td>
<td>27.7</td>
<td>31</td>
</tr>
<tr>
<td>400</td>
<td>11/04/2011</td>
<td>36.9</td>
<td>7.85</td>
<td>28.4</td>
<td>31.7</td>
</tr>
</tbody>
</table>

The pH of groundwater at borehole HG400A indicates slightly alkaline conditions. Samples from the environmental monitoring wells gave similar results with a range of pH from 6.7 to 8.2. Routine sampling and analysis of water samples is ongoing to extend the dataset.

6.3 Potential Impacts

6.3.1 Embedded Mitigation

Given the scarcity of water in Mauritania, consideration of water supply and conservation was a key component of design from the outset of the Project. Many measures are included in the design to protect and conserve water. These are referred to as embedded mitigation and include the Stormwater Management Plan, the Water Use, Discharge and Conservation Management Plan, the Cyanide Management Plan, the Tailings Dam Operations, Maintenance and Surveillance Plan, as well as design measures for specific processes and plants.

National, international and Kinross standards seek to protect and conserve water quality and water resources. IFC Performance Standard 3, for example, promotes more sustainable use of resources, including water. The design process has taken this into account and measures are in place to minimise water use wherever possible. As the Project has developed, the increased water requirements have been considered in the context of the local and national environment, where water is a scarce and precious resource. A water balance was developed which assessed consumption, conservation and re-use of water.

For the Phase 2 development, sea water will be used for operational needs and also in the reverse osmosis (RO) plant for production of potable water. The water balance will continue to evolve through the design process. The impact of sea water abstraction is assessed in the Phase 3 EIA.

The use of sea water will protect the existing borefield from over development as the Mine expands.
There will be inevitable evaporation losses in the water balance but, where possible, water will be recirculated to minimise water demand. For example, wastewater (concentrated brine) will be produced by the RO process. There will be no water loss directly attributed to fresh water production. The brine will be used either for dust suppression or in the process plants. At the power plant, blow down from the raw water cooling tower will be reused, where the water quality is suitable. There may also be reductions in water use associated with increases in tailings slurry density.

The key features of some of the Plans and measures which protect water quality are summarised below.

6.3.1.1 The Stormwater Management Plan

The Plan sets out the drainage strategy for external drainage, plant site drainage and road drainage. Storm events are rare but good practice is still adopted. 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 / process 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 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 adverse environmental impacts.

6.3.1.2 Water Use, Discharge and Conservation Management Plan

This plan covers:

- 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 to standards/methods approved by TMLSA (such as ISO/TS 17924 or NAMAS accreditation). Comparison of results with the World Health Organisation (WHO) Guidelines for Drinking Water Quality or IFC 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 utilisation and management audits; and
- Mine Water Balance to ensure optimum water use and re-use.
6.3.1.3 The Cyanide Management Plan and Tailings Dam Operations, Maintenance and Surveillance Plan

These plans will be in place to minimise discharges. The TSF will be lined and is a zero discharge facility with seepage management and monitoring. A thickener circuit will be used after CIL to maximise internal water recovery and to recover residual cyanide and lime. The overflow from the tails thickener goes to the process water tank to be reused in the process. Underflow slurry goes to the cyanide destruction (CND) circuit to reduce the concentration and mass of cyanide remaining in the solution. The CND Circuit treats slurry by bringing it into contact with air, lime, copper sulphate and sulphur dioxide gas with the intention of meeting the International Cyanide Management Code (ICMC) level of <50ppm (WAD).

All process areas have containment (designed to hold a minimum of 110% of the volume of the largest tank in each area) whereby any spills flow to sump pumps and are returned back to the process stream. All pipes containing cyanide will be located above ground. All process circuit infrastructure and facilities will be designed and operated to ICMC requirements.

Particular design and operational measures for the facilities to be operated under Phase 2 are summarised in Table 6-7.

Table 6-7: Design and Operational Measures to Protect and Conserve Water

<table>
<thead>
<tr>
<th>Plant or Process</th>
<th>Measures in place</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAG (Semi Autogenous Grinding) Mill, Intensive Leach Unit</td>
<td>Areas where cyanide is used are contained systems which have sumps installed to return escaped effluent back to processing. Slurry collected in a common pump box.</td>
</tr>
<tr>
<td>ADR (Adsorption, Desorption, Regeneration) Plant</td>
<td>Containment area.</td>
</tr>
<tr>
<td>CIL (Carbon-In-Leach) Process Plant</td>
<td>Containment area has sumps to return solutions/slurry to process. Installation of cyanide destruction circuit. The whole plant is designed to contain any potential cyanide spills or leaks.</td>
</tr>
<tr>
<td>Treatment Plant Acid Wash, Carbon Strip Circuit</td>
<td>Bermed and contained separately from the cyanide processing containment areas.</td>
</tr>
<tr>
<td>Tailings Storage Facility 3 Cells 1 and 2</td>
<td>Each cell lined with a geosynthetic liner and seepage will be captured in seepage ponds.</td>
</tr>
<tr>
<td>RO Plant</td>
<td>Concentrated brine to be used for dust suppression and/or process.</td>
</tr>
<tr>
<td>Waste Rock Dumps Fresh and oxidized rock</td>
<td>Preliminary testing shows negligible risk of ARD and high neutralising potential from sub-economic rock.</td>
</tr>
<tr>
<td>Heap Leach Facility</td>
<td>Heap leach pads will be sloped and HDPE lined to reduce water build up. A network of perforated drain pipes will be placed within these pads to drain the leachates to solution ponds. There are 4 solution ponds in total, all of which are double HDPE lined and have leak detection.</td>
</tr>
<tr>
<td>Barren Pond</td>
<td>The overland piping will be of HDPE material.</td>
</tr>
<tr>
<td>Dump Leach Facility</td>
<td>Dump leach pads will be sloped and lined with a synthetic geomembrane of HDPE. A network of perforated drain pipes will be placed within these pads to drain the leachates to ponds, all of which are double HDPE lined and have leak detection.</td>
</tr>
<tr>
<td>Power Plant</td>
<td>Liquid fuels will be stored appropriately.</td>
</tr>
<tr>
<td>Plant or Process</td>
<td>Measures in place</td>
</tr>
<tr>
<td>------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Lubrication oil will be stored at site in a clean lubrication oil storage tank. Used turbine oil will be deposited in a used lubrication oil tank. Used lubrication oil will be taken off-site for treatment. All petroleum products stored at the facility will have either double wall tanks or have secondary spill containment.</td>
<td></td>
</tr>
<tr>
<td>Power Plant - Primary movers (utilities)</td>
<td>Oils be used in closed loop cooling systems rejecting heat to fans</td>
</tr>
<tr>
<td>Power Plant In-ground oil/water separator</td>
<td>The separated oil will be contained in the oil water separator and will be periodically pumped out for off-site disposal</td>
</tr>
<tr>
<td>Power Plant Combustion Turbine Water</td>
<td>Wastes collected in the tank will be pumped off-site for disposal</td>
</tr>
<tr>
<td>Power Plant water storage</td>
<td>Stored in tanks</td>
</tr>
<tr>
<td>Accommodation Camp Generators</td>
<td>Oils stored in tanks in the tank farm, beside the power plant</td>
</tr>
<tr>
<td>Fuel Treatment Plant (dependent on selected power plant option)</td>
<td>The Fuel Treatment Plant will consist of reinforced concrete framing, with columns and beams, floor and roof slabs. The buildings will either be steel or concrete structures</td>
</tr>
<tr>
<td>Engine Hall</td>
<td>Waste oils recycling</td>
</tr>
</tbody>
</table>

The following sections discuss potential impacts with embedded mitigation in place.

6.3.2 Construction

6.3.2.1 Surface Water

Potential impacts on surface water, if present, during construction include:

- Change in runoff within the Mine as a result of land clearance, removal of vegetation and construction of facilities;
- Change in runoff within the catchment downstream as a result of land clearance, removal of vegetation and construction of facilities; and
- Change in stormwater quality as a result of stormwater contamination by oils/lubricants and other chemicals.
- There is no permanent natural surface water at the Mine site. Surface water flows are ephemeral but runoff feeds into a larger catchment which may be affected by changes in runoff.

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 moderate. 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.

6.3.2.2 Groundwater

There are no excavations or other activities during construction of Phase 2 components which will extend to the water table. The deepening of the open pit is discussed as part of operational
phase although this commences early in 2012. Therefore potential impacts on groundwater flow during construction are negligible.

Potential impacts on groundwater quality during construction include:

- Seepage of contaminants to the water table from construction activities.

The magnitude of potential impacts on groundwater at the Mine site during construction is low. The sensitivity of groundwater at the Mine site is considered to be low. There is no aquifer at the Mine site; 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.

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

6.3.3 Operation

6.3.3.1 Surface Water

Potential surface water impacts during construction include:

- Change in surface water runoff within the Mine as a result of land clearance, removal of vegetation and operation of facilities;
- Change in runoff within the catchment downstream as a result of stormwater diversion around the Mine site and loss of runoff which enters the Mine site and is not released into the wider catchment area;
- Change in runoff as a result of rain falling on or flowing into the pit;
- Change in stormwater quality as a result of surface water contamination by oils/lubricants and other contaminants; and
- Change in stormwater quality downstream as a result of water used for dust control being released into the wider catchment.

Given the proposed design measures for stormwater management as summarised above, and the low rainfall and runoff, the magnitude of potential impacts on surface water during operation is adverse, moderate to low.

There is no permanent surface water at the Mine site. Surface water flows are ephemeral but runoff feeds into a larger catchment which may be affected by changes in runoff. The sensitivity of surface water is considered to be moderate.

The significance of potential impacts on surface water at the Mine site during operation is therefore adverse, moderate, assuming implementation of the Stormwater Management Plan.

6.3.3.2 Groundwater

The potential impacts on groundwater during operation include:

- Seepage of contaminants to the water table from wet facilities during operations, or from dry processes following rainfall, or as a result of ARD; and
- Lowering of groundwater levels as the open pit is excavated. The final depth of the pit will be approximately 700 m.
The embedded mitigation will prevent release of contaminants. ARD testing shows net neutralizing potential and therefore this is a low risk of ARD occurring. The impact magnitude will therefore be adverse, moderate to low. Groundwater sensitivity is low so the significance of potential impacts on groundwater quality during operation will be low to negligible.

With regard to pit dewatering, the very low permeability in the Mine area, particularly at depth, means that groundwater inflows will be small. Evaporation is high so any seepage into the pit from groundwater will evaporate. Drainage and pumping arrangements will be available to deal with rainfall and to ensure that the pit remains as dry as possible. Most of the time during operation there will be insignificant quantities of water in the base of the pit.

A multi-layered numerical model was developed to simulate the impact of pit dewatering on the regional hydrogeological conditions, the possible inflows that may occur during pit construction and the effects of pit closure (URS, 2012b). The model domain extended over 725 km² including the existing pits and the proposed expanded pit. The results of the simulation indicate that the rate of groundwater inflow to the pit will decline over time as the pit is deepened to give a long term average annual value of around 1400 m³/d.

The low permeability means that the cone of depression as a result of dewatering will be steep and effects of dewatering will be relatively close to the pit. The predicted drawdown will be more than 500 m at the base of the pit and decrease with distance from the pit. The one metre drawdown is predicted to remain within the Mine boundary. This means that groundwater levels will be lowered in the area close to the Mine but measurable effects will not extend to a significant distance.

The model is sensitive to the values of permeability and recharge that are used. The best estimate adopts a conductivity of 3 x 10⁻⁵ m/s above 75 masl (metres above sea level) and 10⁻⁹ m/s below 75 masl. The storage was set at 0.4% in the weathered zone and 0.02% in the unweathered zone. Recharge, if it occurs, is intermittent and less than 2 mm per year on average. If no recharge takes place the effect of dewatering could spread further (URS, 2012a, b, c).

A flow balance model was also prepared to simulate the water level in the open pit (West Branch) as a result of excavation and dewatering activities (URS, 2012c). The model examines the site water balance with inputs from rainfall and surface runoff and evaporative losses from the free water surface in the base of the pit. The model was used to predict the effect of rainfall on the pit during operation and post closure. The results were applied to the expanded pit which covers an area of approximately 13 km².

The model parameters are as follows:

- West Branch pit catchment area: 3.86 km²;
- Surface catchment area: 194 km²;
- Monthly rainfall absorbed prior to runoff: 3 mm; and
- Groundwater leakage rate into pit: 1400 m³/d.

Model Assumptions include:

- Rainfall in excess of the absorbed monthly rainfall generates runoff into the pit lake;
- Post closure, all runoff within the pit catchment area will flow to the lowest point of the pit and augment a single pit lake. No ponding occurs at higher levels within the pit;
• The evaporative losses within the pit are proportional to the surface area of the pit lake post closure;
• Normal rainfall events can generate runoff within the pit footprint;
• Normal rainfall events do not generate runoff from the whole of the surface water catchment;
• Evaporation occurs at the potential rate throughout each month;
• The rate of inflow into the pit from groundwater drainage is uniform and does not decline with time nor is it dependent upon the absolute level of the pit lake;
• The pit lake can only lose water by evaporation loss post closure; and
• The geometry of the pit does not change following pit closure. For example there are minimal rock falls into the pit lake. Neither is there any input of sediment into the pit lake from exceptional rainstorm events generating runoff from the extended catchment. Nor is there any gradual sedimentation from windblown deposits. In the very long term, i.e. geological time scales of millennia both these processes will gradually fill the pit with sedimentary deposits.

During operation the average estimated rainfall over a pit area of 3.86 km² is approximately 1000 m³/d and over the expanded pit area of 13 km² is approximately 3200 m³/d. This rainfall, as with the groundwater seepage, will evaporate. In the event of a large storm there may be some temporary collection of water in the base of the pit which has to be pumped out. This water will be used for dust suppression or re-used elsewhere.

The magnitude of potential impacts on groundwater flows at the Mine site during operation of the Phase 2 facilities and pit is adverse moderate 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.

6.3.4 Closure

6.3.4.1 Surface Water

The potential impacts on surface water at the Mine site during closure are anticipated to be the similar to those during construction and operation. Potential impacts may include:

• Change in runoff within the Mine and wider catchment area as a result of rehabilitation and closure activities of facilities;
• Change in stormwater quality as a result of surface contamination from oils/lubricants and other contaminants used during rehabilitation and closure activities; and
• Change in stormwater quality due to contaminants or salinity leaching from facilities or altered soils that remain post closure.

Both the provisional and detailed Rehabilitation and Closure Plan (RCP) will set out procedures for removal or stabilisation of potentially contaminated waste and soils. Surface water impacts are considered to be adverse, low to moderate. The sensitivity of surface water at the Mine site is moderate. The significance of potential impacts on surface water at the Mine site during closure are therefore adverse, low to moderate, assuming implementation of the detailed RCP.
6.3.4.2 Groundwater

The potential impacts on groundwater at the Mine site during and post closure include:

- Seepage of contaminants or salinity from facilities or soils that remain post closure
- Permanent lowering of the water table around the open pit

The detailed RCP will minimise release of contaminants. The impact magnitude will therefore be adverse, moderate to low. Groundwater sensitivity is low so the significance of potential impacts on groundwater quality during and following closure will be low to negligible.

The same analytical and numerical models were used to assess pit inflows, the cone of depression and radius of influence post closure. The analytical model was also used to assess the likely level of water in the base of the pit post closure. It is assumed that the diversion of runoff around the pit will continue post closure.

The groundwater inflow rate will decline as the pit is deepened but the groundwater inflow to the pit will continue following closure, though at decreasing rates. In the long term there is expected to be a permanent depression of groundwater levels in the vicinity of the pit. Evaporation from the pit means that it is effectively acting as a sink or large diameter abstraction, drawing groundwater from the surrounding area from within the cone of depression. The low permeability means that the cone of depression will be steep and effects will be relatively close to the pit. The ten metre drawdown is predicted to remain within the Mine boundary in the long term. This means that groundwater levels will be permanently lowered in the area close to the Mine but significant effects will not extend beyond this.

Groundwater will continue to flow towards the pit and evaporate during closure. Average rain over the pit area will be greater than groundwater inflow. When there is a small pit lake in the bottom, the surface area will be small and rain plus groundwater inflow will be greater than evaporation and the pit will fill.

Any water in the base of the pit will be initially similar to groundwater quality. This water has high concentrations of dissolved solids and is not potable, as discussed in the baseline section. When it rains, additional water will start to accumulate in the base of the pit. This will result in some dilution but evaporation will then cause further concentration of this water.

Over the years, when rain occurs, it will cause water levels to rise until there is a balance of inflows (from groundwater and rain) with losses (from evaporation). The time taken for this balance to occur could be several decades with a final estimated pit water level approximately 500 m below ground level. This assumes that only the rain over the pit area falls into the pit. Stormwater at surface level will continue to be diverted around the pit to follow its natural course.

The magnitude of potential impacts on groundwater following pit closure is adverse medium to low as the cone of depression is predicted to continue expanding in the immediate locality until a state is reached where recharge balances evaporation. The sensitivity of groundwater at the Mine site is low. The significance of potential impacts on groundwater at the Mine site during closure is therefore negligible.
6.4 Mitigation Measures

6.4.1 Construction

6.4.1.1 Surface Water

If monitoring shows that pollution which exceeds baseline (background) water quality is detected in potential discharges to the environment, 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.

6.4.1.2 Groundwater

No mitigation is required.

6.4.2 Operation

6.4.2.1 Surface Water

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

To minimise changes in runoff downstream, clean runoff will be diverted around the Mine site and away from the open pit. No further mitigation is proposed.

6.4.2.2 Groundwater

The embedded mitigation will limit the release of potential contaminants to groundwater. There are also monitoring wells in place. These will be used to demonstrate that potential pollution from activities and facilities at the Mine site are not having a sustainable adverse impact on groundwater quality. Monitoring wells on-site will be routinely checked for water levels and water quality. 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 proposed. However, if future deterioration is identified as taking place, a risk assessment will be carried out and used to design mitigation measures. These measures could include, for example, installation of interceptor ditches to contain seepage, or pumping of interception boreholes.

Further ARD analysis and characterisation is potentially required if ARD is found to constitute future risk. However, ARD studies to date show a low risk of ARD and high neutralising potential. A Materials Management Plan will be developed. If ARD is found to be a risk in certain materials, suitable measures will be taken to mitigate these risks. Such measures include: limiting exposure of potentially acid generating materials by phasing of development and construction; segregating the materials; covering the materials and/or segregating runoff for management as appropriate.
6.4.3 Closure

6.4.3.1 Surface Water
Mitigation may be needed to prevent the spread of contaminants or salinity downstream post closure. During operation, water quality will be monitored so that the potential risk of contamination can be assessed. It may be necessary to limit runoff post closure. This could be achieved by diverting runoff into the open pit. This would result in the loss of some runoff downstream but would limit the potential spread of pollution.

6.4.3.2 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, if need, as discussed below.

6.4.4 Monitoring
Monitoring of groundwater levels and quality is ongoing at the site at the locations shown on Figure 6-2. Three additional monitoring wells are planned and will be located and drilled to ensure that future developments do not result in unnecessary decommissioning of monitoring boreholes. Water levels are monitored automatically and the data is stored on loggers. Sampling will be at least quarterly in accordance with best practice. Samples will continue to be analysed for the suite of determinants shown in Table 6-5 and the results will be compared with the baseline water quality. Details of ongoing monitoring are contained in the Environmental Monitoring Plan (see Section 18).

Water monitoring will also be included as part of the Stormwater Management Plan.

6.5 Cumulative Impacts
The assessment of impacts on surface water and groundwater considers the catchment in which the Mine is located. Activities over the entire Mine footprint were taken into account in evaluating surface water impacts. Similarly for groundwater, all activities were taken into account.

No effects were identified which would become more significant collectively or over time.

6.6 Evaluation of Mitigated Impacts
Many mitigation measures are already included in the design for the protection of water and to minimise the impact on the water environment. These measures are referred to as ‘embedded mitigation’ and reduce the magnitude of potential impacts.

The embedded mitigation includes the Stormwater Management Plan, the Water Use, Discharge and Conservation Management Plan, the Cyanide Management Plan, the Tailings Dam Operations, Maintenance and Surveillance Plan, as well as design measures for specific processes and plants.

With those measures in place, few additional mitigation measures are needed but monitoring will be important. For groundwater monitoring, boreholes were installed as monitoring wells and will be used to monitor groundwater levels and water quality. Surface water is not permanent so a regular monitoring regime is not possible; however, monitoring in diversion channels will take place so that the quality of water in and around the site can be recorded.
If monitoring shows that concentrations which exceed baseline (background) water quality are detected in potential discharges to the environment, additional measures will be taken to mitigate the effects.

If monitoring shows that deterioration of groundwater is taking place, a risk assessment will be carried out and used to design mitigation measures. These measures could include, for example, installation of interceptor ditches to contain seepage, or pumping of interception boreholes.

Mitigation may be needed to prevent the spread of contaminants or salinity downstream post closure. This could be achieved by diverting runoff into the open pit.

6.6.1 Surface Water

A description of the components of Phase 2 is set out in Section 3. These are being designed in accordance with good practice to minimise the effects of potential pollution or accidental spillage on water quality as required by IFC Guidelines.

The main potential impacts on surface water will be a consequence of rainfall events, as the proposed development may result in changes to the quality and flow of stormwater runoff. There is no natural surface water at other times.

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.

Potentially polluting water will be contained, and discharges will meet environmental discharge criteria. The use of saline water for dust suppression does have the potential to cause some increase in the salinity of runoff from the site. This will be controlled as part of the Stormwater Management Plan.

Given the proposed design measures for stormwater management, and the low rainfall and runoff, the magnitude of potential impacts on surface water during construction, operation and closure is adverse, moderate to low.

There is no permanent surface water at the Mine site. Surface water flows are ephemeral but runoff feeds into a larger catchment which may be affected by changes in runoff. The sensitivity of surface water is considered to be moderate.

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

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

6.6.2 Groundwater

There is no viable 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 saline and not usable.

The sensitivity of groundwater at the Mine site is considered to be low.
The embedded mitigation will limit the release of potential contaminants to groundwater. There are also monitoring wells in place. These will be used to demonstrate that potential pollution from activities and facilities at the Mine site are not having an adverse impact on groundwater quality. 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 proposed. However, if deterioration is shown to be taking place, a risk assessment will be carried out and used to design mitigation measures. These measures could include, for example, installation of interceptor ditches to contain seepage, or pumping of interception boreholes.

Further ARD analysis and characterisation is potentially required if ARD is found to constitute future risk. However, ARD studies to date show a low risk of ARD and high neutralising potential.

With regard to pit dewatering, the very low permeability in the Mine area, particularly at depth, means that groundwater inflows will be small. Evaporation is high so any seepage into the pit from groundwater will evaporate.

The greatest potential inflow to the pit is from rain falling over the surface or running into the pit from the surrounding catchment. To minimise this inflow, water will be diverted around the pit perimeter at surface as far as practically possible.

Low permeability means that the cone of depression as a result of dewatering will be steep and effects of dewatering will be relatively close to the pit and within the Mine footprint.

In the long term there is expected to be a continuing depression of groundwater levels in the vicinity of the pit. The water available to refill the pit post closure is limited. Evaporation rates exceed groundwater inflow rates and the dominant source of inflow is rainfall and runoff. The indications are that the pit will remain with some water at its base which will evaporate. These conditions are observed at the Piment Pits where there is some water present but the water level is lower than surrounding groundwater levels.

Following closure, the water level in the pit will depend on actual rainfall events. Under average conditions it is expected that water levels will rise initially. The rate of rise will decline until equilibrium is achieved. This will occur when average rainfall is balanced by evaporation over the pit lake area at that level. This equilibrium could take around 30 years. The equilibrium water level in the pit is predicted to be around 500 m below surface.

The continuing inflow of groundwater and the evaporation of groundwater and stormwater from the pit water surface will result in continuing increase in concentration of the water in the pit. The water in the base of the pit will, like the current groundwater, be of poor quality. The anticipated depth to water, the slow rate of replenishment and the water quality mean that the water in the pit is unlikely to be of any long term value.

The magnitude of potential impacts on groundwater during construction, operation and closure is adverse moderate to low. The sensitivity of groundwater at the Mine site is low. The significance of potential impacts on groundwater at the Mine site during construction, operation and closure is therefore low.

Residual groundwater impacts during construction, operation and closure are assessed to be adverse, long term and of low significance.
6.7 Summary

A summary of the potential impacts of the proposed Phase 2, following the implementation of mitigation measures with respect to surface and groundwater, are presented in Table 6-8.

Table 6-8: Summary of Potential Residual Impacts\(^1\) - Surface Water and Groundwater

<table>
<thead>
<tr>
<th>Location</th>
<th>Nature of Impacts</th>
<th>Mitigation Measure</th>
<th>Project Phase(^2)</th>
<th>Nature(^3)</th>
<th>Duration(^3)</th>
<th>Significance(^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mine site</td>
<td>Change in surface water runoff and quality</td>
<td>Stormwater management, monitoring and emergency response</td>
<td>C O D</td>
<td>Adverse</td>
<td>Long term</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Change in groundwater quantity and quality</td>
<td>Monitoring boreholes on-site to be routinely checked for water levels and water quality</td>
<td>C O D</td>
<td>Adverse</td>
<td>Long term</td>
<td>Low</td>
</tr>
</tbody>
</table>

\(^1\)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, baseline conditions and calculations employed to assess the significance of potential impacts upon air quality resulting from the Phase 2 development. In addition mitigation measures which aim to reduce, remediate or avoid potential impacts are considered and the residual impacts (impacts after mitigation measures are implemented) assessed. The scope of the assessment covers:

- Baseline conditions;
- Construction phase impacts, including:
  - Emissions from the partially completed Power Plant, operating as a simple cycle system (from four potential fuel options);
  - Fugitive dust emissions from construction activities; and
  - Emissions from traffic on public roads and on the Mine access road.
- Operational phase impacts, including:
  - Emissions from the completed Power Plant (from two potential technology options);
  - Open pit works (drilling, blasting and loading operations);
  - Material transfer activities (via haul routes and conveyors);
  - Material processing facilities (chemical leach facilities using cyanide);
  - Fugitive dust emissions from tailings storage facilities and waste rock dumps; and
  - Emissions from traffic on public roads and on the Mine access road.
- Closure phase impacts.

The potential impacts associated with climate change are considered in Chapter 16 of this ESIA.

7.1.1 What is Air Quality?

The atmosphere comprises a mixture of a large number of gaseous constituents. While the concentrations of the main constituents (i.e. nitrogen, oxygen and carbon dioxide) remain consistent, the concentration of the minor constituents varies constantly in response to natural atmospheric chemical processes. In addition, if particulate matter (such as solid particles and droplets of liquid) are small enough to remain airborne, they may also be constituents of the atmosphere and these particulates play an important role in several atmospheric processes.

The release of substances into the atmosphere (emissions), from Phase 2 activities results in a localised increase in the concentrations of the atmospheric constituents, until natural atmospheric processes change the concentrations back to background concentrations. On the basis of current scientific knowledge, concentrations of atmospheric constituents at which significant adverse effects on human health or environmental systems are unlikely to occur have been identified by the international community. Guideline values and standards exist for individual constituents of the atmosphere but not for air quality as a whole.
7.2 Methodology

7.2.1 General

In the absence of any specific national air pollution criteria, this assessment uses methodologies that are based upon guidance from both the World Bank Group (the IFC) and the European Union (EU). Accordingly, the assessment of potential air pollutant concentrations at sensitive receptor locations is based upon the criteria provided in the EU Air Quality Directive (2008/50/EC) and in the IFC General EHS Guidelines (2007).

The assessment considers the significance of potential effects on human health and the wider environment relative to baseline conditions for a designated assessment year in the future. The assessment year selected represents the year in which the maximum level of mining activity is anticipated to occur, and therefore it presents an upper boundary to predicted emissions from the power plant, vehicle movements and other mining activities. It is currently scheduled to occur in 2016, although the assessment is not sensitive to the calendar year in which this peak level of emissions occurs. For Phase 2 power plant emissions, it is assumed that plant is operated at continuous load once the plant is operational as this provides a conservative estimate of impacts in all years of operation. Operational and post closure fugitive dust emissions are also considered.

The assessment uses 2022 as representative of a later stage of the mine life.

7.2.2 On-Site Receptor Locations

The construction and operation of Phase 2 has the potential to affect air quality at existing on-site receptor points. Specific receptor points have been selected (see Figure 7-1 and Table 7-1) to represent areas just within the Mine site boundary (B1 to B4), the accommodation camp (R1, R2 and R3), the welcome centre (R4) and the site office (R5).

Table 7-1: List of Discrete Receptors

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Description</th>
<th>X Coordinate</th>
<th>Y Coordinate</th>
<th>Z Coordinate</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>Existing Accommodation Camp</td>
<td>448500</td>
<td>2274000</td>
<td>1.5</td>
</tr>
<tr>
<td>R2</td>
<td>Enlarged Camp Northern Edge</td>
<td>448076</td>
<td>2274615</td>
<td>1.5</td>
</tr>
<tr>
<td>R3</td>
<td>Enlarged Camp Southern Edge</td>
<td>448350</td>
<td>2274194</td>
<td>1.5</td>
</tr>
<tr>
<td>R4</td>
<td>Welcome Centre</td>
<td>449308</td>
<td>2275415</td>
<td>1.5</td>
</tr>
<tr>
<td>R5</td>
<td>Office</td>
<td>444638</td>
<td>2271665</td>
<td>1.5</td>
</tr>
<tr>
<td>B1</td>
<td>Boundary (South West)</td>
<td>442000</td>
<td>2267000</td>
<td>1.5</td>
</tr>
<tr>
<td>B2</td>
<td>Boundary (West)</td>
<td>442000</td>
<td>2271000</td>
<td>1.5</td>
</tr>
<tr>
<td>B3</td>
<td>Boundary (North West)</td>
<td>442000</td>
<td>2275500</td>
<td>1.5</td>
</tr>
<tr>
<td>B4</td>
<td>Boundary (North)</td>
<td>445000</td>
<td>2278000</td>
<td>1.5</td>
</tr>
</tbody>
</table>
Receptors R1 to R3 represent locations within the site boundary at which the environmental assessment values would apply. At receptors R4 and R5, occupational workplace exposure standards would apply. Receptors B1 to B4 and Receptor R4 provide locations of the maximum contributions to constituent concentrations at the Mine site boundary. At any sensitive receptor located beyond the Mine site boundary, the impacts will be less than at the site boundary receptors as concentrations of constituents become more diluted with increasing distance from the source of the emission.

7.2.3 Possible Off-site Receptor Locations

Possible off-site receptor locations include the three small semi-permanent communities within 30 km of the Mine site (Emkebden, Guelb Dawass and Ntalve, see Section 11 and Figure 11-1). There are also permanent and temporary dwellings along the Nouakchott–Nouâdhibou N2 highway. The Banc D’Arguin National Park is located approximately 65 km to the west of the Mine site and within 5 km of the borefield. Specific traffic routes in Nouakchott and Nouâdhibou could also represent possible receptor locations due to an increase in mine-related vehicle movements to and from the port areas.

7.2.4 Assessment Criteria

The General EHS Guidelines (Section 1.1 Air Emissions and Ambient Air Quality) provide guidance that applies to facilities that generate emissions to air at any stage of the Project life-cycle. The guidelines consider air emissions and the impact of those emissions on ambient air quality in two separate ways:

- Emissions Guideline values based on emission rates that are achievable by using good international industry practice (GIIP), are defined in the guidelines for activities generating controlled emissions into the atmosphere. For activities generating ‘fugitive’ emissions, mitigation measures representing GIIP are described. The magnitude of the emission rates from industrial facilities (such as the power plant) are compared against emission guideline values and provide a means of demonstrating that the plant design is consistent with GIIP.

- Emissions from the proposed development should not ‘result in pollutant concentrations that reach or exceed relevant ambient [air] quality guidelines and standards by applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines or other internationally recognised sources’. Environmental Assessment Level (EAL) values are used to assess the impact of emissions from the development on ambient air quality at relevant receptor locations.

In this assessment, the predicted emission rates for the proposed power plant have been compared against the relevant IFC emissions guideline values to confirm that the proposed development is consistent with GIIP.

Proposed mitigation measures to control fugitive emissions of particulate matter (dust and PM$_{10}$) from a range of mining activities and emissions of hydrogen cyanide gas (HCN) from processing facilities, have been assessed qualitatively to confirm proposed controls are consistent with GIIP.

The impacts of controlled emissions on ambient air quality have also been considered. In the absence of Mauritanian national air quality standards for the constituents nitrogen dioxide (NO$_2$), sulphur dioxide (SO$_2$) and particulate matter (PM$_{2.5}$), this assessment uses EAL criteria that are consistent with the limit values adopted by the European Union (EU) (Air Quality Directive 2008/50/EC 2008). In adopting limit values for these constituents, the EU considered...
the available evidence for adverse effects on human health associated with the broad range of levels of economic development present across the EU economic area.

Table 7-2 sets out the EAL values used to assess the impact of emissions on ambient constituent concentrations at relevant receptor locations.

**Table 7-2: Environmental Assessment Level Criteria**

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Receptor Type</th>
<th>Averaging Period</th>
<th>EAL Value (µg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulphur dioxide (SO₂)</td>
<td>Human Health</td>
<td>24 hour¹</td>
<td>125</td>
</tr>
<tr>
<td>Nitrogen dioxide (NO₂)</td>
<td>Human Health</td>
<td>1 year</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 hour²</td>
<td>200</td>
</tr>
<tr>
<td>Particulate Matter (PM₁₀)</td>
<td>Human Health</td>
<td>1 year</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24 hour³</td>
<td>50</td>
</tr>
</tbody>
</table>

¹ Value is the 99.18th percentile of one year of 24 hour mean values. 
² Value is the 99.79th percentile of one year of hourly mean values. 
³ Value is the 90.41st percentile of one year of 24 hour mean values.

The IFC General EHS Guidelines suggest that if developments cause impacts that are equivalent to or less than 25% of EAL, it will allow sufficient headroom for further development to take place in the general vicinity without causing unacceptable cumulative effects upon ambient air quality. Given the remote location of the Mine, it is highly unlikely that other developments would be proposed in the area that could impinge on this headroom. In these circumstances an impact that is greater in magnitude than 25% of the EAL value, for the duration of Project operations, is not considered to be a significant issue in its own right as it would not in practice act as a barrier to any further industrial development in the area.

The magnitude of the impacts made by emissions on ambient constituent concentrations is described in this assessment using the descriptors set out in Table 7-3. A change in constituent concentrations of more than 25% of the EAL value is described as a *high* magnitude impact. A change of constituent concentration of less than 10% of the EAL value is described as a *low* magnitude impact.

**Table 7-3: Magnitude of Impact Descriptors**

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Averaging Period</th>
<th>High (&gt;25% of EAL)</th>
<th>Medium (10 -25% of EAL)</th>
<th>Low (&lt; 10% of EAL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulphur dioxide (SO₂)</td>
<td>24 hour¹</td>
<td>&gt; 31.25 µg/m³</td>
<td>31.25 - 12.5 µg/m³</td>
<td>&lt; 12.5 µg/m³</td>
</tr>
<tr>
<td>Nitrogen dioxide (NO₂)</td>
<td>1 year</td>
<td>&gt; 10 µg/m³</td>
<td>10 - 4 µg/m³</td>
<td>&lt; 4 µg/m³</td>
</tr>
<tr>
<td></td>
<td>1 hour²</td>
<td>&gt; 50 µg/m³</td>
<td>50 - 20 µg/m³</td>
<td>&lt; 20 µg/m³</td>
</tr>
<tr>
<td>Particulate Matter (PM₁₀)</td>
<td>1 year</td>
<td>&gt; 10 µg/m³</td>
<td>10 - 4 µg/m³</td>
<td>&lt; 4 µg/m³</td>
</tr>
<tr>
<td></td>
<td>24 hour³</td>
<td>&gt; 12.5 µg/m³</td>
<td>12.5 - 5 µg/m³</td>
<td>&lt; 5 µg/m³</td>
</tr>
</tbody>
</table>

¹ Value is the 99.18th percentile of one year of 24 hour mean values. 
² Value is the 99.79th percentile of one year of hourly mean values. 
³ Value is the 90.41st percentile of one year of 24 hour mean values.

In setting air quality limit values, the European Union have already taken into account the sensitivity of human populations to exposure to each constituent. The limit values have been
set at a level that is intended to protect the health of the whole of the population including the very young, the elderly or those with existing health conditions. The impact assessment approach of defining a scale of receptor sensitivity is not therefore directly applicable to the assessment of air quality effects, where EU limit values have been used as assessment criteria. Instead, the risk of the EU limit value being exceeded is considered in the significance matrix (Table 7-4) used in this assessment.

Table 7-4: Level and Significance of Impacts at Accommodation Camp and Land Outside of Mine Site

<table>
<thead>
<tr>
<th>Ambient Air Quality</th>
<th>Impact Magnitude</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td>Ambient pollutant conc. is &gt;100% of EAL with development</td>
<td>High</td>
</tr>
<tr>
<td>Ambient pollutant conc. is between 75% and 100% of EAL with development</td>
<td>Moderate</td>
</tr>
<tr>
<td>Ambient pollutant conc. is &lt;75% of EAL with development</td>
<td>Low</td>
</tr>
</tbody>
</table>

The significance matrix is applicable to air quality impacts at relevant receptor locations. Relevant receptor locations are considered in more detail in section 7.2.1. The assessment makes reference to some workplace locations as useful geographical reference points for discussion of spatial patterns in air pollutant concentrations. Environmental measures of air pollution concentrations are calculated at these workplace locations, but the Environmental Impact Assessment does not consider occupational exposure to air pollutants.

The assessment of worker exposure in all areas of the Mine site, including offices and workshops, is to be undertaken routinely as a requirement of the TMLSA Management Systems. Such assessments consider exposure of workers to air pollutants against the relevant occupational criteria and their use of personal protective equipment (such as safety glasses and facemasks) in areas subject to high levels of dusts or other pollutants. These criteria are typically set at a value that is much higher than the equivalent environmental assessment criteria as they assume workers are able to spend their time off shift in a location with pollutant concentrations that should meet the environmental criteria.

7.2.5 Construction

7.2.5.1 Assessment Methodology for Construction Phase Emissions of Dust

Research undertaken in the UK has provided an indication of the distance within which emissions of particulate matter are dispersed by the wind, before being deposited. These studies have focused on the mining industry, although the transportation of particulates by wind applies to all dust generating activities, including those of construction and also natural weather processes (sand/dust storms).

Large particles (> 30 µm), 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 µm) can be carried further by the wind and are likely to travel between 250 – 500 m from the source. Fine particulate (< 10 µm i.e. PM10), 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, any 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 likely to be impacted in this way is the accommodation camp.

In this assessment it is the smaller size fractions of particulates (PM\(_{10}\)) that are of concern due to the risks they pose to human health. The larger particles (> 10 µg/m\(^3\)), are typically associated with public awareness of increased rates of soiling to fabrics (clothing and household textiles) and glossy surfaces (car paint work or the windows of properties). As baseline rates of surface soiling are very high in desert environments and the public is familiar with this effect, such impacts are not likely to cause nuisance. Therefore the assessment focuses on construction activities with the potential to generate emissions of mineral dusts, cement dust, wood particle or exhaust particles, to impact on ambient concentrations of PM\(_{10}\).

Whilst there is no international standard in relation to dust nuisance, there are several standards relating to concentrations of PM\(_{10}\) (Table 7-2). In this instance, the emphasis of the regulation and control of particulate emissions from construction activities at the site should be achieved through the adoption of best working practices.

A qualitative assessment methodology has been adapted to:

- Assess the sensitivity of the surrounding areas and identify dust-sensitive locations;
- Evaluate prevailing meteorological conditions and particulate dispersal;
- Assess the potential of the site and its activities to generate dust;
- Assess the potential effects of the site on local air quality, based on existing baseline conditions, including meteorology and the proximity of receptors to sources of particulate emissions; and
- Propose recommendations to reduce potential dust emissions from the site.

The generation of particulates during the proposed Phase 2 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 process considered the likelihood of fugitive releases occurring and included a review of the controls to be outlined within the EMP (see Section 18). Appraisal of appropriate working practices is used to identify how particulate emissions may be minimised and controlled effectively.

**7.2.5.2 Assessment Methodology for Additional Power Plant Capacity**

The calculation of the magnitude of impacts and constituent concentrations for the proposed power plant has been undertaken using the dispersion model ISC-AERMOD, which is a regulatory dispersion model (developed by the United States Environmental Protection Agency) to quantify the dispersion of emissions from industrial sources over distances of up to 50 km.

The assessment considers:

- A Construction Phase scenario during which power plant based on the turbine technology option would operate as simple cycle system for a period of less than 1 year, while the construction of the additional plant required to operate the power plant as a combine cycle system is completed.
For the turbine technology option the new plant will replace the existing power plant (including Phase 1 additional capacity) once it is able to operate as a simple cycle system, for the remainder of the construction phase, while the equipment required to operate a combined cycle system is being installed. The assessment recognises that the type of fuel to be used for the new power plant has not yet been selected; therefore the impact of using each of four alternative fuels (Heavy Fuel Oil, Light Crude Oil, diesel and Natural Gas) has been assessed.

The dispersion model methodology and the predicted impacts are reported in Appendix 2, Section 1.3. The assessment approach assumed that the three base load turbines are operated continuously at their rated maximum load as simple cycle systems, and that a fourth turbine is used as a stand-by unit as a simple cycle system. The plant is scheduled to operate in this mode for a period of approximately six months and the magnitude of short term impacts have been calculated based on a full twelve months of meteorological conditions. Therefore the predicted impacts represent a conservative assessment of the impacts from the power plant.

For the reciprocating engine technology based power plant option there is no equivalent construction phase assessment scenario, as the reciprocating engine based power plant would only become operational after it was completed.

7.2.6 Operational

7.2.6.1 Assessment Methodology for Potential Emissions of Dust from Mine Site Operations

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.

7.2.6.2 Assessment Methodology for Additional Power Plant Capacity

The calculation of the magnitude of impacts and constituent concentrations has been undertaken using the dispersion model ISC-AERMOD for the proposed power plant. The assessment considers:

- An Operational Phase Scenario during which power plant based on turbine technology would operate as a combined cycle system, with an additional stand-by unit available as a single cycle system. This assessment scenario represents technology that would meet the Mine’s envisaged upper range of the operations’ power requirements from an on-site power plant.
- An Operational Phase Scenario during which power plant based on the reciprocating engine technology option would operate, with an additional stand-by capacity available from retention of the Phase 1b power plant. This assessment scenario represents the technology option with the upper range of emission rates envisaged for consideration within the optimisation process for the Mine.
The assessment of the turbine technology option recognises that the fuel to be used for the power plant has not be selected yet and therefore the impact of using each of four alternative fuels (Heavy Fuel Oil, Light Crude Oil, diesel and Natural Gas) has been assessed. The predicted impacts can be applied to the assessment of effects on air quality in any year of operation during Phase 2 of the Project. The Fuel for the reciprocating engine technology option would be Heavy Fuel Oil.

This approach will overestimate actual emissions from the power plant, even in 2016 which is identified as the year of peak mining activity. Therefore the predicted impacts represent a conservative assessment of the maximum impacts from the power plant during the lifetime of the Project. The technical detail of the assessment is described fully in Appendix 2, Section 1.2.

7.2.6.3 Assessment Methodology for Potential Emissions of Hydrogen Cyanide Gas from Mine Site Operations

There is the potential for hydrogen cyanide gas to be emitted into the atmosphere from the tailings storage facility (TSF 3), dump leach facilities, heap leach facility and associated solution storage ponds. A qualitative assessment method is used to assess the potential for significant impacts to occur during the operational lifetime of the Mine based upon the distance between sources of emissions and sensitive receptors and a review of the effectiveness of controls in use as part of existing mining operations.

7.2.6.4 Assessment Methodology for Road Traffic Emissions

The estimated emissions from the vehicle fleet considered in the assessment has been assumed to be equivalent to the EURO I engine specification or older. The predicted emissions have been estimated for baseline and with development flows using a screening method (DMRB v1.02) published by the Department of Transport in the UK.

Annual mean concentrations of nitrogen dioxide and particulate matter (PM10) have been estimated at a distance of 10 m from the carriageway. Annual average traffic flows (vehicles per day) have been used and a nominal average speed of 60 kph. 100% conversion of all oxides of nitrogen emitted from the vehicle’s exhausts to nitrogen dioxide is assumed, although in practice the conversion is very unlikely to occur so rapidly. Impacts at receptors located more than 10 m from the road will be smaller in magnitude.

7.3 Baseline Conditions

7.3.1 Air Quality

The Mine is located in a remote area where the nearest industries to the 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. Due to the remoteness of the Mine’s location and the distances from the Mine to these industries, air quality at the Mine is not considered to be affected by any other industries.

Current sources of emissions of oxides of nitrogen, sulphur dioxide, carbon monoxide and carbon dioxide at the Mine include exhaust emissions from the 19 MW power plant, mobile plant and equipment, and vehicles. Additional (temporary) power plant is being constructed as part of Phase 1b of the Project, but is not operational at the current time.

Potential sources of odour exist at facilities for the management of waste and waste water, but any resultant odours are unlikely to be noticeable at the perimeter fence.
The TSFs, the CIL plant and the existing dump leach facility and its ponds represent potential sources of emissions of HCN gas. These facilities and emissions are subject to stringent controls to meet specific guidelines, protecting the health of workers and the wider environment.

7.3.2 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 ongoing at the Mine site. Diffusion tubes for each constituent have been positioned at various on-site locations (see Figure 7.1) and are exposed for periods of one calendar month per sample then sent for laboratory analysis. The survey commenced on the 3rd March 2011 and, at this time, data is available for the period up to the 6th October 2011. Period mean concentrations and maximum measured concentrations from the survey to date are reported in Table 7-5 to Table 7-7.

Table 7-5: Baseline Nitrogen Dioxide Concentrations for Period 03/03/2011 to 06/10/2011.

<table>
<thead>
<tr>
<th>Monitoring Location</th>
<th>No. of Samples</th>
<th>Max Period Concentration (µg/m³)</th>
<th>Period Mean Concentration (µg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>China Beach (T1)</td>
<td>4</td>
<td>4.7</td>
<td>3.4</td>
</tr>
<tr>
<td>Cyanide Store (T2)</td>
<td>3</td>
<td>4.2</td>
<td>3.4</td>
</tr>
<tr>
<td>Fuel Farm (T3)</td>
<td>4</td>
<td>14.1</td>
<td>8.8</td>
</tr>
<tr>
<td>Dump Leach Facility (T4)</td>
<td>5</td>
<td>8.2</td>
<td>4.9</td>
</tr>
<tr>
<td>West Branch Offices (T5)</td>
<td>2</td>
<td>4.7</td>
<td>4.0</td>
</tr>
<tr>
<td>Mean Background Value*</td>
<td></td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

* Mean Background Value has been calculated from period mean values for China Beach (T1), Cyanide Store (T2) and West Branch Office (T5). The value is rounded to a whole number.

Table 7-6: Baseline Sulphur Dioxide Concentrations for Period 03/03/2011 to 06/10/2011.

<table>
<thead>
<tr>
<th>Monitoring Location</th>
<th>No. of Samples</th>
<th>Max Period Concentration (µg/m³)</th>
<th>Period Mean Concentration (µg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>China Beach (T1)</td>
<td>4</td>
<td>26.1</td>
<td>15.4</td>
</tr>
<tr>
<td>Cyanide Store (T2)</td>
<td>5</td>
<td>86.8</td>
<td>41.7</td>
</tr>
<tr>
<td>Fuel Farm (T3)</td>
<td>4</td>
<td>173.3</td>
<td>110.8</td>
</tr>
<tr>
<td>Dump Leach Facility (T4)</td>
<td>3</td>
<td>52.8</td>
<td>26.2</td>
</tr>
<tr>
<td>West Branch Offices (T5)</td>
<td>3</td>
<td>89.9</td>
<td>36.7</td>
</tr>
<tr>
<td>Mean Background Value*</td>
<td></td>
<td>31</td>
<td></td>
</tr>
</tbody>
</table>

* Mean Background Value has been calculated from period mean values for China Beach (T1), Cyanide Store (T2) and West Branch Office (T5). The value is rounded to a whole number.

The period mean concentrations are very low and clearly indicate that annual mean concentrations of nitrogen dioxide and sulphur dioxide are likely to achieve the corresponding EU air quality limit values for the current baseline conditions at the Mine site. Air quality across most of the Mine site - and therefore at all locations beyond the site boundary fence line - has not become degraded as a result of existing operations.
The fuel farm monitoring location (T3) is located close to the point of maximum impact of emissions from the stacks of the existing HFO fuelled power plant. This plant does not use fuel with low sulphur content as it is not currently available in country. Emissions from the power plant have locally increased the concentrations of sulphur dioxide and nitrogen dioxide (see Table 7-5 and Table 7-6 T3), but these concentrations rapidly decrease back towards background concentrations with increasing distance from the source. At the Cyanide Store concentrations have decreased to background levels. At the dump leach facility exhaust emissions from mobile plant have increased measured concentrations of nitrogen dioxide by a small but measureable amount.

The period mean background concentration of ozone is high at 110 µg/m³. The natural chemistry of the atmosphere produces high concentrations of ozone in the study area. The absence of any sources of large volume emissions of oxides of nitrogen (cities, major roads, power stations) means that ozone concentrations remain high over much of the Sahara (NASA, 2011). At locations impacted upon by power plant or mobile plant exhaust emissions of oxides of nitrogen, the concentration of ozone is reduced slightly (Table 7-7, T3 and T4), but increases again as the emissions disperse downwind.

<table>
<thead>
<tr>
<th>Monitoring Location</th>
<th>No. of Samples</th>
<th>Max Period Concentration (µg/m³)</th>
<th>Period Mean Concentration (µg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>China Beach (T1)</td>
<td>4</td>
<td>151.0</td>
<td>117.5</td>
</tr>
<tr>
<td>Cyanide Store (T2)</td>
<td>5</td>
<td>143.9</td>
<td>106.7</td>
</tr>
<tr>
<td>Fuel Farm (T3)</td>
<td>4</td>
<td>118.7</td>
<td>92.6</td>
</tr>
<tr>
<td>Dump Leach Facility (T4)</td>
<td>3</td>
<td>108.8</td>
<td>83.1</td>
</tr>
<tr>
<td>West Branch Offices (T5)</td>
<td>3</td>
<td>156.3</td>
<td>105.7</td>
</tr>
<tr>
<td><strong>Mean Background Value</strong></td>
<td></td>
<td><strong>110</strong></td>
<td></td>
</tr>
</tbody>
</table>

* Mean Background Value has been calculated from period mean values for China Beach (T1), Cyanide Store (T2) and West Branch Office (T5). The value is reported to no decimal places.

At this time there are no reported measurements of particulate matter concentrations in Mauritania. Research undertaken at Nouakchott international airport in 2000 (Ozer et al, 2006) estimated annual mean concentrations of PM₁₀ from optical based observations and concluded that baseline annual mean concentrations of PM₁₀ were 108 µg/m³. This is more than 200% of the EU limit value of 40 µg/m³ and it is therefore highly likely that the annual mean and the 24 hour mean limit values for PM₁₀ are not achieved in the study area for the baseline scenario.

### 7.3.3 Hydrogen Cyanide Gas Detection

The Environmental Management Plan (EMP) for the Mine recognises the potential for cyanide gas to be emitted into the atmosphere by evaporation from aqueous solutions containing cyanide compounds. The solution storage ponds and the dump leach facility are the only locations on the Mine site where concentrations of cyanide in the atmosphere have the potential to pose an acute risk to the health of workers. The continuous monitoring of concentrations of hydrogen cyanide gas at the northern, eastern, southern and western edges of these areas is an existing management control. Measured values exceeding a lower (action) threshold of 5 ppm or the more critical upper threshold (evacuation) value of 10 ppm trigger the appropriate management response to safeguard worker health and to address the cause of the increased rate of emissions of hydrogen cyanide gas. The relationship between the acidity (pH)
of material and the rate of emissions of hydrogen cyanide gas is well understood and pH control provides a very effective means of controlling emissions of hydrogen cyanide gas at source. The potential risk to health is limited to the immediate area of the source of the emissions, within the Mine site, as the concentration of the gas decreases rapidly as it mixes in the atmosphere. Hydrogen cyanide gas molecules are broken down in sunlight by atmospheric chemical processes and therefore hydrogen cyanide gas is a short lived constituent of the atmosphere.

Monitoring data for the period October 2010 to September 2011 is the most recent data available for this assessment (see Appendix 2 Figures 2-13 and 2-14). The average concentrations of hydrogen cyanide gas demonstrate that HCN gas is usually present at both the Solution Ponds area and the dump leach facility pad area, at concentrations that are less than half of the lower threshold value. There are occasional episodes when concentrations are more than the lower threshold value. At such times controls have always been adequate to keep concentrations below the upper threshold value and to return it to concentrations that are below the lower threshold value. Concentrations of HCN gas are rapidly dissipated with distance from the existing sources and concentrations at sensitive receptors (R1 to R5 or beyond the fence line) are predicted to be so small as to not be measurable.

7.3.4 Dust and Particulates

Respirable particles (PM\textsubscript{10}) and larger particles are generated from the existing operations at the Mine site (crushing, vehicle movements on the unsurfaced haul roads, blasting, etc). These are subject to controls as defined in the TMLSA Environmental and Health and Safety Management Systems. A survey to measure existing concentrations of airborne particular matter at the Mine site was commissioned in 2011, but there is no data available yet to support this assessment.

Baseline levels of particulate matter at the Mine site (R1-R4 and B1 to B4) 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. The flat open nature of the terrain provides limited opportunity for dust particles to deposit and to accumulate except where vegetation or a stone provides some shelter from the wind. The introduction of buildings, plant, bunds and the pits into the study area have increased the potential for dust particles transported onto the Mine site to accumulate there. This accumulation of dust particles increases the potential for the re-suspension of this material.

Atmospheric concentrations of both coarse dust particles and respirable particles (PM\textsubscript{10}) are likely to be high as a result of the desert conditions, particularly during windy periods. Due to the nature of the terrain e.g. loose and semi-consolidated soils 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.

7.4 Potential Impacts

7.4.1 Construction

7.4.1.1 Construction of Phase 2 Facilities

The activities assessed under the Phase 1B EIA included works for the preparation of the areas on which the new power plant and new processing plant will be constructed in Phase 2. The construction works under this Phase 2 mainly involve the assembly of buildings and plant
from pre-fabricated components and the associated potential for the generation of emissions of dust is low.

The construction of additional accommodation increases the number of receptors located on the Mine site, but the proposed site for the accommodation is in the general area of the existing accommodation (R1 to R3). The expansion of the accommodation camp does not increase the risk of adverse impacts occurring as a result of mining operations at the Mine site.

The control measures adopted during Phase 1 construction activities will be retained for the construction of Phase 2 construction works and it can reasonably be expected that they will be equally effective in ensuring that the impact of dust from construction works at the accommodation camp or at off-site receptors is low in magnitude and of negligible significance.

7.4.1.2 Additional Power Plant Capacity

The existing power plant (Figure 7-1) is based on reciprocating engines that are fuelled by HFO. The turbines proposed under the turbine technology option are an inherently cleaner technology than reciprocating engines and, together with embedded/planned emissions abatement equipment (low sulphur fuel, low NOx burners, wet low NOx combustion, an appropriate stack height), represent the use of best available technology with respect to emissions control for the largest power plant option considered. This is recognised in the IFC guidelines through the setting of much lower emission limit values for turbines than engines could achieve. Discharge to atmosphere from the power plant will occur via one stack, per operational turbine. During the construction phase, four turbines will be in use. Three turbines operated as base load units and a fourth stand-by unit operating for less than 500 hours per year equivalent. At this time the fuel used by the plant has not been confirmed and this assessment considers impacts for each of the four alternative fuels currently under consideration.

The additional energy recovery plant required to operate the power plant as a combined cycle system is scheduled to come on line approximately six months after the turbine generators. The impacts of the new power plant are therefore only considered against the short-term criteria for each constituent. The power plant will emit oxides of nitrogen, sulphur dioxide, and particulate matter (PM10). The power plant will operate on fuel with a sulphur content of 1% or less (i.e. in line with IFC EHS Guidelines for Thermal Power), which is expected to be available within Mauritania by the time the plant is available to be used.

IFC Emission Guideline value for power plant using a combination of turbines and a gaseous fuel has been set at 25 ppm NOx. The emission guideline for the same technology using liquid fuels (including diesel, light crude oil or heavy fuel oil) has been set at 74 ppm NOx. When completed the power plant will operate as a combined cycle system and has been designed to achieve emission rates for NOx at base load that are equal to the IFC Emission Guideline value or lower.

However, for those hours during the construction phase that the power plant operates as a simple cycle system at max load, the emission rates of NOx would be up to 1.3 times the guideline value for liquid fuels and 2.4 times the guideline value for natural gas. The short term and temporary nature of these emissions during the construction and commissioning of the power plant are considered to be consistent with good international industrial practice. The impacts of these emissions on ambient concentrations of nitrogen dioxide have been assessed, in the remainder of this section, to confirm that Environment Assessment Levels will not be exceeded at any relevant receptor locations.
As a simple cycle system the power plant does not make best use of the thermal energy available from the combustion of the fuel. It does not therefore represent a sustainable option in the long term as it burns much more fuel than would be required by a combined cycle system. However, one benefit is that, when the exhaust gases are emitted at temperatures of 470°C to 510°C, the hot plume rises higher into the atmosphere after it is released thereby dispersing pollutants more effectively and ensuring more rapid dilution of constituents to lower environmental concentrations.

Figure 7-2 illustrates the predicted process contribution to annual mean nitrogen dioxide concentrations for the power plant using each of the four potential fuels. An impact of 10% of the EAL value is represented by the 4 µg/m³ line on each plot, and is limited to a small area close to the power plant. The 0.4 µg/m³ line represents an impact equivalent to 1% of the EAL and this line extends beyond the Mine site boundary in the south west corner of the site (beyond receptor B1). There are no receptors located within the area between the Mine site boundary and the position of the 0.4 µg/m³ line on the plots for the plant operating on Diesel, LCO or HFO fuel. The magnitude of the impact on annual mean concentrations of nitrogen dioxide at all receptors will be less than 10% of the EAL which represents an impact of low magnitude. As the background concentration is so low, an impact of low magnitude would have a negligible effect at the accommodation camp or at all off-site receptors.

It is very unlikely that the power plant will operate as a simple cycle system for as long as a year and therefore the most appropriate EAL to apply to the assessment of concentrations of nitrogen dioxide are the short term criteria based on the hourly mean concentration. The predicted process contribution to hourly mean concentrations of nitrogen dioxide is illustrated in Figure 7-3 for the power plant using each of the four potential fuels. The maximum predicted impacts will occur within the Mine site close to the power plant (R5). This area is identified by the 20 µg/m³ line on the plots and represents 10% of the EAL value for nitrogen dioxide. As the impact will be less than 10% of the EAL value at the accommodation camp and all receptors beyond the site boundary (see also Table 7-8 to Table 7-11) the magnitude of the impact on nitrogen dioxide concentrations from the operation of the plant using any of the four fuels is described as low and would have a negligible effect.

Table 7-8: Magnitude of Simple Cycle Plant Emissions Impacts – Natural Gas Fuel

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Process Contribution² (µg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>5.1 (L)</td>
</tr>
<tr>
<td>R2</td>
<td>3.9 (L)</td>
</tr>
<tr>
<td>R3</td>
<td>4.6 (L)</td>
</tr>
<tr>
<td>R4*</td>
<td>4.1 (L)*</td>
</tr>
<tr>
<td>R5</td>
<td>11.0 (L)*</td>
</tr>
<tr>
<td>B1</td>
<td>5.7 (L)</td>
</tr>
<tr>
<td>B2</td>
<td>6.6 (L)</td>
</tr>
<tr>
<td>B3</td>
<td>2.2 (L)</td>
</tr>
<tr>
<td>B4</td>
<td>1.8 (L)</td>
</tr>
<tr>
<td>Assessment Criteria</td>
<td>200</td>
</tr>
</tbody>
</table>

²
1. Process Contribution is the change in air constituent level as a result of the emission.

Magnitude of impact descriptors reported in parentheses: High (H); Medium (M) or Low (L).

* Receptor represents impacts at a workplace location and environmental assessment criteria do not apply.

### Table 7-9: Magnitude of Simple Cycle Plant Emissions Impacts – Diesel Fuel

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Process Contribution</th>
<th>Hourly Mean NO₂ (µg/m³)</th>
<th>24 Hour Mean PM₁₀ (µg/m³)</th>
<th>24 Hour Mean SO₂ (µg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td></td>
<td>9.2 (L)</td>
<td>1.5 (L)</td>
<td>19.9 (M)</td>
</tr>
<tr>
<td>R2</td>
<td></td>
<td>7.0 (L)</td>
<td>1.2 (L)</td>
<td>20.0 (M)</td>
</tr>
<tr>
<td>R3</td>
<td></td>
<td>8.5 (L)</td>
<td>1.4 (L)</td>
<td>21.8 (M)</td>
</tr>
<tr>
<td>R4*</td>
<td></td>
<td>7.5 (L)</td>
<td>1.1 (L)</td>
<td>22.5 (M)</td>
</tr>
<tr>
<td>R5*</td>
<td></td>
<td>20.2 (M)</td>
<td>4.9 (L)</td>
<td>56.0 (H)</td>
</tr>
<tr>
<td>B1</td>
<td></td>
<td>10.4 (L)</td>
<td>3.5 (L)</td>
<td>41.1 (H)</td>
</tr>
<tr>
<td>B2</td>
<td></td>
<td>13.6 (L)</td>
<td>2.0 (L)</td>
<td>32.9 (H)</td>
</tr>
<tr>
<td>B3</td>
<td></td>
<td>4.1 (L)</td>
<td>0.8 (L)</td>
<td>9.9 (L)</td>
</tr>
<tr>
<td>B4</td>
<td></td>
<td>3.4 (L)</td>
<td>0.6 (L)</td>
<td>7.8 (L)</td>
</tr>
<tr>
<td>Assessment Criteria</td>
<td>200</td>
<td>50</td>
<td>125</td>
<td></td>
</tr>
</tbody>
</table>

Magnitude of impact descriptors reported in parentheses: High (H); Medium (M) or Low (L).

* Receptor represents impacts at a workplace location and environmental assessment criteria do not apply.

The process contribution to concentrations of particulate matter (PM₁₀) and sulphur dioxide has been calculated for the power plant using the liquid fuels diesel, LCO and HFO. Burning liquid fuels has the potential to result in emissions of unburnt fuel as very small particles, and oxides of sulphur from sulphur contained in the fuel. Gaseous fuels like natural gas typically contain extremely low levels of sulphur and being gaseous have very limited potential to generate particles. IFC guidelines recognise the reduced risk of emissions of PM₁₀ and sulphur dioxide from turbines burning gaseous fuels and no emissions limit has been set for this technology and fuel combination.

The impact of the power plant on annual mean concentrations of particulate matter (Figure 7-4) is similar to those for nitrogen dioxide. The 4 µg/m³ line on the plots represents impacts equal to 10% of the EAL values which are restricted to a small part of the Mine site. Concentrations decrease rapidly with distance and at the accommodation camp (R1 to R3) and at all off-site receptors the magnitude of the impact is low for emissions resulting from the use of each type of fuel and are of negligible significance. The magnitude of the process contribution to 24 hour mean concentrations of particulate matter is illustrated in Figure 7-5, and impacts at specific locations are also reported in Table 7-9 to Table 7-11. The 5 µg/m³ lines on Figure 7-5 represent impacts equal to 10% of the 24 hour EAL value for PM₁₀ and these lines do not extend to the accommodation camp or beyond the Mine site boundary. Impacts resulting from the use of any of the four fuels would be low magnitude and taking into account the nature of the desert environment are considered to be of low significance.
### Table 7-10: Magnitude of Simple Cycle Plant Emissions Impacts – LCO Fuel

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Process Contribution</th>
<th>Hourly Mean NO$_2$ (µg/m$^3$)</th>
<th>24 Hour Mean PM$_{10}$ (µg/m$^3$)</th>
<th>24 Hour Mean SO$_2$ (µg/m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td></td>
<td>9.2 (L)</td>
<td>1.5 (L)</td>
<td>40.1 (H)</td>
</tr>
<tr>
<td>R2</td>
<td></td>
<td>7.0 (L)</td>
<td>1.2 (L)</td>
<td>40.3 (H)</td>
</tr>
<tr>
<td>R3</td>
<td></td>
<td>8.6 (L)</td>
<td>1.4 (L)</td>
<td>43.6 (H)</td>
</tr>
<tr>
<td>R4$^*$</td>
<td></td>
<td>7.5 (L)$^*$</td>
<td>1.1 (L)$^*$</td>
<td>45.1 (H)$^*$</td>
</tr>
<tr>
<td>R5</td>
<td></td>
<td>20.2 (M)$^*$</td>
<td>5.0 (L)</td>
<td>113.1 (H)$^*$</td>
</tr>
<tr>
<td>B1</td>
<td></td>
<td>10.4 (L)</td>
<td>3.5 (L)</td>
<td>82.4 (H)</td>
</tr>
<tr>
<td>B2</td>
<td></td>
<td>12.1 (L)</td>
<td>2.1 (L)</td>
<td>66.0 (H)</td>
</tr>
<tr>
<td>B3</td>
<td></td>
<td>4.0 (L)</td>
<td>0.8 (L)</td>
<td>19.8 (M)</td>
</tr>
<tr>
<td>B4</td>
<td></td>
<td>3.3 (L)</td>
<td>0.6 (L)</td>
<td>15.7 (M)</td>
</tr>
</tbody>
</table>

**Assessment Criteria**: 200  50  125

Magnitude of impact descriptors reported in parentheses: High (H); Medium (M) or Low (L).

$^*$ Receptor represents impacts at a workplace location and environmental assessment criteria do not apply.

### Table 7-11: Magnitude of Simple Cycle Plant Emissions Impacts - HFO Fuel

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Process Contribution</th>
<th>Hourly Mean NO$_2$ (µg/m$^3$)</th>
<th>24 Hour Mean PM$_{10}$ (µg/m$^3$)</th>
<th>24 Hour Mean SO$_2$ (µg/m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td></td>
<td>10.2 (L)</td>
<td>1.6 (L)</td>
<td>36.8 (H)</td>
</tr>
<tr>
<td>R2</td>
<td></td>
<td>7.2 (L)</td>
<td>1.3 (L)</td>
<td>35.6 (H)</td>
</tr>
<tr>
<td>R3</td>
<td></td>
<td>9.2 (L)</td>
<td>1.5 (L)</td>
<td>38.2 (H)</td>
</tr>
<tr>
<td>R4$^*$</td>
<td></td>
<td>8.0 (L)$^*$</td>
<td>1.1 (L)$^*$</td>
<td>38.8 (H)$^*$</td>
</tr>
<tr>
<td>R5</td>
<td></td>
<td>23.1 (M)$^*$</td>
<td>5.8 (M)$^*$</td>
<td>107.9 (H)$^*$</td>
</tr>
<tr>
<td>B1</td>
<td></td>
<td>11.3 (L)</td>
<td>3.7 (L)</td>
<td>71.3 (H)</td>
</tr>
<tr>
<td>B2</td>
<td></td>
<td>13.6 (L)</td>
<td>2.4 (L)</td>
<td>58.6 (H)</td>
</tr>
<tr>
<td>B3</td>
<td></td>
<td>4.1 (L)</td>
<td>0.8 (L)</td>
<td>16.8 (M)</td>
</tr>
<tr>
<td>B4</td>
<td></td>
<td>3.4 (L)</td>
<td>0.6 (L)</td>
<td>14.5 (M)</td>
</tr>
</tbody>
</table>

**Assessment Criteria**: 200  50  125

Magnitude of impact descriptors reported in parentheses: High (H); Medium (M) or Low (L).

$^*$ Receptor represents impacts at a workplace location and environmental assessment criteria do not apply.
Baseline measurements of sulphur dioxide indicate (Table 7-6) that annual mean concentrations are low at 31 µg/m³. During periods of low wind speeds or turbulence in the lower atmosphere (such as a storm event) the processes that disperse the emissions may not be as effective and short term increases in pollutant concentration can occur at ground level. In the absence of other local sources of emissions of sulphur dioxide, the background contribution to the total concentration is unlikely to change significantly as a result of short term changes in meteorological conditions; however, the process contribution from the power plant can change the concentration significantly. Figure 7-6 illustrates the process contribution to 24 hour mean concentrations of sulphur dioxide from the power plant using each of the liquid fuels. The pattern of predicted impacts is not an even shape and reflects short term episodes when ground level concentrations would be increased in a very localised area.

For example, infrequently occurring meteorological conditions are predicted to result in elevated 24 hour mean concentrations along a narrow corridor from the power plant across the accommodation camp and beyond the north east boundary of the Mine site. The pattern of predicted impacts is the same for the power plant regardless of the fuel used, but the magnitude of the impacts is proportional to the sulphur content of the fuel. For the plot of process contributions to 24 hour mean sulphur dioxide concentrations, for a power plant using diesel as a fuel, the 31.25 µg/m³ line (25% of EAL value) extends beyond the southern Mine site boundary. The equivalent line on the plots for a power plant using LCO or HFO as the fuel, extend to include the accommodation camp (R1 to R3 in Table 7-9 to Table 7-11) and a large area of land beyond the site boundary.

At the accommodation camp the predicted impact on annual mean concentrations of sulphur dioxide are predicted to be up to 44 µg/m³ for a power plant using LCO as the fuel. This is more than 35% of the EAL value and is described as being an impact of high magnitude. The total concentration calculated by adding the process contribution (44 µg/m³) and the baseline value (31 µg/m³) is 75 µg/m³ and 60% of the EAL value of 125 µg/m³. Where the ambient concentration is predicted to be less than 75% of the EAL value, a high magnitude impact represents an effect of low significance (see Table 7-4).

At other locations surrounding the Mine site, impacts are greater than at the accommodation camp; however, no ambient concentration of more than the EAL is predicted to occur at any receptor beyond the Mine site boundary. The EAL values have been set at a value that represents air of good quality, so it can be concluded with confidence that air would remain of good quality with the operation of the power plant as a simple cycle system. At off-site receptors, such as the small semi-permanent communities at Emkebden, Guelb Dawass and Ntalve, the significance of the effect of the predicted impacts ranges from moderate to low, with effects of low to negligible significance predicted at locations to the north and north west of the Mine site boundary.

The impacts from the construction phase operation of the new power plant would be limited to the construction phase and are therefore short term only. The significance of the effect resulting from the impact on concentrations of each air pollutant is summarised in Table 12.

### Table 7-12: Summary of predicted residual impacts for Construction Phase Scenario

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Fuel¹</th>
<th>Location of Impacts</th>
<th>Magnitude of Process Contribution¹</th>
<th>Duration</th>
<th>Environmental Concentration as % of EAL</th>
<th>Significance of Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen Dioxide (NO₂)</td>
<td>D, LCO, HFP or NG</td>
<td>Accommodation Camp</td>
<td>Low</td>
<td>Short term</td>
<td>&lt; 75%</td>
<td>Negligible</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Off Site Receptors</td>
<td>Low</td>
<td>Short term</td>
<td>&lt; 75%</td>
<td>Negligible</td>
</tr>
<tr>
<td>Sulphur Dioxide</td>
<td>D, LCO,</td>
<td>Accommodation Camp</td>
<td>Medium</td>
<td>Short term</td>
<td>&lt; 75 %</td>
<td>Negligible</td>
</tr>
</tbody>
</table>
The magnitude of the process contribution to ambient concentrations of nitrogen dioxide and particulate matter would be low in magnitude, as a result of the use of modern technology and incorporated mitigation, for each of the fuel types under consideration. These emissions would not significantly affect the future achievement of the EAL values at any receptor and would be described as negligible if it were not for the risk that baseline concentrations of particulate matter are already at or above the EAL value. The magnitude of the impact of emissions of sulphur dioxide on 24 hour mean concentrations is determined by the sulphur content of the fuels available in Mauritania. The absence of permanent settlements within the area predicted to experience high to medium magnitude impacts on 24 hour mean sulphur dioxide concentrations greatly limits the potential for adverse impacts to occur. The limited potential for exposure to occur and the fact that predicted pollutant concentrations are less than the EAL criteria for each constituent, reduces the weight that should be given to the reported sulphur dioxide impacts in assessing the effect of the construction phase operation of the power plant.

Overall the (turbine technology) power plant operating as a simple cycle system during the construction phase would have an adverse effect on local air quality at receptors that would be of low significance and be of short term duration.

### 7.4.1.3 Construction Traffic on N2 Highway and Mine Road

Equipment and materials required for construction will mainly be transported to the Mine site from Nouâdhibou Port. Operational fuel supplies currently come from Nouâdhibou Port, and the frequency of these supplies will increase significantly during construction. Operational equipment and materials currently come from Nouakchott Port, and this will continue throughout construction. Buses currently transport workers from Nouakchott to the Mine site and the frequency of these will increase during construction.

Table 13 shows current vehicle pass-bys (buses are included with lorries in the numbers) and peak vehicle pass-bys during the construction phase on the N2 Highway between Nouâdhibou and the Mine access road, on the N2 Highway between Nouakchott and the Mine access road, and on the Mine access road itself. The contribution of vehicle exhaust emissions to ambient concentrations of air pollutants has been estimated at a distance of 10m from the carriageway. Estimates are based on the assumption of EURO I or older vehicles being used and impacts will be less if vehicles achieving more recent engine emissions specifications are used.
Table 7-13: Impact of Vehicle Exhaust Emissions on Annual Mean Concentrations of Nitrogen Dioxide and PM$_{10}$ (Construction)

<table>
<thead>
<tr>
<th>Road Link</th>
<th>Number of vehicle Pass-Bys / Day</th>
<th>Contribution to Ambient Concentration of NO$_2$ (µg/m$^3$)</th>
<th>Contribution to Ambient Concentration of PM$_{10}$ (µg/m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Current Operation</td>
<td>Future Operation</td>
<td>Current Operation</td>
</tr>
<tr>
<td>N2 Highway: Nouâdhibou to Mine Access Road</td>
<td>12</td>
<td>84</td>
<td>0.4</td>
</tr>
<tr>
<td>N2 Highway: Nouakchott to Mine Access Road</td>
<td>16</td>
<td>102</td>
<td>0.4</td>
</tr>
<tr>
<td>Mine Access Road</td>
<td>28</td>
<td>186</td>
<td>1.0</td>
</tr>
</tbody>
</table>

For locations situated at a distance of 10 m or more from the edge of the N2 highway between Nouâdhibou and the Mine access road, the increase in vehicle movements will result in an increase in annual mean concentrations of nitrogen dioxide of less than 3 µg/m$^3$. The corresponding increase in exposure to PM$_{10}$ from vehicle exhaust emissions will be < 1 µg/m$^3$. The significance of this increase is assessed as negligible/low adverse.

For locations situated at a distance of 10 m or more from the edge of the N2 highway between Nouakchott and the Mine access road, the increase in vehicle movements will result in an increase in annual mean concentrations of nitrogen dioxide of 3 µg/m$^3$. The corresponding increase in exposure to PM$_{10}$ from vehicle exhaust emissions will be < 1 µg/m$^3$. The significance of this increase is assessed as negligible/low adverse.

For locations situated at a distance of 10 m or more from the edge of the Mine access road, the increase in vehicle movements will result in an increase in annual mean concentrations of nitrogen dioxide of 5 µg/m$^3$. The corresponding increase in exposure to PM$_{10}$ from vehicle exhaust emissions will be < 1 µg/m$^3$. The significance of this increase is assessed as negligible/low adverse.

7.4.2 Operation

7.4.2.1 Additional Power Plant Capacity

Gas Turbine Combined Cycle Technology Option

The existing power plants (Figure 7-1) are based on reciprocating engines that are fuelled by HFO. The turbines proposed under Phase 2 represent the use of best available technology with respect to emissions control for the largest power plant option considered. This is recognised in the IFC guidelines through the setting of much lower emission limit values for turbines than engines could achieve. Discharge to atmosphere from the power plant will occur via one stack, per operational turbine. During the operational phase, four turbines will be in use. Three turbines operated as base load units and a fourth stand-by unit operating for less than 500 hours per year equivalent. At this time the fuel used by the plant has not been confirmed and...
this assessment considers impacts for each of the four alternative fuels currently under consideration.

The power plant will emit oxides of nitrogen, sulphur dioxide, and particulate matter (PM$_{10}$). The power plant will operate on fuel with a sulphur content of less than 1% (in line with IFC EHS Guidelines for Thermal Power), which is expected to be available within Mauritania by the time the plant is commissioned and operational.

IFC Emission Guideline values for power plant using a combination of turbines and gaseous fuels has been set at 25 ppm. The emission guideline for the same technology using liquid fuels (including diesel, light crude oil or heavy fuel oil) has been set at 74 ppm. The power plant will operate as a combined cycle system and has been designed to achieve emission rates for NOx at base load that are equal to or lower than the IFC Emission Guideline value.

Figure 7-7 illustrates the predicted process contribution to annual mean nitrogen dioxide concentrations for the power plant using each of the four potential fuels. An impact of 10% of the EAL value is represented by the 4 µg/m$^3$ line on each plot, and is limited to a small area close to the power plant. The 0.4 µg/m$^3$ line represents an impact equivalent to 1% of the EAL and this line extends beyond the southern Mine site boundary (beyond receptors B1 and B2). There are no receptors located within the area between the Mine site boundary and the position of the 0.4 µg/m$^3$ line on the plots for the plant operating on Diesel, LCO or HFO fuel. The magnitude of the impact on annual mean concentrations of nitrogen dioxide at all receptors will be less than 10% of the EAL which represents an impact of low magnitude. As the background concentration is so low, an impact of low magnitude would have a negligible effect at the accommodation camp or at all off site receptors as listed in 7.2.1.

The predicted contribution to hourly mean concentrations of nitrogen dioxide is illustrated in Figure 7-8 for the power plant using each of the four potential fuels. The maximum predicted impacts will occur within the Mine site close to the power plant (R5). The area defined by the 20 µg/m$^3$ line on the plots, represents 10% of the EAL value for nitrogen dioxide. As the impact will be less than 10% of the EAL value at the accommodation camp and all receptors

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Process Contribution</th>
<th>Annual Mean NO$_2$ (µg/m$^3$)</th>
<th>Hourly Mean NO$_2$ (µg/m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>0.1 (L)</td>
<td>4.7 (L)</td>
<td></td>
</tr>
<tr>
<td>R2</td>
<td>0.1 (L)</td>
<td>4.8 (L)</td>
<td></td>
</tr>
<tr>
<td>R3</td>
<td>0.1 (L)</td>
<td>4.9 (L)</td>
<td></td>
</tr>
<tr>
<td>R4$^*$</td>
<td>0.1 (L)$^*$</td>
<td>4.9 (L)$^*$</td>
<td></td>
</tr>
<tr>
<td>R5$^*$</td>
<td>0.9 (L)$^*$</td>
<td>21.1 (M)$^*$</td>
<td></td>
</tr>
<tr>
<td>B1</td>
<td>0.2 (L)</td>
<td>5.4 (L)</td>
<td></td>
</tr>
<tr>
<td>B2</td>
<td>0.1 (L)</td>
<td>7.9 (L)</td>
<td></td>
</tr>
<tr>
<td>B3</td>
<td>&lt; 0.1 (L)</td>
<td>1.8 (L)</td>
<td></td>
</tr>
<tr>
<td>B4</td>
<td>&lt; 0.1 (L)</td>
<td>1.3 (L)</td>
<td></td>
</tr>
<tr>
<td>Assessment Criteria</td>
<td>40</td>
<td>200</td>
<td></td>
</tr>
</tbody>
</table>

Magnitude of impact descriptors reported in parentheses: High (H); Medium (M) or Low (L).
Table 7-15: Magnitude of Combined Cycle Plant Emissions Impacts – Diesel Fuel

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Annual Mean NO₂ (µg/m³)</th>
<th>Hourly Mean NO₂ (µg/m³)</th>
<th>Annual Mean PM₁₀ (µg/m³)</th>
<th>24 Hour Mean PM₁₀ (µg/m³)</th>
<th>24 Hour Mean SO₂ (µg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>0.2 (L)</td>
<td>12.1 (L)</td>
<td>0.3 (L)</td>
<td>2.4 (L)</td>
<td>34.1 (H)</td>
</tr>
<tr>
<td>R2</td>
<td>0.2 (L)</td>
<td>11.4 (L)</td>
<td>0.2 (L)</td>
<td>2.6 (L)</td>
<td>26.1 (M)</td>
</tr>
<tr>
<td>R3</td>
<td>0.2 (L)</td>
<td>12.7 (L)</td>
<td>0.3 (L)</td>
<td>2.8 (L)</td>
<td>35.4 (H)</td>
</tr>
<tr>
<td>R4*</td>
<td>0.1 (L)*</td>
<td>12.7 (L)*</td>
<td>0.2 (L)*</td>
<td>3.1 (L)*</td>
<td>32.6 (H)*</td>
</tr>
<tr>
<td>R5*</td>
<td>2.4 (L)*</td>
<td>55.8 (M)*</td>
<td>3.7 (L)*</td>
<td>16.6 (M)*</td>
<td>149.0 (H)*</td>
</tr>
<tr>
<td>B1</td>
<td>0.7 (L)</td>
<td>14.3 (L)</td>
<td>1.0 (L)</td>
<td>4.7 (L)</td>
<td>42.4 (H)</td>
</tr>
<tr>
<td>B2</td>
<td>0.4 (L)</td>
<td>21.2 (M)</td>
<td>0.6 (L)</td>
<td>5.1 (M)</td>
<td>58.6 (H)</td>
</tr>
<tr>
<td>B3</td>
<td>0.1 (L)</td>
<td>4.9 (L)</td>
<td>0.1 (L)</td>
<td>1.1 (L)</td>
<td>10.8 (L)</td>
</tr>
<tr>
<td>B4</td>
<td>0.1 (L)</td>
<td>3.3 (L)</td>
<td>0.1 (L)</td>
<td>0.8 (L)</td>
<td>13.5 (M)</td>
</tr>
<tr>
<td>Assessment Criteria</td>
<td>40</td>
<td>200</td>
<td>40</td>
<td>50</td>
<td>125</td>
</tr>
</tbody>
</table>

Magnitude of impact descriptors reported in parentheses: High (H); Medium (M) or Low (L).

* Receptor represents impacts at a workplace location and environmental assessment criteria do not apply beyond the site boundary (B2 and B3) (see also Tables 7-14 to 7-17) the magnitude of the impact on nitrogen dioxide concentrations from the operation of the plant using any of the four fuels is described as low and would have a negligible effect.

The impact of the power plant on annual mean concentrations of particulate matter (Figure 7-9) is similar to those for nitrogen dioxide. The 4 µg/m³ line on the plots represents impacts equal to 10% of the EAL values and these are restricted to a small part of the Mine site. Annual mean concentrations decrease rapidly with distance and at the accommodation camp (R1 to R3) and at all off-site receptors the magnitude of the impact is low for emissions resulting from the use of each type of fuel and are of negligible significance. The magnitude of the process contribution to 24 hour mean concentrations of particulate matter is illustrated in Figure 7-10, and impacts at specific locations are also reported in Table 7-15 to Table 7-17. The 5 µg/m³ lines on Figure 7-10 represent impacts equal to 10% of the 24 hour EAL value for PM₁₀ and these lines do not extend to the accommodation camp, but do extend beyond the southern and south western site boundaries (B2 an B3). There are no permanent sensitive receptors located in the area between the 5 µg/m³ line and the Mine site boundary. The impacts at receptors resulting from the use of any of the four fuels would be low magnitude and taking into account the nature of the desert environment are considered to be of low significance.
### Table 7-16: Magnitude of Combined Cycle Plant Emissions Impacts – LCO Fuel

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Process Contribution</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Annual Mean NO$_2$ (µg/m$^3$)</td>
<td>Hourly Mean NO$_2$ (µg/m$^3$)</td>
<td>Annual Mean PM$_{10}$ (µg/m$^3$)</td>
<td>24 Hour Mean PM$_{10}$ (µg/m$^3$)</td>
<td>24 Hour Mean SO$_2$ (µg/m$^3$)</td>
</tr>
<tr>
<td>R1</td>
<td>0.2 (L)</td>
<td>12.5 (L)</td>
<td>0.3 (L)</td>
<td>2.4 (L)</td>
<td>68.8 (H)</td>
</tr>
<tr>
<td>R2</td>
<td>0.2 (L)</td>
<td>11.6 (L)</td>
<td>0.2 (L)</td>
<td>2.6 (L)</td>
<td>51.3 (H)</td>
</tr>
<tr>
<td>R3</td>
<td>0.2 (L)</td>
<td>13.2 (L)</td>
<td>0.3 (L)</td>
<td>2.8 (L)</td>
<td>67.3 (H)</td>
</tr>
<tr>
<td>R4*</td>
<td>0.2* (L)</td>
<td>13.2 (L)*</td>
<td>0.2 (L)*</td>
<td>3.1 (L)*</td>
<td>60.9 (H)*</td>
</tr>
<tr>
<td>R5*</td>
<td>2.4* (L)</td>
<td>57.8 (H)*</td>
<td>3.7 (L)*</td>
<td>16.6 (H)*</td>
<td>286.3 (H)*</td>
</tr>
<tr>
<td>B1</td>
<td>0.7 (L)</td>
<td>15.0 (L)</td>
<td>1.0 (L)</td>
<td>4.7 (L)</td>
<td>83.9 (H)</td>
</tr>
<tr>
<td>B2</td>
<td>0.4 (L)</td>
<td>22.5 (M)</td>
<td>0.6 (L)</td>
<td>5.1 (M)</td>
<td>115.9 (H)</td>
</tr>
<tr>
<td>B3</td>
<td>0.1 (L)</td>
<td>5.1 (L)</td>
<td>0.1 (L)</td>
<td>1.1 (L)</td>
<td>21.2 (M)</td>
</tr>
<tr>
<td>B4</td>
<td>0.1 (L)</td>
<td>3.5 (L)</td>
<td>0.1 (L)</td>
<td>0.8 (L)</td>
<td>26.5 (M)</td>
</tr>
<tr>
<td>Assessment Criteria</td>
<td>40</td>
<td>200</td>
<td>40</td>
<td>50</td>
<td>125</td>
</tr>
</tbody>
</table>

Magnitude of impact descriptors reported in parentheses: High (H); Medium (M) or Low (L).

* Receptor represents impacts at a workplace location and environmental assessment criteria do not apply.

### Table 7-17: Magnitude of Combined Cycle Plant Emissions Impacts - HFO Fuel

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Process Contribution</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Annual Mean NO$_2$ (µg/m$^3$)</td>
<td>Hourly Mean NO$_2$ (µg/m$^3$)</td>
<td>Annual Mean PM$_{10}$ (µg/m$^3$)</td>
<td>24 Hour Mean PM$_{10}$ (µg/m$^3$)</td>
<td>24 Hour Mean SO$_2$ (µg/m$^3$)</td>
</tr>
<tr>
<td>R1</td>
<td>0.2 (L)</td>
<td>13.5 (L)</td>
<td>0.2 (L)</td>
<td>2.3 (L)</td>
<td>59.7 (H)</td>
</tr>
<tr>
<td>R2</td>
<td>0.2 (L)</td>
<td>11.7 (L)</td>
<td>0.2 (L)</td>
<td>2.4 (L)</td>
<td>48.7 (H)</td>
</tr>
<tr>
<td>R3</td>
<td>0.2 (L)</td>
<td>14.3 (L)</td>
<td>0.3 (L)</td>
<td>2.4 (L)</td>
<td>60.8 (H)</td>
</tr>
<tr>
<td>R4*</td>
<td>0.2* (L)</td>
<td>13.9 (L)*</td>
<td>0.2 (L)*</td>
<td>2.7 (L)*</td>
<td>53.1 (H)*</td>
</tr>
<tr>
<td>R5*</td>
<td>2.6* (L)*</td>
<td>62.3 (H)*</td>
<td>3.3 (L)*</td>
<td>15.5 (M)*</td>
<td>264.5 (H)*</td>
</tr>
<tr>
<td>B1</td>
<td>0.8 (L)</td>
<td>16.5 (L)</td>
<td>1.0 (L)</td>
<td>4.7 (L)</td>
<td>81.7 (H)</td>
</tr>
<tr>
<td>B2</td>
<td>0.5 (L)</td>
<td>24.3 (M)</td>
<td>0.6 (L)</td>
<td>5.1 (M)</td>
<td>110.7 (H)</td>
</tr>
<tr>
<td>B3</td>
<td>0.1 (L)</td>
<td>5.6 (L)</td>
<td>0.1 (L)</td>
<td>1.1 (L)</td>
<td>20.0 (M)</td>
</tr>
<tr>
<td>B4</td>
<td>0.1 (L)</td>
<td>3.8 (L)</td>
<td>0.1 (L)</td>
<td>0.8 (L)</td>
<td>25.1 (M)</td>
</tr>
</tbody>
</table>
Baseline measurements of sulphur dioxide indicate (Table 7-6) that annual mean concentrations are low at 31 µg/m³. During periods of low wind speeds or turbulence in the lower atmosphere (such as a storm event) the processes that disperse the emissions may not be as effective and short term increases in pollutant concentration can occur at ground level. In the absence of other local sources of emissions of sulphur dioxide, the background contribution to the total concentration is unlikely to change significantly as a result of short term changes in meteorological conditions, but the process contribution from the power plant will do. Figure 7-11 illustrates the process contribution to 24 hour mean concentrations of sulphur dioxide from the power plant using each of the liquid fuels. The pattern of predicted impacts is not an even shape and reflects short term episodes when ground level concentrations would be increased in a very localised area.

For example, infrequently occurring meteorological conditions are predicted to result in elevated 24 hour mean concentrations along a narrow corridor from the power plant across the accommodation camp and beyond the North East boundary of the Mine site. The pattern of predicted impacts is the same for the power plant regardless of the fuel used, but the magnitude of the impacts is proportional to the sulphur content of the fuel. For the plot of process contributions to 24 hour mean sulphur dioxide concentrations, for a power plant using diesel as a fuel, the 31.25 µg/m³ line (25% of EAL value) extends beyond the southern and south western Mine site boundary. The equivalent line on the plots for a power plant using LCO or HFO as the fuel, extend to include the accommodation camp (R1 to R3 in Table 7-15 to Table 7-17) and a large area of land beyond the site boundary.

At the accommodation camp the predicted impact on 24 hour mean concentrations of sulphur dioxide are predicted to be up to 69 µg/m³ for a power plant using LCO as the fuel. This is more than 55% of the EAL value and is described as being an impact of high magnitude. The total concentration calculated by adding the process contribution (69 µg/m³) and the baseline value (31 µg/m³) is 100 µg/m³ and 80% of the EAL value of 125 µg/m³. Where the ambient concentration is predicted to be between 75% and 100% of the EAL value, a high magnitude impact represents an effect of Moderate significance (see Table 7-4).

At other locations surrounding the Mine, site impacts are greater than at the accommodation camp and are described as high close to receptor B2. However, at no permanent sensitive receptor located beyond the Mine site is an ambient concentration of more than the EAL predicted to occur. The EAL values have been set at a value that represents air of good quality, so it can be concluded with confidence that air would remain of good quality with the operation of the power plant as a combined cycle system. At off-site receptors the significance of the effect of the predicted impacts ranges from Moderate to Low, with effects of low to negligible significance predicted at locations to the north and north west of the Mine site boundary.

The impacts from the operation of the new power plant would be limited to the operational phase and are therefore medium term in duration. Air pollution will return to baseline levels.
when the power plant is taken out of service. The significance of the effect resulting from the impact on concentrations of each air pollutant is summarised in Table 7-18.

Table 7-18: Summary of predicted residual impacts for Operational Phase Scenario

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Fuel(^2)</th>
<th>Location of Impacts</th>
<th>Magnitude of Process Contribution(^1)</th>
<th>Duration</th>
<th>Environmental Concentration as % of EAL</th>
<th>Significance of Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen Dioxide (NO(_2))</td>
<td>D, LCO, HFO or NG</td>
<td>Accommodation Camp</td>
<td>Low</td>
<td>Medium term</td>
<td>&lt; 75%</td>
<td>Negligible</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Off Site Receptors</td>
<td>Low</td>
<td>Medium term</td>
<td>&lt; 75%</td>
<td>Negligible</td>
</tr>
<tr>
<td>Sulphur Dioxide (SO(_2))</td>
<td>D, HFO</td>
<td>Accommodation Camp</td>
<td>High</td>
<td>Medium term</td>
<td>&lt; 75%</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Off Site Receptors</td>
<td>High/Medium</td>
<td>Medium term</td>
<td>75 – 100%</td>
<td>Moderate to Low</td>
</tr>
<tr>
<td>Particulate Matter (PM(<em>{10}) and PM(</em>{2.5}))</td>
<td>D, LCO, HFO or NG</td>
<td>Accommodation Camp</td>
<td>Low</td>
<td>Medium term</td>
<td>&gt; 100%(^4)</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Off Site Receptors</td>
<td>Medium/Low</td>
<td>Medium term</td>
<td>&gt; 100%(^4)</td>
<td>Moderate to Low</td>
</tr>
</tbody>
</table>

\(^1\)Following implementation of incorporated Mitigation Measures

\(^2\)Fuel: D = Diesel, LCO = Light Crude Oil, HFO = Heavy Fuel Oil, NG = Natural Gas

\(^3\)Relates to the frequency of episodes of 24 hour mean concentrations of sulphur dioxide that are greater than the limit value, during a calendar year period. Predicted concentrations using LCO fuel are > 100% at site boundary, but not at any relevant receptor. Impact for Natural Gas has not been modelled as IFC guidelines advise that sulphur content can be assumed to be very low and the effect would be negligible.

\(^4\)Available evidence (Ozer, 2006) indicates that natural processes result in ambient concentrations of PM\(_{10}\) that are greater than the EAL value.

The magnitude of the process contribution to ambient concentrations of nitrogen dioxide and particulate matter would be low in magnitude at sensitive receptors, as a result of the use of modern technology and incorporated mitigation, for each of the fuel types under consideration. These emissions would not significantly affect the future achievement of the EAL values at any receptor and would be described as negligible if it were not for the risk that baseline concentrations of particulate matter are already at or above the EAL value. The magnitude of the impact of emissions of sulphur dioxide on 24 hour mean concentrations is determined by the sulphur content of the fuels available in Mauritania. The absence of permanent settlements within the area predicted to experience high to medium magnitude impacts on 24 mean sulphur dioxide concentrations greatly limits the potential for adverse impacts to occur. The limited potential for exposure to occur and the fact that predicted pollutant concentrations are less than the EAL criteria for each pollutant at sensitive receptor locations, reduces the weight that should be given to the reported sulphur dioxide impacts in assessing the effect of the operational phase of the power plant.

Overall the power plant operating as a simple cycle system during the construction phase would have an adverse effect on local air quality at sensitive receptors that would be of low significance and be of medium term duration.

Overall the turbine technology option power plant operating as a combined cycle system during the operational phase, would have an adverse effect on local air quality at sensitive receptors that would be of low significance and be of medium term duration.
Reciprocating Engines Technology Option

The existing power plants (Figure 7-1) are based on reciprocating engines that are fuelled by HFO. Reciprocating engines provide maximum flexibility for medium size power plant and are industry standard for power plants of this size. Under this technology option the Phase 1b plant would be retained as backup power plant to supplement the new power plant capacity of 7 x 17.1 MW reciprocating engines that would also be fuelled by HFO. Discharge to atmosphere from the power plant will occur via one stack per operational engine and stacks would be clustered to promote plume rise. At this time the assessment scenario is based on the emission rates that would be achieved by a modern engine (Wartsila 18V46E or similar) without the application of additional abatement options. The assessment therefore provides a reference point against which other engine or abatement options could be judged if the technology option was progressed through detailed design.

The power plant will emit oxides of nitrogen, sulphur dioxide, and particulate matter (PM$_{10}$). The assessment scenario has assumed that the power plant will operate on fuel with a sulphur content of 2% or less (in line with IFC EHS Guidelines for Thermal Power).

The existing airshed is not degraded by existing human activities. IFC Emission Guideline values for power plant using reciprocating engines and liquid fuels have been set at 1850 mg/Nm$^3$ for the technology option assessed. The emission guideline for particulate matter is 50 mg/Nm$^3$ for the same technology using liquid fuel. The power plant as assessed would operate with emissions rates at the IFC Emission Guideline value.

Figure 7-12 illustrates the predicted process contribution to annual mean concentrations of nitrogen dioxide and particulate matter (PM$_{10}$) for the power plant using the new engines and phase 1b engines at full continuous load. An impact of 25% of the EAL value is represented by the 10 µg/m$^3$ line on each plot, and this line extends beyond the southern Mine site boundary (beyond receptor B1) for annual mean concentrations of nitrogen dioxide. There are no receptors located within the area between the Mine site boundary and the position of the 10 µg/m$^3$ line on the plots for nitrogen dioxide impacts. The magnitude of the impact on annual mean concentrations of nitrogen dioxide at all receptors will be less than 25% of the EAL which represents an impact of medium magnitude. The magnitude of the impact on annual mean concentrations of particulate matter at all receptors will be less than 10% of the EAL which represents an impact of low magnitude. As the background concentration is so low, an impact of medium to low magnitude would have a negligible effect at the accommodation camp or at all off site receptors including the small semi-permanent communities at Emkebden, Guelb Dawass and Ntalve.

The predicted process contribution to hourly mean concentrations of nitrogen dioxide is illustrated in Figure 7-13 for the power plant using the new engines and phase 1b engines at full continuous load. The maximum predicted impacts will occur within the Mine site close to the power plant (R5). The area defined by the 200 µg/m$^3$ line on the plot, represents the one hour mean EAL value for nitrogen dioxide. The impact will be less than the EAL value at the accommodation camp and all receptors without any abatement to reduce the magnitude of emissions of NOx prior to their release into the atmosphere.
At the accommodation camp the predicted impact on 24 hour mean concentrations of sulphur dioxide are predicted to be up to 32 µg/m³ for the reciprocating engine technology option. This is approximately 25% of the EAL value and is described as being an impact of high magnitude. The total concentration calculated by adding the process contribution (31 µg/m³) and the baseline value (31 µg/m³) is 62 µg/m³ and 50% of the EAL value of 125 µg/m³. Where the ambient concentration is predicted to be less than 75% of the EAL value, a high magnitude impact represents an effect of low significance (see Table 7-4).

At southern and western boundary of the Mine site impacts are greater than at the accommodation camp and are described as medium close to receptors B1 and B2. However, at no permanent sensitive receptor located beyond the Mine site is an ambient concentration of more than the EAL predicted to occur. The EAL values have been set at a value that represents air of good quality, so it can be concluded with confidence that air would remain of good quality with the operation of the power plant as a combined cycle system. At off-site receptors the significance of the effect of the predicted impacts ranges from Moderate to Low, with effects of low to negligible significance predicted at locations to the north and north west of the Mine site boundary.

The impacts from the operation of the new power plant would be limited to the operational phase and are therefore medium term in duration. Air pollution will return to baseline levels when the power plant is taken out of service. The significance of the effect resulting from the impact on concentrations of each air pollutant is summarised in Table 7-20.

### Table 7-19: Magnitude of Reciprocating Engine Power Plant Emissions Impacts - HFO Fuel

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Annual Mean NO₂ (µg/m³)</th>
<th>Hourly Mean NO₂ (µg/m³)</th>
<th>Annual Mean PM₁₀ (µg/m³)</th>
<th>24 Hour Mean PM₁₀ (µg/m³)</th>
<th>24 Hour Mean SO₂ (µg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>2.6 (L)</td>
<td>168.3 (H)</td>
<td>1.1 (L)</td>
<td>1.7 (L)</td>
<td>27.1 (M)</td>
</tr>
<tr>
<td>R2</td>
<td>2.3 (L)</td>
<td>155.4 (H)</td>
<td>0.9 (L)</td>
<td>1.4 (L)</td>
<td>28.7 (M)</td>
</tr>
<tr>
<td>R3</td>
<td>2.7 (L)</td>
<td>180.3 (H)</td>
<td>1.2 (L)</td>
<td>1.6 (L)</td>
<td>31.8 (H)</td>
</tr>
<tr>
<td>R4*</td>
<td>2.1 (L)*</td>
<td>153.9 (H)*</td>
<td>0.9 (L)*</td>
<td>1.1 (L)*</td>
<td>26.3 (M)*</td>
</tr>
<tr>
<td>R5*</td>
<td>31.6 (H)*</td>
<td>528.9 (H)*</td>
<td>19.4 (H)*</td>
<td>49.1 (H)*</td>
<td>123.1 (H)*</td>
</tr>
<tr>
<td>B1</td>
<td>9.1 (M)</td>
<td>145.0 (H)</td>
<td>2.2 (L)</td>
<td>6.2 (M)</td>
<td>27.6 (M)</td>
</tr>
<tr>
<td>B2</td>
<td>5.2 (M)</td>
<td>218.1 (H)</td>
<td>1.7 (L)</td>
<td>4.0 (M)</td>
<td>35.7 (M)</td>
</tr>
<tr>
<td>B3</td>
<td>1.2 (L)</td>
<td>47.1 (M)</td>
<td>0.3 (L)</td>
<td>0.8 (L)</td>
<td>8.4 (L)</td>
</tr>
<tr>
<td>B4</td>
<td>0.9 (L)</td>
<td>35.6 (M)</td>
<td>0.3 (L)</td>
<td>0.6 (L)</td>
<td>8.0 (L)</td>
</tr>
<tr>
<td>Assessment Criteria</td>
<td>40</td>
<td>200</td>
<td>40</td>
<td>50</td>
<td>125</td>
</tr>
</tbody>
</table>

Magnitude of impact descriptors reported in parentheses: High (H); Medium (M) or Low (L).

* Receptor represents impacts at a workplace location and environmental assessment criteria do not apply.
Table 7-20: Summary of predicted residual impacts for Operational Phase Reciprocating Engine Option Scenario

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Fuel</th>
<th>Location of Impacts</th>
<th>Magnitude of Process Contribution</th>
<th>Duration</th>
<th>Environmental Concentration as % of EAL</th>
<th>Significance of Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen Dioxide (NO$_2$)</td>
<td>HFO</td>
<td>Accommodation Camp</td>
<td>High/Medium/Low</td>
<td>Medium-term</td>
<td>75 - 100%</td>
<td>Moderate to Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Off Site Receptors</td>
<td>High/Medium/Low</td>
<td>Medium-term</td>
<td>&lt; 75%</td>
<td>Low</td>
</tr>
<tr>
<td>Sulphur Dioxide (SO$_2$)</td>
<td>HFO</td>
<td>Accommodation Camp</td>
<td>Medium</td>
<td>Medium-term</td>
<td>&lt; 75%</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Off Site Receptors</td>
<td>Medium/Low</td>
<td>Medium-term</td>
<td>&lt; 75%</td>
<td>Low</td>
</tr>
<tr>
<td>Particulate Matter (PM$<em>{10}$ and PM$</em>{2.5}$)</td>
<td>HFO</td>
<td>Accommodation Camp</td>
<td>Low</td>
<td>Medium-term</td>
<td>&gt; 100%$^4$</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Off Site Receptors</td>
<td>Medium/Low</td>
<td>Medium-term</td>
<td>&gt; 100%$^4$</td>
<td>Moderate to Low</td>
</tr>
</tbody>
</table>

1Following implementation of incorporated Mitigation Measures
2Fuel: HFO = Heavy Fuel Oil.
3Relates to the frequency of episodes of 24 hour mean concentrations of sulphur dioxide that are greater than the limit value, during a calendar year period.
4Available evidence (Ozer, 2006) indicates that natural processes result in ambient concentrations of PM$_{10}$ that are greater than the EAL value.

7.4.2.2 Power Plant Summary

The magnitude of the process contribution to long term (annual mean) concentrations of nitrogen dioxide and particulate matter would be low in magnitude at sensitive receptors, as a result of the use of modern technology and an appropriate stack height, for each of the technology options under consideration. These emissions would not significantly affect the future achievement of the EAL values at any receptor and would be described as negligible if it were not for the risk that baseline concentrations of particulate matter are already at or above the EAL value. The magnitude of the predicted impact on short term (1 hour mean) concentration of nitrogen dioxide differs between the technology options, but neither option would result in receptors experiencing nitrogen dioxide at 1 hour mean concentrations above the EAL value.

The absence of permanent settlements within the area predicted to experience high to medium magnitude impacts on 24 hour mean sulphur dioxide concentrations greatly limits the potential for adverse impacts to occur. The limited potential for exposure to occur and the fact that predicted constituent concentrations are less than the EAL criteria for each constituent at sensitive receptor locations. This reduces the weight that should be given to the reported sulphur dioxide impacts in assessing the effect of the operational phase of the power plant.

A power plant can be developed that would meet the energy requirements of the Mine with impacts that are small enough to ensure that the concentration of air constituents would remain below the assessment level that has been adopted for the protection of human health, at all locations outside the Mine where people are likely to live and at the Mine’s accommodation camp.
7.4.2.3  Mine Operations

The locations of Project components referred to in this section are illustrated on Figure 3-3.

**Pit, Haul Routes and Conveyors**

The proposed mining operations include the same type of activities as are currently undertaken as part of existing mining operations and which currently generate emissions of dust or gaseous constituents. The expanded Mine has the potential to emit these substances over a longer period of time, from some different locations, and to generate more emissions at some locations. The only sensitive receptor located on-site remains the accommodation camp. The accommodation camp will be expanded as part of Phase 2, but the closest receptors (R1 to R3) remain a similar distance from mining operations as has been the case for several years.

Mine operations will create the final Expanded Open Pit progressively over the lifetime of the mine. Peak mining activity is scheduled to be in 2016 and Mine closure is scheduled for 2030. At any one time, mining activity will progress at a number of isolated faces within the pit and for the majority of the time at greater distances from the Accommodation Camp than it has for the current open pit series. The mining methods proposed remain the same as are in current use. It can reasonably be concluded that the control techniques and site management practices currently in use will continue to ensure that the magnitude of impacts at the accommodation camp remain infrequent and low in magnitude.

The use of haul routes by vehicles moving extracted material from the pit to the processing facilities, Leach Facilities or the waste rock dumps has the potential to cause dust to become airborne and travel distances in excess of 100 m under some meteorological conditions. Haul routes comprise the most spatially extensive source of dust within the Mine site. In the water-limited environment of the Mine, water intensive dust suppression methods are not a practical option, although some water is reused to suppress dust emissions. In these conditions, the principal means of minimising emissions at source is to maintain the quality of the road surface through regular maintenance and to enforce speed controls.

The inclusion of access points to the eastern and western side of the Expanded Open Pit will minimise the distances travelled by vehicles between the area of active mining and the destination for the load. The eventual construction of a land bridge across the Expanded Open Pit will act to further reduce the distances travelled. Both of these incorporated measures will reduce the potential to generate airborne dust and reduce the total magnitude of exhaust emissions from vehicles on-site.

**CIL Plant**

The primary and secondary crushing plant has been sited to the south west of the new CIL plant. This location is more than 3 km from the Accommodation Camp and the wind direction data from the Mine indicates that the wind only occasionally blows from the crushing plant towards the Accommodation Camp. This combination of factors means that impacts at the accommodation camp from crushing and milling plant emissions will be infrequent, very low in magnitude and of negligible significance. The proposed scheme includes abatement plant in the form of bag-house filters to control emissions of dust from the crushing plant.

The CIL Plant operates a wet process and as such do not represent a potential source of dust emissions. However the handling and temporary storage of crushed material does represent a potential source of dust. In particular the area regularly traversed by plant transferring material is a priority area for damping down with reclaimed water. A dome enclosure is included to minimise emissions from the stockpile.
Waste Rock Dumps

The construction of waste rock dumps has limited potential to generate emissions of dust, apart from those associated with vehicle movements along haul routes and short term emissions during material handling. As the dumps increase in size they have the potential to modify the wind flow patterns within the Mine site. The size of the Mine, the non-continuous nature of the waste rock dumps and open nature of the terrain make it unlikely that these changes will have a significant effect.

Leach Facilities

The processing of ore at the Leach Facilities requires the use of a solution containing cyanide. Some emissions of hydrogen cyanide gas are an unavoidable consequence of its use, although emissions are minimised by controlling the pH of the solution. The embedded mitigation is consistent with the principles and standards of practice set out in the International Cyanide Management Code (ICMC). In particular, the continuous monitoring of concentrations of hydrogen cyanide gas at the edge of the Leach Facility pads provides a means of triggering management actions and also provides data about the effectiveness of process management. Additional monitoring is included in the design at the cyanide process solution storage ponds. Data available for 2010/2011 at the existing dump leach facility and Ponds (see Appendix 2 Figures 2-13 and 2-14) demonstrates that the risks associated with this source are currently well managed and the health of workers is safeguarded. The application of similar controls at the new leach facilities will ensure that impacts remain low in magnitude and of negligible significance beyond the monitored boundary of the facilities and outside the perimeter fence line.

The thickened slurry from the CIL process will be treated in a Cyanide Destruction Circuit (CND) before being piped to Tailings Storage Facility 3 (TSF 3). The CND reduces the mass of cyanide in the slurry by bringing it into contact with air, lime, copper sulphate and sulphur dioxide. The incorporation of a CND will mitigate the risk of hydrogen cyanide emissions from the tailings facility during the operational lifetime of the Mine and continue to do so after closure. A by-product of the CND will be emissions of sulphur dioxide gas. The emissions will be less than 1% sulphur dioxide and the mass of the emissions will be very small compared with emissions from the nearby power plant. The sulphur dioxide emissions have the potential to have a low to moderate impacts on air quality in the immediate vicinity of the CND and the resulting effect on the Accommodation Camp or off-site receptors would be negligible.

Waste Management Facility

At the expanded waste management facility additional incineration units will be added to the units installed as part of Phase 1b of the Project. The proposed incinerators for the expanded waste management facility are 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 (i.e. Directive 2000/76/EC).

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 magnitude and the sitting of the facility will ensure that the magnitude of impacts at the accommodation camp is low in magnitude and of negligible significance.
Operational Traffic on N2 Highway and Mine Access Road

Operational fuel supplies currently come from Nouâdhibou Port, and the frequency of these supplies will increase significantly during post-construction operation. Operational equipment and materials currently come from Nouakchott Port, and the frequency of these supplies will increase during post-construction operation. Buses currently transport workers from Nouakchott to the Mine site and the frequency of these will increase during post-construction operation.

Table 7-21 shows current vehicle pass-bys (buses are included with lorries in the vehicle numbers) and peak vehicle pass-bys during post-construction operation on the N2 Highway between Nouâdhibou and the Mine access road, on the N2 Highway between Nouakchott and the Mine access road, and on the Mine access road itself. The contribution of vehicle exhaust emissions to ambient concentrations of constituents has been estimated at a distance of 10m from the carriageway. Estimates are based on the assumption of vehicles with EURO I engine specifications or older vehicles being used and impacts will be less if more modern vehicles are used.

Table 7-21: Impact of Vehicle Exhaust Emissions on Annual Mean Concentrations of Nitrogen Dioxide and PM$_{10}$ (Post-Construction Operation)

<table>
<thead>
<tr>
<th>Road Link</th>
<th>Number of Vehicle Pass-Bys / Day</th>
<th>Contribution to Ambient Concentration of NO$_2$ ($\mu$g/m$^3$)</th>
<th>Contribution to Ambient Concentration of PM$_{10}$ ($\mu$g/m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Current Operation</td>
<td>Future Operation</td>
<td>Current Operation</td>
</tr>
<tr>
<td>N2 Highway: Nouâdhibou to Mine Access Road</td>
<td>12</td>
<td>84</td>
<td>0.4</td>
</tr>
<tr>
<td>N2 Highway: Nouakchott to Mine Access Road</td>
<td>16</td>
<td>96</td>
<td>0.4</td>
</tr>
<tr>
<td>Mine Access Road</td>
<td>28</td>
<td>180</td>
<td>1.0</td>
</tr>
</tbody>
</table>

For locations situated at a distance of 10 m or locations situated at a distance of 10 m or more from edge of the N2 highway between Nouâdhibou or Nouakchott and the Mine access road, the increase in vehicle movements will result in an increase in annual mean concentrations of nitrogen dioxide of 3 $\mu$g/m$^3$ or less. The corresponding increase in exposure to PM$_{10}$ from vehicle exhaust emissions will be < 1 $\mu$g/m$^3$. The significance of this increase is assessed as negligible/low adverse.

For locations situated at a distance of 10 m or more from the edge of the Mine access road, the increase in vehicle movements will result in an increase in annual mean concentrations of nitrogen dioxide of 4 $\mu$g/m$^3$. The corresponding increase in exposure to PM$_{10}$ from vehicle exhaust emissions will be < 1 $\mu$g/m$^3$. The significance of this increase is assessed as negligible/low adverse.

During the operation of Phase 2, the N2 will be paved and the Mine access road will be hard surfaced. The regular movements of vehicles and other vehicles along these routes restricts the accumulation of dusty material on the road surface and dwellings will be exposed to much smaller impacts of re-suspended dust than they would experience next to the existing (unsurfaced) Mine access road.
7.4.3 Closure

Closure will involve comparable activities to those employed in the construction of Phase 1 and Phase 2, in particular earthmoving works and plant and building demolition and removal. Air quality impacts will be less than those for the construction phases.

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 is likely to be much reduced from operational numbers. Hence, the significance of these impacts during closure will be less than during construction and operation.

7.4.3.1 Tailings Storage Facilities

In the 2022 assessment scenario, it is assumed that TSF 1 will be closed, TSF 2 will be non-operational and TSF 3 will be receiving material. At this time the potential for windblown dust from the TSFs is at a maximum and the potential will be less than this following the closure and capping of all of the TSFs. Under these conditions the largest potential source of material available to become windblown dust would be from recently applied material at TSF 3 and not from the material previously incorporated into the TSFs.

The capping of the TSF 3 will ensure its integrity as required by the ICMC, and will prevent dust emissions during the post closure phase. The reduction of the mass concentration of cyanide in the TSF 3 is consistent with international best practice. The long term effect of emissions of windblown dust and hydrogen cyanide gas from the TSF following closure is considered to be negligible if best practicable means are applied as proposed.

7.5 Mitigation Measures

7.5.1 Construction

No additional mitigation measures are considered necessary beyond those already incorporated/embedded in the proposed scheme and the existing provisions for environmental management.

7.5.2 Operation

The Environmental Management Plan sets out the approach to controlling air quality and dust emissions and exposure at the Mine site, and will incorporate an Air Emissions Management Plan. The EMP also defines the procedures for the monitoring, control and the use of a cyanide destruction circuit to reduce the potential for emissions of hydrogen cyanide gas. The effectiveness of both physical abatement measures and management controls for the mitigation of air quality impacts should be reviewed on a regular basis depending upon the parameter being measured.

To ensure that continued protection is provided to receptors and the wider environment, monitoring of emissions at source should be undertaken to recognised standard methods for the parameters set out in Table 7-22.
## Table 7-22: Recommended Monitoring

<table>
<thead>
<tr>
<th>Monitoring Locations</th>
<th>Parameters</th>
</tr>
</thead>
</table>
| Representative locations around Mine site including accommodation camp, office complex, power plant. Incinerator at Waste Management Facility | • NO₂, NOₓ, SOₓ, Ozone & Acid Gases; emissions performance; fuel consumption including quality.  
• Performance against Air Emission Management Plan  
• Deposited particulate matter and airborne concentrations of TSP (total suspended particulate) and PM₁₀ at locations upwind and downwind of the mine. |
| Power plant         | • Measurements at source to a recognised standard method, to demonstrate achievement of Emissions Limits set out in IFC Guidelines for NOₓ, SO₂, PM₁₀ and CO  
• Recording of fuel quality and fuel consumption to demonstrate consistency with IFC Guidelines |
| Incinerators at Waste Management Facility | • Measurements at source to a recognised standard method, to demonstrate achievement of Emissions Limits for pollutants as set out in EU Waste Incineration Directive |
| Crushing Plants     | • Measurements at source for PM₁₀ to a recognised standard method, to confirm performance to design criteria is achieved |
| CIL plant, dump leach facility and heap leach facility | • Measurements of concentrations in non-confined workplaces in-line with requirements of ICMC |
| TSFs, leach facility, Crusher, Open Pit, Haul roads and waste rock dumps | Visual assessment of dust concentrations supported by quantitative monitoring using fixed or handheld device. |

Monitoring of ambient concentrations of nitrogen dioxide, ozone, sulphur dioxide and particulate matter should be continued at appropriate locations within the Mine site.

### 7.5.3 Closure

As part of the Mine closure plan, TMLSA should develop a plan for occasional inspections of the integrity of the tailings storage facilities to confirm the potential for emissions of particulate matter and hydrogen cyanide gas.

### 7.6 Cumulative Impacts

The assessment for Phase 2 presented here includes the operation of the Phase 1a and 1b components. Thus, the assessment is inherently cumulative in that it provides an assessment of the total impacts for the construction and development phases.

### 7.7 Evaluation of Mitigated Impacts

#### 7.7.1 Construction

The implementation of standard control measures, which will reduce emissions of particulates at source, will ensure that any effects associated with the construction Phase of 2 will have a negligible impact on air quality.

The new power plant will exceed the IFC NOₓ emissions standards during the initial commissioning phase, pending completion of the power plant and activation of the combined cycle system. However, this exceedance is justified as it is a) a short-term variance only, and b)
our predictions show that there is no significant risk to human health or the environment during the period when NOx emissions exceed the IFC standard.

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

### 7.7.2 Operational

The careful siting of the proposed elements of Phase 2 and the implementation of standard control measures, where applicable, will assist in reducing any effects during the operation of the phase so that any impacts at sensitive receptors (including the accommodation camp) are low to negligible.

The volume of vehicle movements required to support the operational activity of the Mine would have a negligible effect on local air quality at receptors located close to the route of operational phase deliveries.

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. Following closure impacts on the wider environment are likely to low in magnitude.

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 2 following the implementation of mitigation measures with respect to air quality are presented in Table 7-23.
Table 7-23: Summary of potential residual impacts\(^1\) - Air Quality

<table>
<thead>
<tr>
<th>Location</th>
<th>Nature of Impacts</th>
<th>Mitigation Measure</th>
<th>Project Phase(^2)</th>
<th>Nature</th>
<th>Duration</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mine site</td>
<td>Construction Dust</td>
<td>Best Practicable Means</td>
<td>C</td>
<td>Adverse</td>
<td>Short Term</td>
<td>Negligible</td>
</tr>
<tr>
<td></td>
<td>Power Plant Emissions</td>
<td>Best Practicable Means</td>
<td>C</td>
<td>Adverse</td>
<td>Short Term</td>
<td>Negligible</td>
</tr>
<tr>
<td>Off-site Roads</td>
<td>Construction Traffic</td>
<td>Scheduling, use of hard surfaced roads</td>
<td>C</td>
<td>Adverse</td>
<td>Short Term</td>
<td>Negligible</td>
</tr>
<tr>
<td></td>
<td>Emissions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mine site</td>
<td>Dust from Mine operations</td>
<td>Control Techniques and Site Management Practices</td>
<td>O</td>
<td>Adverse</td>
<td>Medium Term</td>
<td>Low/Negligible</td>
</tr>
<tr>
<td></td>
<td>Waste Management Plant</td>
<td>Control Techniques and Site Management Practices</td>
<td>O</td>
<td>Adverse</td>
<td>Medium Term</td>
<td>Negligible</td>
</tr>
<tr>
<td></td>
<td>Plant Emissions</td>
<td>Control Techniques and Site Management Practices</td>
<td>O</td>
<td>Adverse</td>
<td>Medium Term</td>
<td>Moderate/Low</td>
</tr>
<tr>
<td>Off-site Roads</td>
<td>Operational Traffic</td>
<td>Scheduling, use of hard surfaced roads</td>
<td>O</td>
<td>Adverse</td>
<td>Medium Term</td>
<td>Negligible</td>
</tr>
<tr>
<td></td>
<td>Emissions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mine site</td>
<td>HCN gas emissions</td>
<td>Control Techniques and Site Management Practices</td>
<td>O</td>
<td>Adverse</td>
<td>Medium Term</td>
<td>Low/Negligible</td>
</tr>
<tr>
<td></td>
<td>Windblown Dust for TSFs</td>
<td>Best Practicable Means</td>
<td>D</td>
<td>Adverse</td>
<td>Long Term</td>
<td>Negligible</td>
</tr>
<tr>
<td></td>
<td>HCN gas emissions from</td>
<td>Best Practicable Means</td>
<td>D</td>
<td>Adverse</td>
<td>Long Term</td>
<td>Negligible</td>
</tr>
<tr>
<td></td>
<td>TSFs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^1\)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 Section 5.
8 Noise and Vibration

This Section presents the methodology, baseline conditions and calculations employed to assess the potential impacts of noise and vibration resulting from implementing Phase 2. In addition mitigation measures which aim to reduce, remediate or avoid potential impacts are proposed and the residual impacts (impacts after mitigation measures are implemented) assessed.

The scope of the assessment covers:

- Baseline conditions;
- Construction noise and vibration impacts (including construction traffic);
- Operational noise and vibration impacts (including; open pit works (drilling, blasting and loading operations), Mine haul roads; fixed plant; and
- Operational traffic on public roads and on the Mine access road).

There will be intermittent vibration impacts resulting from blasting and continuous vibration impacts resulting from fixed plant such as crushers.

8.1 Methodology

As referred to in Section 2, this assessment takes into consideration national legislation, international guidance and Kinross standards, such as Mauritanian Decree 2000-045, International Finance Corporation (IFC) General Environmental Health and Safety (EHS) Guidelines and Kinross Standard 10.1 - Occupational Health and Safety Operational Controls.

8.1.1 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’. BS 5228 is the industry standard in the UK for the estimation of noise levels from construction sites, waste sites, opencast coal sites and hard rock quarries.

BS 5228 provides a methodology for the prediction of noise levels and takes into account the following:

- The noise generated by fixed and mobile plant or equipment used on-site, including vehicles on haul roads, generally expressed as sound power levels ($L_{WA}$);
- 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 and barrier effects; and
- The reflection of noise due to the presence of hard surfaces such as the sides of buildings.

BS 5228 also provides a database of sound power levels for plant and site activities, which covers construction sites, waste sites, opencast coal mines and hard rock quarries.

Specific details of construction works were not available at the time of writing and therefore representative construction activities have been assumed using experience of similar projects/constructions.
Sound power level data for the assumed plant and construction activities have been sourced from BS 5228.

Construction noise levels have been assessed against the parameters specified in the International Finance Corporation (IFC) General Environmental Health and Safety (EHS) Guidelines provided in Table 8-1.

### 8.1.2 Operation

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

An assessment of the operation of the Phase 2 infrastructure has been carried out, based on the proposed operations, equipment to be employed and representative noise emission levels, the locations of sensitive receptors and the existing noise climate.

Sound power level data for mobile plant and fixed plant have been sourced from data provided for similar mining operations and from BS 5228 (see Appendix 3). Operational noise levels have been calculated using the methodology provided in ISO 9613-2: 1996 ‘Attenuation of Sound During Propagation Outdoors’. ISO 9613-2 specifies an engineering method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources. The sources may be moving or stationary. Specific algorithms are provided in the methodology for the following physical effects:

- Geometrical divergence;
- Atmospheric absorption;
- Ground effects;
- Screening by obstacles; and
- Reflection from surfaces.

The method is applicable to a great variety of noise sources, including road and rail sources, industrial noise sources, construction activities and many other ground-based noise sources.

Models of the existing mining operations and the operations for two future years (2016 and 2022) have been developed in SoundPLAN, a commercial software package which implements a range of prediction methodologies including the ISO 9613-2 methodology.

The software enables the development of complex three-dimensional models of the Mine site and surroundings, including the excavated pit and the waste rock dumps. Noise sources can be defined as point sources, line sources, area sources, moving point sources on a defined route (e.g. trucks on a haul road) or as buildings with defined internal noise levels and wall and roof sound insulation values. The models include imported base mapping and existing and proposed site layouts, enabling the precise location (including height above ground) of all noise sources.

The two future years have been selected on the basis that the tonnage of mined material will peak in 2016 and on-site vehicle movements will peak in 2022.
The models take into account:

- Ground topography (including the proposed Mine excavations, processing and waste dumps);
- Mobile plant noise sources;
- Fixed plant (process plant, conveyors);
- Trucks on haul roads;
- Shielding effects of ground features; and
- Air absorption

The models have been employed to calculate noise level contours and noise level difference contours for the existing and future scenarios across the Mine site out to the site boundary. The calculated noise levels are provided as $L_{Aeq,1\ hour}$ values for a worst-case hour assuming all plant is operational. Appendix 3

Operational noise levels have also been assessed against the IFC General EHS Guidelines provided in Table 8-1.

### 8.1.3 Closure

Closure will involve comparable activities to some of those employed in the construction and operation of the Project, in particular earthmoving works and removal of steelwork.

A qualitative assessment of noise and vibration impacts during closure has been carried out based on the results of the Phase 2 construction and operation activities. Activities during closure will be comparable to some of those pertaining during construction and operation.

### 8.1.4 Assessment of Significance

Articles 72, 73 and 74 of the Framework Law on the Environment (Islamic Republic of Mauritania, Decree No. 2000-045) relate to noise and vibration.

Article 72 states “The production of noise of an intensity exceeding the thresholds set by the legal or regulatory standards is prohibited”.

Article 73 states “Public or private establishments, facilities, edifices, buildings, structures, worksites, equipment, vehicles and appliances are constructed, equipped, operated, used and maintained in such a way as to eliminate or reduce noise and vibrations that cause…………or are likely, due to their intensity, to inconvenience the neighbourhood or harm or affect the quality of the environment, in accordance with the texts in force”.

Article 74 states “The provisions made in application of this law determine the regulatory noise or vibration intensity thresholds that are not to be exceeded and provide for measurement systems and monitoring methods to be implemented in order to ensure compliance with the admissible thresholds”.

No quantitative noise limits or thresholds are provided in the Mauritanian legislation.

The IFC’s General EHS Guidelines provide guidance on acceptable noise levels to residential and other sensitive receptors. The values used by the IFC are based upon the Guidelines for Community Noise, issued by the World Health Organisation (WHO) in 1999. Table 8-1 presents these noise levels.
Table 8-1: IFC Noise Level Guidelines

<table>
<thead>
<tr>
<th>Receptor</th>
<th>One Hour L_{Aeq} (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daytime (07:00 to 22:00)</td>
</tr>
<tr>
<td>Residential; Institutional; Educational</td>
<td>55 (free-field)</td>
</tr>
<tr>
<td>Industrial; Commercial</td>
<td>70 (free-field)</td>
</tr>
</tbody>
</table>

The daytime limit of 55 dB L_{Aeq,1h} is a free-field level (58 dB L_{Aeq,1h} at the façade). The night time limit of 45 dB L_{Aeq,1h} is a façade level, meaning the noise level at the wall of a property (e.g. just outside a bedroom window). A façade noise level of 45 dB L_{Aeq} is equivalent to an internal noise level of approximately 30 dB L_{Aeq}, assuming small open areas to the building. This would ensure no disturbance to sleep.

The Mine operates 24 hrs/day and workers will be resting and sleeping during day time and night time. Therefore the 45 dB L_{Aeq} limit applies for day time and night time at the accommodation camp. However, it is understood that the accommodation blocks will be air conditioned (to provide acceptable internal conditions and keep out windblown sand), negating the need for open windows. The façades of the existing and proposed accommodation (including windows) should provide a noise reduction (outside to inside) of approximately 30 dB(A). Therefore, an external free-field noise level of 60 dB L_{Aeq} would allow for a good internal noise climate of 30 dB L_{Aeq}.

BS 8233:1999 ‘Sound Insulation and Noise Reduction for Buildings – Code of Practice’ provides acceptable internal noise levels for office accommodation. An internal level of 40 dB L_{Aeq} is considered good and an internal level of 50 dB L_{Aeq} is considered reasonable. The façades of the existing and proposed offices (including windows) should provide a noise reduction (outside to inside) of approximately 30 dB(A). Therefore, an external free-field noise level of 70 dB(A) would allow for a good internal noise climate. Thus, the day time and night time noise limit of 70 dB L_{Aeq} for commercial receptors in Table 8-1 is applicable for office accommodation on the Mine site.

Where noise levels resulting from construction or operational activities exceed the limits provided in Table 8-1, a significance of effect is assigned based on the increase in noise level and the matrix provided in Table 8-2.

Table 8-2: Significance of Noise Impacts

<table>
<thead>
<tr>
<th>Receptor Sensitivity</th>
<th>Impact Magnitude</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High (&gt; 10 dB(A))</td>
</tr>
<tr>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Medium</td>
<td>Moderate</td>
</tr>
<tr>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

In line with Table 8-2, construction noise impacts are classified as short term (persist for 36 months or less) and operational noise impacts are classified as medium term (persist for...
between 36 months and approximately 16 years (the anticipated life of the mine). There will be no long term noise impacts that persist longer than 16 years (post closure).

The IFC’s EHS Guidelines for Mining state that noise levels at the nearest sensitive receptors should meet the noise guidelines in the IFC’s General EHS Guidelines. With respect to vibration the Guidelines state that significant sources of vibration should be minimised, for example through adequate design of crusher foundations.

For blasting related emissions (ground borne vibration, air overpressure) the Guidelines recommend a range of management practices to minimise these.

8.2 Baseline Conditions

The Mine site 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.

A site visit, in February 2011, confirmed that noise levels at the accommodation camp resulting from existing mining operations (blasting, excavation, haulage, processing) are negligible. Limited, short duration vibration effects resulting from blasting can be experienced at the accommodation camp, depending on blast location and blast size.

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

8.2.1 Sensitive Receptors

The sensitive receptors are:

1) The workers located at the Mine site itself including those involved in mining and processing, as well as infrastructure and administrative personnel;

2) There is an existing accommodation camp located to the east of the open pit. A new accommodation camp is to be constructed, also to the east of the open pit and proximal to the existing camp;

3) Further potential sensitive receptors are three communities located within 30 km of the Mine site. These are:
   - Guelb Dawass, located to the north east of the Mine site;
   - Emkebden, located to the south west of the Mine site; and
   - Ntalve, located at a significantly greater distance to the north of the Mine site.

These three communities are shown in Figure 11-2.

4) A small settlement is located at the junction of the access road with the Nouakchott–Nouâdhibou N2 highway, approximately 50 km from the Mine and 1 km from the existing borefield. This will not be affected by on-site activities but will be affected by noise from increased traffic during both construction and operation of Phase 2.
8.3 Potential Impacts

8.3.1 Construction

Construction noise levels have been predicted for a range of distances from typical construction activities associated with the Phase 2 Project components.

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

The following construction activities have been assumed during the Phase 2 construction works:

- Site clearance and earthworks;
- Excavations and foundations;
- Slab construction;
- Steelwork construction;
- Finishing and fitting; and
- Road construction

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 Appendix 3, Table 1. Sound power levels for each item of plant have been sourced from BS 5228.

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

Table 8-3: Predicted Façade Noise Levels

<table>
<thead>
<tr>
<th>Distance (m)</th>
<th>Site Clearance</th>
<th>Earthworks</th>
<th>Excavations and Foundations</th>
<th>Slab Construction</th>
<th>Steelwork Construction</th>
<th>Finishing and Fitting</th>
<th>Road Construction</th>
<th>Aggregates crusher</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>76</td>
<td>76</td>
<td>77</td>
<td>74</td>
<td>78</td>
<td>76</td>
<td>72</td>
<td>77</td>
</tr>
<tr>
<td>100</td>
<td>72</td>
<td>71</td>
<td>73</td>
<td>68</td>
<td>72</td>
<td>70</td>
<td>67</td>
<td>71</td>
</tr>
<tr>
<td>150</td>
<td>68</td>
<td>68</td>
<td>68</td>
<td>65</td>
<td>69</td>
<td>67</td>
<td>64</td>
<td>68</td>
</tr>
<tr>
<td>200</td>
<td>66</td>
<td>65</td>
<td>65</td>
<td>62</td>
<td>66</td>
<td>64</td>
<td>61</td>
<td>65</td>
</tr>
<tr>
<td>300</td>
<td>62</td>
<td>62</td>
<td>62</td>
<td>59</td>
<td>63</td>
<td>61</td>
<td>58</td>
<td>62</td>
</tr>
<tr>
<td>400</td>
<td>60</td>
<td>59</td>
<td>62</td>
<td>59</td>
<td>61</td>
<td>58</td>
<td>55</td>
<td>59</td>
</tr>
<tr>
<td>500</td>
<td>58</td>
<td>57</td>
<td>59</td>
<td>52</td>
<td>58</td>
<td>56</td>
<td>54</td>
<td>57</td>
</tr>
</tbody>
</table>
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.

Noise levels resulting from the construction of the various Phase 2 components are provided in the following sections. Locations for each component are shown in Figure 3.3.

8.3.1.1 Carbon-In-Leach (CIL) Process Plant

Construction activities associated with the erection of the CIL Process Plant will be earthworks, excavation, concrete slab and steelwork construction. The nearest sensitive receptors to the new CIL process plant are the proposed office facilities. These are located approximately 380 m to the west of the processing plant. Noise levels from the construction of the proposed process plant at these offices, if in use while the process plant is being constructed, are likely to be in the region of 55 to 63 dB $L_{A_{eq,1h}}$. Internal noise levels, assuming the façade will provide 30 dB(A) attenuation, will be between 25 to 33 dB $L_{A_{eq}}$. These predicted internal noise levels meet the BS 8233 guideline levels for offices. As external noise levels are below the 70 dB $L_{A_{eq}}$ limit for offices, the significance of the effect is assessed as negligible.

The nearest residential receptors (at the existing accommodation camp) are located approximately 4,000 m from the new process plant and therefore noise levels from its construction will be below 40 dB $L_{A_{eq,1h}}$, with internal noise levels falling below 10 dB $L_{A_{eq,1h}}$. These construction activities are therefore likely to be inaudible. As external noise levels are below the 45 dB $L_{A_{eq}}$ limit for rooms to be used for resting and sleeping, the significance of the effect is assessed as negligible.

8.3.1.2 Fuel Farm and Fuel Storage

Construction activities associated with the construction of the proposed fuel farm and fuel storage area are assumed to be earthworks, excavation, slab and steelwork construction. The nearest offices to the proposed fuel farm are located approximately 290 m away to the south.
west (construction office), therefore unmitigated noise levels from its construction are predicted to be in the region of 59 to 66 dB $L_{Aeq,1h}$. This results in internal noise levels of 36 dB $L_{Aeq,1h}$, which meets the BS 8233 guideline levels for offices. As external noise levels are below the 70 dB $L_{Aeq}$ limit for offices, the significance of the effect is assessed as negligible.

The nearest residential areas to the location of the proposed fuel farm are located approximately 4,500 m away, therefore unmitigated noise levels from these construction activities are predicted to be no greater than 40 dB $L_{Aeq,1h}$. This results in internal noise levels of less than 10 dB $L_{Aeq,1h}$. These construction activities are therefore likely to be inaudible. As external noise levels are below the 45 dB $L_{Aeq}$ limit for rooms to be used for resting and sleeping, the significance of the effect is assessed as negligible.

8.3.1.3 Offices, Workshops and Warehouses

The new warehouse facilities are to be located approximately 600 m to the south of the proposed general offices, and next to the construction offices, however it has been assumed that the construction offices, workshop and the warehouses will be constructed at the same time and therefore the construction offices will not be occupied. Noise levels at the general offices, if occupied before the construction offices, workshop and warehouses facilities are built, are likely to experience external noise levels in the region of 50 to 59 dB $L_{Aeq,1h}$, resulting in internal noise levels of between 17-28 dB $L_{Aeq,1h}$, meeting the BS 8233 internal noise levels criteria for offices. As external noise levels are below the 70 dB $L_{Aeq}$ limit for offices, the significance of the effect is assessed as negligible.

The nearest residential areas to the construction offices, workshops and warehouses are located more than 5,000 m away, therefore unmitigated noise levels from these construction activities are predicted to be no greater than 38 dB $L_{Aeq,1h}$. These construction activities are therefore will be inaudible. As external noise levels are below the 45 dB $L_{Aeq}$ limit for rooms to be used for resting and sleeping, the significance of the effect is assessed as negligible.

8.3.1.4 Power Plant

Construction activities associated with the construction of the proposed power plant area are assumed to be the erection of steelwork and the finishing and installation of plant. The nearest offices to the proposed power plant are located approximately 250 m away to the north (general office), therefore unmitigated noise levels from its construction are predicted to be in the region of 61 to 66 dB $L_{Aeq,1h}$. This results in an internal noise level of 36 dB $L_{Aeq,1h}$, which meets the BS 8233 internal noise levels criteria for offices. As external noise levels are below the 70 dB $L_{Aeq}$ limit for offices, the significance of the effect is assessed as negligible.

The accommodation area is located approximately 4,400 m away, therefore unmitigated noise levels from these construction activities are predicted to be no greater than 38 dB $L_{Aeq,1h}$. This results in internal noise levels of less than 10 dB $L_{Aeq,1h}$. These construction activities are therefore likely to be inaudible. As external noise levels are below the 45 dB $L_{Aeq}$ limit for rooms to be used for resting and sleeping, the significance of the effect is assessed as negligible.

8.3.1.5 Access Roads

Predicted noise levels at the nearest offices to road construction activities will be in the region of 72 to 75 dB $L_{Aeq,1h}$, resulting in temporary internal noise levels of 42 to 45 dB $L_{Aeq,1h}$. This exceeds the “good” internal noise level criterion for offices, but is below the “reasonable”
criterion. However, it is likely that access roads will be constructed before the offices will be occupied, therefore there is unlikely to be any impacts upon sensitive receptors during their construction.

At the accommodation camps, the construction of access roads is assumed to be located approximately 100 m from the nearest residential building. Activities at this distance will result in temporary noise levels of up to 67 dB $L_{A\text{eq},1h}$. This results in internal noise levels of approximately 37 dB $L_{A\text{eq},1h}$ assuming closed windows. As external noise levels are greater than the 45 dB $L_{A\text{eq}}$ limit for rooms to be used for resting and sleeping, the significance of the effect is assessed as moderate, due to being temporary in nature.

8.3.1.6 Construction Traffic on N2 Highway and Mine Access Road

Equipment and materials required for construction will be transported to the Mine site from Nouâdhibou Port. Operational fuel supplies currently come from Nouâdhibou Port, and the frequency of these supplies will increase significantly during construction. Operational equipment and materials currently come from Nouakchott Port, and this will continue throughout construction. Buses currently transport workers from Nouakchott to the Mine site and the frequency of these will increase during construction.

Table 8-4 shows current truck pass-bys (buses are included with trucks in the numbers) and peak truck pass-bys during construction on the N2 highway between Nouâdhibou and the Mine access road, on the N2 highway between Nouakchott and the Mine access road, and on the Mine access road itself. Traffic data were provided in the Project descriptions and confirmed with the Project team on-site.

Table 8-4: Numbers of Truck Pass-Bys/Day (Construction)

<table>
<thead>
<tr>
<th>Road Link</th>
<th>Number of truck Pass-Bys/Day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Current Operation</td>
</tr>
<tr>
<td>N2 highway: Nouâdhibou to Mine Access Road¹</td>
<td>12</td>
</tr>
<tr>
<td>N2 highway: Nouakchott to Mine Access Road²</td>
<td>44</td>
</tr>
<tr>
<td>Mine Access Road</td>
<td>56</td>
</tr>
</tbody>
</table>

¹ Number of vehicles to transport fuel from Nouâdhibou Port to the Mine site
² Number of vehicles to transport materials, equipment and workers from Nouakchott to the Mine site

Dwellings along the N2 highway between Nouâdhibou and the Mine access road will experience an increase in noise events due to truck pass-bys, from one per hour to seven per hour (assuming trucks operate 12 hrs/day). The significance of this increase is assessed as low adverse.

Dwellings along the N2 highway between Nouakchott and the Mine access road will experience a less substantial increase in noise events due to truck pass-bys, from just less than four per hour to just over eight per hour (assuming trucks operate 12 hrs/day). The significance of this increase is assessed as negligible/low adverse.

The contractor’s camp, located outside the fence line adjacent to the access road, will experience an increase in noise events due to truck pass-bys, from just under five per hour to just fewer than 16 per hour (assuming trucks operate 12 hrs/day). The significance of this increase is assessed as low adverse.
8.3.1.7 Summary

Generally, noise impacts upon sensitive receptors, resulting from construction of Phase 2 Project components are assessed as being within IFC guidelines and therefore are of negligible to low significance.

For most of the construction period, noise levels will be significantly lower than those given in Table 8-3 above, with high noise levels for short periods only.

8.3.2 Operation

Assumed fixed and mobile plant for the existing scenario, the 2016 scenario and the 2022 scenario are provided in Appendix 3, Table 2. Sound power level data for each item of plant have been sourced from URS data for similar installations and from BS 5228.

Generally, excavation and processing operations will result in relatively continuous noise across the Mine site, with intermittent noise events at particular receptors due to truck pass-bys.

The results from the operational noise models have been processed to provide $L_{Aeq,1\text{ hour}}$ noise level contours across the Mine site for the following scenarios:

- Existing Scenario;
- 2016 Scenario; and
- 2022 Scenario.

The results have also been processed to provide the following noise level difference contours:

- 2016 minus Existing; and
- 2022 minus Existing.

Figure 8-1 shows the calculated noise level contours (at a height of 2 m above ground level) across the Mine site for the Existing Scenario.

Figure 8-2 shows the calculated noise level contours (at a height of 2 m above ground level) across the Mine site for the 2016 Scenario.

Figure 8-3 shows the calculated noise level contours (at a height of 2 m above ground level) across the Mine site for the 2022 Scenario.

Figure 8-4 shows the calculated noise level difference contours (2016 Scenario minus Existing Scenario). The northern half of the Mine site generally experiences noise level increases of less than 10 dB(A). The southern half of the Mine site, where there is minimal activity for the Existing Scenario, experiences higher noise level increases which reflect the proposed activity in the expanded open pit and on the proposed waste rock dumps.

Figure 8-5 shows the calculated noise level difference contours (2022 Scenario minus Existing Scenario). The northern half of the Mine site generally experiences noise level increases of less than 10 dB(A). As for the 2016 Scenario, the southern half of the Mine site, where there is minimal activity for the Existing Scenario, experiences higher noise level increases which reflect the proposed activity in the expanded open pit and on the new waste rock dumps.

The maximum calculated free-field noise levels at on-site accommodation and office receptors, and at the fence line, are provided in Table 8-5 for all three scenarios.
Table 8-5: Calculated Maximum Free-Field Operational Noise Levels

<table>
<thead>
<tr>
<th>Receptor</th>
<th>Calculated Free-Field Noise Level dB $\text{L}_{\text{Aeq,1 hour}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Existing Scenario</td>
</tr>
<tr>
<td>Existing accommodation camp</td>
<td>44</td>
</tr>
<tr>
<td>Proposed accommodation camp</td>
<td>-</td>
</tr>
<tr>
<td>Offices – existing CIL</td>
<td>74</td>
</tr>
<tr>
<td>Offices – proposed CIL</td>
<td>-</td>
</tr>
<tr>
<td>Construction offices – SW of proposed CIL</td>
<td>-</td>
</tr>
<tr>
<td>Fence line – north</td>
<td>35</td>
</tr>
<tr>
<td>Fence line – east</td>
<td>24</td>
</tr>
<tr>
<td>Fence line – south</td>
<td>&lt; 20</td>
</tr>
<tr>
<td>Fence line - west</td>
<td>24</td>
</tr>
</tbody>
</table>

The night time limit for residential receptors of 45 dB $\text{L}_{\text{Aeq,1 hour}}$ in Table 8-1 is equivalent to a free-field limit of 42 dB $\text{L}_{\text{Aeq,1 hour}}$. Inspection of the results in Table 8-5 shows that this limit is exceeded at the existing accommodation camp for both the existing scenario and for the future scenarios.

The existing accommodation camp will experience an increase of 3 dB(A) with Phase 2 in operation. With reference to the criteria in Table 8-2, the significance of this increase is assessed as low (accommodation classed as high sensitivity).

However, as discussed in Section 8.2.4, the accommodation blocks will be air conditioned (to provide acceptable internal conditions and keep out windblown sand), negating the need for open windows. The façades of the existing and proposed accommodation (including windows) should provide a noise reduction (outside to inside) of approximately 30 dB(A). Therefore, an external free-field noise level of 60 dB $\text{L}_{\text{Aeq}}$ would allow for a good internal noise climate of 30 dB $\text{L}_{\text{Aeq}}$.

Hence, with Phase 2 in operation, external noise levels will result in internal noise levels to the existing and proposed accommodation camps of less than 30 dB $\text{L}_{\text{Aeq}}$ and be acceptable.

The 70 dB $\text{L}_{\text{Aeq,1 hour}}$ limit in Table 8-1 for office accommodation is exceeded at the offices to the east of the existing CIL process plant for the existing scenario. The estimated noise level is 74 dB $\text{L}_{\text{Aeq,1 hour}}$.

These offices will experience an increase of 1 dB(A) with Phase 2 in operation in 2016. With reference to the criteria in Table 8-2, the significance of this increase is assessed as negligible (offices classed as medium sensitivity).
The existing CIL process plant will not be operational in 2022. This is reflected in the estimated noise level at the offices to the east of the existing CIL process plant, which is 52 dB L_{Aeq,1 hour}.

Assuming a noise reduction (outside to inside) of approximately 30 dB(A), the internal noise levels to these offices in 2016 will be 45 dB L_{Aeq,1 hour}, which lies between a “good” and “reasonable” internal noise climate as discussed in Section 8.1.4. This should be acceptable.

The estimated noise levels at the proposed offices to the west of the proposed CIL process plant, and at the construction offices to the south west of the CIL process plant, are substantially below the 70 dB L_{Aeq,1 hour} limit in Table 8-1 for office accommodation. Internal noise levels will be acceptable.

Noise levels at the fence line will increase as a result of the operation of Phase 2 (see Figures 8-4 and 8-5). The noise increases will vary along the fence line, being least to the north and north east and greatest to the south and south east.

The night time free-field limit of 42 dB L_{Aeq,1 hour} in Table 8-1 is not exceeded in 2016 or 2022 at the fence line.

At the community of Guelb Dawass, located to the north east of the Mine site, noise levels resulting from mining activities will increase by approximately 5 dB(A). However, the resultant noise level in 2022 will be very low at less than 30 dB(A). Additionally, prevailing background noise levels, due to wind for example, will mask noise from the Mine to a certain extent. Consequently, the effect of noise increases at Guelb Dawass resulting from mining activities is assessed as negligible.

At the community of Emkebden, noise levels resulting from mining activities will increase by approximately 10 to 15 dB(A). However, the resultant noise level in 2022 will be very low at less than 20 dB(A). Additionally, prevailing background noise levels, due to wind for example, will mask noise from the Mine. Consequently, the effect of noise increases at Emkebden resulting from mining activities is assessed as negligible.

8.3.2.1 Blasting - Ground Vibration and Air Overpressure

No predictions of vibration levels to sensitive receptors across the Mine site have been carried out. Prediction of ground borne vibration from blasting without site specific measurement data is not an accurate exercise.

Accurate prediction of air overpressure is almost impossible due to the variable effects of the prevailing weather conditions and the large distances often involved. Control of air overpressure should always be by its minimisation at source through appropriate blast design.

The Mine operator will continue to employ appropriate blast design to minimise the effects of blasting at sensitive receptors.

Sensitive receptors include the accommodation camps (high sensitivity), offices (medium sensitivity) and archaeological remains. The latter have been classified as being of low sensitivity in relation to ground borne vibration.

8.3.2.2 Operational Traffic on N2 Highway and Mine Access Road

Operational fuel supplies currently come from Nouâdhibou Port, and the frequency of these supplies will increase significantly during post-construction operation. Operational equipment and materials currently come from Nouakchott Port, and the frequency of these supplies will increase significantly during post-construction operation. Buses currently transport workers
from Nouakchott to the Mine site and the frequency of these will increase during post-construction operation.

Table 8-6 shows current truck pass-bys (buses are included with trucks in the numbers) and peak truck pass-bys during post-construction operation on the N2 highway between Nouâdhibou and the Mine access road, on the N2 highway between Nouakchott and the Mine access road, and on the Mine access road itself. Traffic data were provided in the Project descriptions and confirmed with the Project team on-site. Non-mine traffic on the N2 highway at the junction with the Mine access road was observed to be very low during two 1 hour traffic counts.

Table 8-6: Numbers of Truck Pass-Bys / Day (Post-Construction Operation)

<table>
<thead>
<tr>
<th>Road Link</th>
<th>Current Operation</th>
<th>Future Operation (Post Construction)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N2 highway: Nouâdhibou to Mine Access Road¹</td>
<td>12</td>
<td>44</td>
</tr>
<tr>
<td>N2 highway: Nouakchott to Mine Access Road²</td>
<td>44</td>
<td>96</td>
</tr>
<tr>
<td>Mine Access Road</td>
<td>56</td>
<td>144</td>
</tr>
</tbody>
</table>

¹ Number of vehicles to transport fuel from Nouâdhibou Port to the Mine site
² Number of vehicles to transport materials, equipment and workers from Nouakchott to the Mine site

Dwellings along the N2 highway between Nouâdhibou and the Mine access road will experience an increase in noise events due to truck pass-bys, from one per hour to seven per hour (assuming trucks operate 12 hrs/day). The significance of this increase is assessed as low adverse.

Dwellings along the N2 highway between Nouakchott and the Mine access road will experience an increase in noise events due to truck pass-bys, from just less than four per hour to eight per hour (assuming trucks operate 12 hrs/day). The significance of this increase is assessed as negligible/low adverse.

The contractor’s camp, located outside the fence line adjacent to the access road, will experience an increase in noise events due to truck pass-bys, from just fewer than 5 per hour to 12 per hour (assuming trucks operate 12 hrs/day). The significance of this increase is assessed as low adverse.

### 8.3.3 Closure

Closure will involve comparable activities to some of those employed in the construction and operation of the Project, in particular earthmoving works and plant and building deconstruction. Noise and vibration impacts will be less than those for the construction and operation phases.

It is likely that, as the plant is closed and dismantled, some office receptors will also be removed. Additionally, the number of occupants in the accommodation camps will be much reduced from operational numbers. Hence, the significance of these impacts during closure will be less than during construction and operation, although particular receptors may experience comparably significant impacts for some closure activities.
8.4 Mitigation Measures

8.4.1 Construction

Best practicable means should be followed both in construction and operations 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 national, or international, noise emission limits (for example European Commission Directive 2000/14/EC, European Commission Directive 2000/14/EC);
- Selection of inherently quiet plant where appropriate. All 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;
- Proper use of plant with respect to minimising noise emissions and regular maintenance. All 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;
- Machines in intermittent use should be shut down in the intervening periods between work or throttled down to a minimum;
- Where appropriate, plant and equipment such as skips and chutes can 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
- Where practicable, 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.

Where practicable, localised noise barriers could be provided to screen particular 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.

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 programme 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.

8.4.2 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 could be employed, as warranted, to minimise operational noise and vibration levels to the workplace and workforce in general:

- Selection of inherently quiet plant where appropriate;
- All ancillary plant such as generators, compressors and pumps should be positioned so as to cause minimal noise disturbance;
• Proper design of foundations to crushers and other significant vibration sources;
• Acoustic enclosure and cladding of processing plant, where necessary;
• Employment of earth berms as noise barriers at facility boundaries, where necessary;
• Optimisation of internal traffic routing to maximise 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;
• Machines in intermittent use should be shut down in the intervening periods between work or throttled down to a minimum; and
• If necessary, blast monitoring at key receptors, such as accommodation blocks and offices, dependent on blasting locations.

8.4.3 Closure

Some of the mitigation measures recommended for the construction and operational phases will also apply to the closure works.

8.5 Cumulative Impacts

The operational noise assessment for Phase 2 presented here includes the operation of the Phase 1 components. Thus, the assessment is inherently cumulative in that it provides an assessment of the total noise impacts in 2016 and 2022 when compared to the existing scenario.

8.6 Evaluation of Mitigated Impacts

8.6.1 Construction

With the exception of road construction when close to the accommodation camp, construction noise effects are assessed as negligible. Apart from the best practicable means outlined in Section 8.4.1, no additional mitigation measures are required.

The employment of localised noise barriers or bunds to the accommodation camp when road construction is carried out in close proximity should reduce the significance of the effect to negligible/low. Barriers can be constructed of a range of materials including steel, plastic or wood, as long as the surface density is of the order of 12 kg/m². The appropriate barrier height range will be 2 to 3 m.

8.6.2 Operation

Operational noise effects to the accommodation camps and offices are assessed as negligible. Apart from the good site management practices outlined in Section 8.4.2, no additional mitigation measures are required.

Residual operational noise effects are assessed as negligible.

With appropriate blast design and a suitable vibration monitoring regime in place, ground borne vibration and air overpressure to sensitive receptors should be minimised and residual operational vibration effects are assessed as negligible.
8.6.3 Closure

Closure will involve comparable activities to some of those employed in the construction and operation of Phase 1 and Phase 2, in particular earthmoving works and steelwork (dismantling rather than erection). The significance of effects during closure will be less than those during construction and operation due to the absence of blasting and operational fixed plant noise.

8.7 Summary

A summary of the potential impacts of the proposed Phase 2, following the implementation of mitigation measures with respect to noise and vibration, are presented in Table 8-7.

Table 8-7: Summary of Potential Residual Impacts1 - Noise and Vibration

<table>
<thead>
<tr>
<th>Location</th>
<th>Nature of Impacts</th>
<th>Mitigation Measure</th>
<th>Project Phase</th>
<th>Nature</th>
<th>Duration</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mine site</td>
<td>Construction Noise</td>
<td>Best Practicable Means</td>
<td>C</td>
<td>Adverse</td>
<td>Short Term</td>
<td>Low/Negligible</td>
</tr>
<tr>
<td></td>
<td>Construction Vibration</td>
<td>Best Practicable Means</td>
<td>C</td>
<td>Adverse</td>
<td>Short Term</td>
<td>Negligible</td>
</tr>
<tr>
<td></td>
<td>Operational Noise</td>
<td>Control Techniques and Site Management Practices</td>
<td>O</td>
<td>Adverse</td>
<td>Medium Term</td>
<td>Negligible</td>
</tr>
<tr>
<td></td>
<td>Operational Vibration</td>
<td>Control Techniques and Site Management Practices</td>
<td>O</td>
<td>Adverse</td>
<td>Medium Term</td>
<td>Negligible</td>
</tr>
<tr>
<td>Noise</td>
<td>Best Practicable Means</td>
<td></td>
<td>D</td>
<td>Adverse</td>
<td>Short Term</td>
<td>Negligible</td>
</tr>
<tr>
<td>Vibration</td>
<td>Best Practicable Means</td>
<td></td>
<td>D</td>
<td>Adverse</td>
<td>Short Term</td>
<td>Negligible</td>
</tr>
<tr>
<td>Off-site Roads</td>
<td>Construction Traffic Noise</td>
<td>Scheduling</td>
<td>C</td>
<td>Adverse</td>
<td>Short Term</td>
<td>Low/Negligible</td>
</tr>
<tr>
<td></td>
<td>Operational Traffic Noise</td>
<td>Scheduling</td>
<td>O</td>
<td>Adverse</td>
<td>Medium Term</td>
<td>Low/Negligible</td>
</tr>
</tbody>
</table>

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 Section 5.
9 Soils and Land Use

This Section presents the methodology and baseline conditions used to assess the potential impacts on soils and land use resulting from Phase 2. In addition to the assessment, mitigation measures which aim to avoid, reduce, remediate or compensate potential impacts are proposed and the residual impacts (impacts after mitigation measures implemented) assessed.

9.1 Methodology

As referred to in Section 2, this assessment takes into consideration national legislation, international guidance and Kinross standards such as International Finance Corporation (IFC) Performance Standard 3 – Pollution Prevention and IFC Performance Standard 6 – Biodiversity Conservation, Sustainable Natural Resource Management and Kinross Standard 10.13 – Land Use. These documents require consideration of the existing use of land and the sustainable management of soils.

The soil conditions at the Mine site were determined by:

- Review 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 in the Mine site (i.e. within the perimeter fence) was determined by walkover survey undertaken by the Environmental Impact Assessment (EIA) team during site visits and baseline surveys for the Project.

9.2 Baseline Conditions

The proposed Phase 2 Project components are all located within the existing footprint of the Mine site perimeter fence and therefore the soils and land use have already been disturbed, to varying degrees, by mining related activities.

9.2.1 Soils

The area assessed for this EIA is within the existing Mine site boundary and is therefore disturbed, to varying degrees, by the ongoing mining operations and associated activities.

Reference to the Harmonised World Soil Database (FAO et al, 2009) indicated that within the vicinity of the Mine site are classified as Leptosols, with a small area classified as Arenosols. Leptosols are described as “Very shallow soils over hard rock or in unconsolidated very gravelly material”. Arenosols are described as “Sandy soils featuring very weak or no soil development”.

The Mine site is generally flat, and is affected by windblown sand and associated sand dune movements. Based on a visual inspection of soil at the site the soil resource is considered to be minimal and dominated by sand deposits, numerous rock outcrops, gravel and small pockets of sediment in wadi channels. The majority of on-site soil is dry, weakly cemented, generally degraded, unproductive and easily eroded with low agricultural potential.

Baseline soil sampling at the Mine site was undertaken in March 2010 as part of the Mine’s environmental monitoring programme (Scott Wilson, 2010b). The samples were analysed for a range of geochemical parameters, using standard UK methods at a UKAS certified laboratory. The analysis focused on those elements typically associated with gold mining activities in order to determine baseline conditions for future monitoring. Forty eight samples (eight per location)
were collected at six locations within the Mine site including two points at Tailing Storage Facility (TSF) 1, and 1 at each of TSF 2, the dump leach facility, West Branch open pit area and the existing accommodation camp (see Figure 9-1).

In the absence of any Mauritanian equivalent, the Dutch Intervention Guidelines (DIV) for soils (which provide reference values used for environmental assessment of potential soil contaminants, 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. Appendix 4 presents the full data set and a summary of the results of the soil analysis undertaken in 2010. The data indicates that there is no evidence of soil contamination resulting from the on-going mining and associated activities at the Mine site. Only one sample collected at the dump leach facility marginally exceeded any of the DIV levels; this was for Barium (sample indicated 640 ppm which marginally exceeds the DIV level of 625 ppm) and this was attributed to the natural geochemistry of the soil (Scott Wilson, 2010b).

In addition, as part the environmental monitoring programme, samples of tailings material were also tested to assist in determining baseline conditions and potential sources of soil contamination, the results of this analysis are presented in Appendix 3. The only element in the tailings samples which marginally exceeded the DIV threshold was Arsenic.

9.2.2 Land Use

The Mine is located in a remote desert area and with the exception of the Mine itself there are no permanent land uses in the vicinity. The nearest towns to the Mine site are located over 100 km away and the Parc National du Banc d’Arguin (PNBA) is located 65 km west of the Mine site.

Potentially sensitive receptors comprise a variable number of nomadic/semi-nomadic people who are present in seasonally variable numbers in the area within 30 km of the Mine site. Also, a small temporary community is located at the current junction of the access road with the Nouakchott–Nouâdhîbou N2 highway, approximately 1 km from the existing borefield. These people are involved in pastoralist, labourer, driver and shop keeping activities (see Section 11) and land use is largely limited to grazing by livestock herds owned by local residents and those of semi-nomadic/nomadic residents who pass through the area.

Within the Mine site, the area is already associated with mining-related activities, including exploration, open pit mining, processing and ancillary works. Some exploration activity is undertaken outside of the perimeter fence but within the permitted mining license area (MLA). Phase 2 Project components are located within the footprint of the existing Mine site perimeter fence and are therefore in keeping with existing land use.

9.3 Potential Impacts

Whilst potential impacts need to be considered, the scope for any impacts of a new nature is markedly reduced as a result of the location of all Phase 2 components within the perimeter fence and the existing Mine site context.

9.3.1 Construction and Operation

In the context of Phase 2, while it is possible to separate construction and operational impacts, there is little merit in doing so given the nature of the soil and land use baseline.
9.3.1.1 Soils

Phase 2 Project components are located within the existing operational Mine site, in areas which have already experienced a significant degree of disturbance due to mining activities. Given the sandy nature of the soil, and its lack of potential to support arable land use or intensive livestock grazing, the potential impacts on soil during construction and operation of Phase 2 include:

- Wind and water erosion and subsequent loss of soils resulting from construction and operation activities such as site clearance, earthworks and vehicle movements, which disturb soils;
- Wind and water erosion and subsequent loss of soils resulting from the removal of vegetation (trees, shrubs and grasses) which provide limited soil stability;
- Soil contamination as a result of spills and/or leaks of fuels, oils or other chemicals;
- Contamination of soils within the Mine site and its vicinity as a result of windblown contaminated dust blowing off the TSF, dump leach and heap leach facilities, during extreme weather conditions.

The impact on soil is therefore considered to be adverse, medium term, and of low significance due to its sand and gravel nature and low agricultural potential.

9.3.1.2 Land Use

The construction and operation of Phase 2 Project components is consistent with the existing land use within the Mine site. The impact on land use required for Phase 2 Project components is therefore limited to the area within the existing perimeter fence (12,300 ha), which has already been demarcated and disturbed, to varying degree, by mining-related activities.

The impact on local residents is considered to be negligible as they are already excluded from the Mine site due the perimeter fence; the impact on ecology and biodiversity is also considered negligible due to its low value (see Section 10).

The impact on land use is therefore considered to be neutral, medium term and of negligible significance.

9.3.2 Closure

9.3.2.1 Soils

Due to the conditions on-site it is unlikely that significant, if any, material suitable for reuse during rehabilitation will be encountered during construction and stockpiled. Should such material be available for re-use during rehabilitation and closure, it will be used in the passive re-vegetation of the Mine site (see Section 19).

The impact on soil is therefore considered to be neutral, long term and of low significance.

9.3.2.2 Land Use

Impacts on land use at closure of Phase 2 infrastructure will be restricted due to the location of Project components within the overall Mine site. Where possible facilities and associated infrastructure will be removed from the Mine site and flora and fauna will be restored through
passive re-vegetation. 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.

Certain Phase 2 Project components, such as the expanded open pit, waste rock dumps, TSF, dump leach facilities, heap leach facilities and waste landfill will not be removed from the Mine site following closure. However they will be rehabilitated to a land use compatible with surrounding land uses.

The impact on land use is therefore considered to be neutral, long term and of low significance.

9.4 Mitigation Measures

9.4.1 Construction and Operation

9.4.1.1 Soils

Disturbance of soil during construction and operation are limited as Phase 2 activities are located in areas which may previously been disturbed, to varying degree, by mining related activities and are within the Mine site perimeter fence. It is unlikely that significant volumes of suitable material for reuse will be encountered during the construction due to the sandy nature of the soil; however, if sufficient material is encountered during the construction phase it will be stockpiled and covered/secured for use in progressive or final closure and rehabilitation works.

Erosion of soils during construction and operation will be minimised by ensuring that, wherever practical, vehicles 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.

Any spills or leaks will be managed in accordance with the provisions of emergency response planning (see Section 18). The response plan will include methods for spill clean-up and the disposal of any contaminated materials and soils to either the incinerator, waste landfill or for reprocessing. Spill kits will be available at key locations and all relevant workers will be trained to prevent and respond to incidents in an appropriate manner. Routine inspection, monitoring and maintenance of bulk storage facilities and secondary containment systems will take place to reduce the risks of spills and accidents.

Dust levels on internal and haul roads will be visually monitored and dust suppression applied if necessary to reduce dust generation (see Section 7 - air quality).

9.4.1.2 Land Use

The key mitigation measure for Phase 2 is the optimisation of Project layout to ensure all proposed Phase 2 Project components are located within the existing perimeter fence and Mine site. The land requirement for the expanded operations is limited to that which has already been designated for mining-related activities and will not impact local residents as they do not have access to the Mine site. No specific mitigation measures are therefore proposed.
9.4.2 Closure

9.4.2.1 Soils

During closure where possible Phase 2 facilities and associated infrastructure will be removed from the Mine site. Limited re-contouring of the land surface will take place where necessary and, if available, stockpiled material will be used in the passive re-vegetation of the Mine site in order to promote soil stability.

9.4.2.2 Land Use

As discussed above, facilities and associated infrastructure will be removed from the Mine site and minimal land surface will be re-contoured where necessary and, if available, stockpiled material will be used in the passive re-vegetation in order to promote soil stability and to restore the land to a state which is compatible with surrounding land uses, and to a condition which is safe and suitable for a land use compatible with surroundings (see Section 19). Post closure, no mitigation measures are required.

Facilities which will remain post closure of the Mine include the expanded open pit, waste rock dumps, TSF, dump and heap leach facilities and waste landfill. These facilities will remain permanent features of the land and will be capped and re-profiled, where appropriate, to allow a land use compatible with surroundings.

9.4.3 Monitoring

No formal soil or land use monitoring programmes are considered necessary during the construction and operational phases of the Project. However, TMLSA will undertake visual assessments of any significant changes in soil conditions, including possible contamination, erosion and/or dune encroachment, and implement mitigation measures as appropriate. If deemed necessary, further soil sampling and analysis may be undertaken (e.g. to determine remediation strategy and confirm successful interventions following actual or suspected soil contamination incidents).

Any changes in land use, such as vegetation cover within the Mine site shall be recorded during routine inspections and internal management system audits.

9.5 Cumulative Impacts

Phase 2 of the Mine’s expansion will significantly extend the area of land that is required for the expanded operations. However, all of the disturbance will be contained within the confines of the Mine site perimeter fence and this area is already considered to be designated for mining related activities.

As Phase 2 is confined within the Mine site perimeter fence, there are no cumulative impacts upon soil and land use outside of the Mine site perimeter fence.
9.6 Evaluation of Mitigated Impacts

9.6.1 Construction and Operation

9.6.1.1 Soils

Adverse impacts on soil during construction and operation will be generally negligible due to the poor quality of the soil.

Soil disturbance and erosion are likely due to mining related activities; however due to the low rainfall, wind erosion and sand dune ‘creep’, soil erosion will occur as a natural process. Residual soil impacts caused by disturbance and erosion are assessed to be adverse, short term and of low/negligible significance.

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 fuel for the power plant or reagents for the process plant. Any spills or leaks will be managed in accordance with the emergency response plan and routine inspection, monitoring and maintenance will take place to reduce the risks of spills and accidents (see Section 18). Residual soil impacts caused by contamination due to the proposed management plan are assessed to be adverse, medium term and of low/negligible significance.

Dust emissions from mining operations and vehicle movements will be visually monitored and dust suppression applied, if considered necessary, to manage dust. However, due to the arid and windy conditions and lack of vegetation it is common for sand and dust storms to occur at the Mine site. Residual soil impacts caused by dust are adverse, short term and low/negligible.

9.6.1.2 Land Use

The impacts on land use during construction and operation are considered negligible as the existing land use is not being altered from current land use. The perimeter fence prevents access to the Mine site for non-mine related land use, and alternative land uses are limited due to the climatic and biodiversity conditions. Residual land use impacts during are assessed to be negligible, medium term and of negligible significance.

9.6.2 Closure

9.6.2.1 Soils

Impacts on soil will be neutral as land available for rehabilitation will be returned, through passive re-vegetation, to a condition compatible with surrounding land uses. It is unlikely that significant volumes of suitable material will be encountered during the construction; however, if there is sufficient topsoil to warrant stockpiling it will be used to assist in the passive re-vegetation of the Mine site.

Passive re-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.

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

Land lost to Mine operations will be, where practical, restored to a state which is compatible with surrounding land uses, and to a condition which is safe and suitable for an alternative use. However after application of the closure plan, the mitigated impact is considered to be adverse as there will be facilities and infrastructure that cannot be removed such as the open pit, waste rock dumps, leach pads and waste landfill. These areas will be closed as per the rehabilitation and closure plan to ensure their stability and safety to local residents.

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

9.7 Summary

A summary of the potential impacts of the proposed Phase 2, following the implementation of mitigation measures with respect to soils and land use, are presented in Table 9-1.

Table 9-1: Summary of Potential Residual Impacts1 - Soils and Land Use

<table>
<thead>
<tr>
<th>Location</th>
<th>Nature of Impacts</th>
<th>Mitigation Measure</th>
<th>Project Phase2</th>
<th>Nature3</th>
<th>Duration3</th>
<th>Significance3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mine site</td>
<td>Soil contamination</td>
<td>Emergency Response Plan</td>
<td>C O D</td>
<td>Adverse</td>
<td>Short term</td>
<td>Low/Negligible</td>
</tr>
<tr>
<td></td>
<td>Soil disturbance and erosion</td>
<td>Limit disturbance; Ensure vehicles designated roads and tracks</td>
<td>C O</td>
<td>Adverse</td>
<td>Medium term</td>
<td>Low/Negligible</td>
</tr>
<tr>
<td></td>
<td>Dust</td>
<td>Visual inspection and use of dust suppression where appropriate</td>
<td>C O</td>
<td>Adverse</td>
<td>Short term</td>
<td>Low/Negligible</td>
</tr>
<tr>
<td></td>
<td>Change of land use</td>
<td>No mitigation proposed</td>
<td>C O</td>
<td>Neutral</td>
<td>Long term</td>
<td>Low/Negligible</td>
</tr>
<tr>
<td></td>
<td>Restoration of soil and land use</td>
<td>Passive re-establishment of vegetation</td>
<td>D</td>
<td>Neutral</td>
<td>Long term</td>
<td>Low/Negligible</td>
</tr>
</tbody>
</table>

1Following implementation of proposed Mitigation Measures
2Project Phase: C = Construction, O = Operation, D = Closure
3Duration 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 and Biodiversity

This Section presents the methodology and baseline conditions used to assess the potential impacts on ecology and biodiversity resulting from Phase 2 (the Project). It also describes the desktop research and field surveys used to determine the baseline conditions associated with the Project and to place the Project in its wider ecological and biodiversity context.

In addition, mitigation measures which aim to or avoid, reduce or remediate potential impacts are proposed and the residual impacts (impacts remaining after mitigation measures are implemented) assessed. The assessment of the impacts of the Project on ecology and biodiversity was undertaken in accordance with the methodology detailed in Section 5.

10.1 Methodology

10.1.1 Legislative and Policy Context

The approach for the ecology and biodiversity assessment has taken into consideration relevant national legislation, international guidance and Kinross standards (e.g. Standard 10.14: Biological Resources). Further detail on the legislative and policy context considered by the assessment is provided in Section 2.

10.1.1.1 National

The relevant national legislative instruments with respect to the Project are:

- The Environment Code (Law No. 2000-045) which affords legal protection to flora, fauna, soils, forests and protected areas through Articles 24 to 30. Specifically, it addresses the over-exploitation of wildlife (Article 25), genetic conservation as part of species and habitat conservation (Article 25), and affords enhanced protection to animal and plant species threatened with extinction (Article 28). It also requires ministerial authorisation for mining projects that require destruction of habitats (Article 26);
- The Hunting Code (Law No. 97-006) which extends legal protection to certain fauna based on socio-economic value but not rarity;
- The Protection of Vegetation Law (Law No. 2000-042) which legislates on the protection of vegetation as a natural resource and on the import and export of vegetation; and
- The Forestry Code (Law No. 2007-055) which regulates the exploitation of forest products, the classification of forests and forest clearance. It also provides for the protection of specific species of native trees.

10.1.1.2 International Finance Corporation (IFC)

This assessment is also being undertaken in accordance with the requirements of the International Finance Corporation (IFC) Performance Standards. Of particular relevance is Performance Standard 6 (IFC, 2006), which promotes an international approach for the protection of biodiversity and the sustainable management and use of natural resources.

To satisfy Performance Standard 6, the assessment process considers direct and indirect project-related impacts on biodiversity and ecosystem services and identifies any significant residual impacts. This process also considers relevant threats to biodiversity and ecosystem services, especially focusing on habitat loss, degradation and fragmentation, invasive alien species, overexploitation, hydrological changes, nutrient loading, and pollution. It also
10.1.2 Desktop Research

Published information on the ecological baseline status of the Mine site and surrounding region is limited. Therefore the assessment of the Mine site is largely reliant on the results of the programme of field surveys undertaken for the Project and previous survey reports for the Mine site. Desktop research was undertaken to define the national context (see Section 10.3.3) as part of the ecology scoping prior to the formalisation of the field survey programme.

A review was undertaken of available (primarily online) literature to gather information on both the national biodiversity context and the regional context of the Mine.

Aerial photography (satellite imagery) to 1:1000 m resolution was obtained and used in conjunction with the field survey data to determine the baseline conditions of the Mine. The aerial photography was also interpreted to determine the relative distribution of tree cover and discrete habitat types.

Discussions were held with the staff of the Parc National du Banc D’Arguin (PNBA) to identify any additional information resources relevant to the area, and, in particular, the Mine site.

10.1.3 Overview of Field Surveys

The ecological surveys undertaken to date for the Mine and the Project are summarised below in Table 10-1 and the methodologies for these surveys are included in the respective reports.

The range of habitats within the Mine site is identified as limited due to the lack of variation in topography, soils, climate and availability of water. This background combined with the relatively large size of the Mine site informed the development of the baseline survey methodology described below.

The habitat baseline surveys for the Project, including Phase 2, were undertaken during the period 16 to 23 February 2011 by a survey team comprising international and local ecologists; namely, a Mauritanian botanist, a Mauritanian ornithologist and two ecologists from the United Kingdom. The ecologists were accompanied alternately by two Mine-based TMLSA environmental technicians who assisted with the surveys and received practical training.

The baseline survey covered the area within the Mine’s perimeter fence as well as additional off-site areas that are not specific to this EIA including the new airfield area to the north west of the site, the water borefield by the N2 highway and the corridor of the existing access road to the Mine.

In February 2011, a vehicle based reconnaissance survey of the Mine site including the full fence perimeter was undertaken prior to undertaking the baseline survey. This was then followed by the main vegetation, bird and faunal surveys which comprised a combination of vehicle-based transects and more detailed sampling at selected points along those transects.

Lower survey effort was made in areas with shifting vegetation patterns and low vegetation cover such as the dune system in the south eastern corner of the Mine site which was considered to present less ecological risk than other habitats. A very limited amount of specialist bat activity recording and small mammal survey by live-trapping was also carried out at specific locations. The locations of driven survey transects and sampling points for all of the...
surveys were recorded using a hand held Garmin Geographical Positioning System (GPS), which recorded to a minimum accuracy of 5 m. Further detail on the baseline survey methodology is given below in Section 10.3.3.

Bird vantage point surveys to document usage of these areas by birds were undertaken at the dump leach facility, Tailing Storage Facility (TSF 2) and the accommodation camp sewage lagoons. Bird surveys were undertaken by a local ornithologist who received training in bird identification and the survey methodology from an experienced UK ornithologist. Weekly surveys bird activity surveys are also undertaken by the environmental technicians at the TSF 2 and dump leach lagoons.

During September 2011 additional bird vantage, transect and point counts were undertaken on the Mine site along with a tree and tree seedling distribution and regeneration survey of the areas identified for development as part of Phase 1.

10.1.4 Field Survey Methodologies for the Baseline Survey

10.1.4.1 Botanical Survey

Botanical survey data was gathered within the survey area using a twin transect approach comprising a combination of driving and point surveys (see below).

10.1.4.2 Driving Transect

The survey area was covered by slowly driving a series of transects in a site vehicle. This driving time was used to gather background distributional data on the trees and plant communities within the survey area. During the driven transects, surveyors continuously made observations for any obvious new plant species or communities and photographs were taken at selected points to document specific features.

10.1.4.3 Point Survey

At selected points along each driving transect line the vehicle was stopped to allow the ecologists to undertake a more detailed survey on foot out from a central survey point. The survey points were selected to take in typical habitats as well as habitats of more local distribution including wadis and areas with a more varied topography such as small dune areas.

The abundance of plant species was recorded using the following qualitative abundance scale:

- D – dominant;
- A – abundant;
- F – frequent;
- O – occasional; and
- R – rare.

The number of trees growing within 1 km radius of each survey point was estimated. Photographs also provided additional information on typical tree cover. A qualitative scale of frequency of trees was used as follows: very low (less than 5), low (less than 10) medium (10-
30), high (more than 30), very high (more than 50). The counts were approximate because they were based on a radius of 500 m, which was estimated by surveyors who have practised making field estimates of that distance; hence by calculation the area of each point site was actually less than 1 km². However, part of the site was surveyed previously (Ismail, 2011b) and all trees were counted, averaging 2.4 trees km⁻². This was used as a comparison for the estimates independently made by our surveyors in the same area. The qualitative scale was used consistently throughout. As well as these intensive point surveys, observations were made of the wider flora and tree distribution along each transect so that any additional plant species present could be recorded. Where necessary, voucher specimens were collected for further investigation/verification.

Any other relevant ecological records made during the baseline survey period were also included in the survey results.

10.1.4.4 Ornithological Survey

Bird survey data was gathered within the survey area (see Figure 10-4) using a twin transect approach comprising a combination of driving and walking transect surveys (see below).

10.1.4.5 Driving Transect

As with the botanical surveys, the area was covered by slowly driving a series of transects in a vehicle. Aided by the use of binoculars, the birds seen and heard along an approximate 20 m corridor either side of the vehicle were recorded along each transect route, although larger birds such as birds of prey that could be confidently identified further afield were also noted. To help ensure 360 degree visual coverage two ecologists in the car assisted the ornithologist by pointing out any bird activity, although this was not a continual input as they had other survey data to collect at the same time. Where necessary the vehicle was stopped to enable identification of specific birds. Birds were recorded as using the site or flying over the site.

10.1.4.6 Walking Transect

At the selected stopping points along the driving transect used for botanical and other ecological elements of the survey, the ornithologist undertook a more detailed walking transect survey. Most of the survey area was relatively flat and visually open for bird viewing thus allowing the bird interest of these areas to be adequately surveyed when undertaking the driving transects. As such, the walking transects were focussed in more vegetated areas such as wadis and areas with a more varied topography. Such habitats are more likely to support greater numbers and types of birds.

Each walking transect covered a survey corridor approximately 20 m either side of the recorder and covering a total transect length of approximately 300 m. Walking survey time along each transect was approximately 15 minutes. Where potentially important species were seen outside the 20 m corridor, additional time was taken to try to accurately identify that species. The location of nest sites was also recorded. Casual bird observations were also made by other members of the team, who also alerted the bird surveyor to the presence of other birds that may be worthy of recording as part of the general transect survey.
10.1.5 Other Faunal Surveys

10.1.5.1 Driving Transect

As with other elements of the survey, the survey area was covered by slowly driving a series of transects in a vehicle using binoculars to spot potentially important faunal refuge features such as rocky outcrops. Where such features were identified within approximately 500 m of the survey transect, the vehicle was driven to them, the feature was geo-referenced and the feature was carefully and quietly searched for signs of reptiles, mammals and other fauna. Rocky outcrops were limited in distribution and in physical size and could be typically searched in less than thirty minutes. Photographs were taken at selected points to document specific features.

10.1.5.2 Point Survey

The survey points were the same as those used for the bird and plant surveys.

From each survey point the local area, including the underside of possible refugia such as rocks, was searched for 15 minutes by an ecologist looking for fauna and signs of faunal activity such as tracks, dung, body parts such as skulls or skins, or possible animal holes. Any features were noted in the field notes. Photographs were taken where appropriate. Observations were predominantly of the signs of reptiles and mammals. Invertebrates were noted as seen, but no detailed sampling of invertebrates was carried out in this survey.

10.1.5.3 Small Mammal Survey

No internationally or nationally rare mammal species are listed for Mauritania apart from Dorcas gazelle (*Eudorcas rufifrons*), previously cited *Gazella ruffifrons* (SNC Lavalin, 2004). This shy species is now restricted to just two known locations in Mauritania and so dedicated surveys were not undertaken for this species, although vigilance was maintained at all times by the survey team for any possible sightings of this species, or evidence of spoor in the soft sand.

The high daily temperatures and low vegetation cover that typically occurs in a desert results in limited surface refugia from predators and so many smaller mammal species are largely nocturnal or crepuscular in desert habitats. Accordingly there is less chance of directly picking up mammal activity during day time surveys.

A number of small animal holes and small mammal footprints were recorded during the baseline surveys and to help us try to understand a little more about the small mammals that currently use the site, three baited small mammal traps were each deployed for one night at each of four different locations on 17th, 18th, 21st, and 22nd of February. The traps were UK standard metal box small mammal traps and they were baited with peanuts both inside and just outside the traps. Paper bedding was also provided within each trap. These traps were chosen to accommodate a range of small mammal species. The smaller "longworth" trap was considered to be too small for the majority of species that may be encountered.

Based on the traps being successfully used on the first night of survey (17th February), habituation time was not considered necessary, although it is recognised that some species may not have been picked up as only a single night of trapping was done at each survey site.

The limitations of the survey are acknowledged, but the survey still provided some useful data without the need for a night-time survey.
10.2 Baseline Conditions

10.2.1 Overview

The baseline conditions have been defined through a range of desk and field investigations as described in Section 10.1.3. The field surveys commissioned for the Project are summarised in Table 10-1.

The following sections provide a summary of the ecological baseline conditions based on the work undertaken to date and cross-referenced, as required, to the source documents. The results of the 2011 baseline ecology surveys have provided the majority of the data upon which the ecology assessment is based.

A summary of the other ecological investigations undertaken on the Mine site are also given in Table 10-1. The 2004 survey was undertaken to provide ecological data for the initial EIA undertaken for the Mine site. The 2009 survey was done at the request of the Mauritanian Authorities who were keen for some ecological surveillance data to be collected.

A selection of illustrative photographs (Photographs 10-1 to 10-9) taken during the 2011 field surveys show habitats present on the Mine site and examples of some of the wildlife recorded are provided.

Table 10-1: Summary of the ecological investigations undertaken to date at the Mine

<table>
<thead>
<tr>
<th>Scope and survey period</th>
<th>Author and report date</th>
<th>Surveys</th>
<th>Surveyors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flora and fauna 2004</td>
<td>SNC Lavalin, 2004</td>
<td>Feasibility study report site walk over to assess flora and fauna (point count)</td>
<td>National ecologist</td>
</tr>
<tr>
<td>Flora and fauna 2009</td>
<td>Ismail &amp; Clarke, 2009</td>
<td>Baseline ecological survey of flora and fauna within the West Branch Development (point and transect survey) Includes survey training for national ecologists</td>
<td>National ecologist</td>
</tr>
<tr>
<td>Birds March 2011 onwards (TSF and dump leach facility at least weekly)</td>
<td>Daddah, 2011a and b TSF and dump leach facility Weekly Kinross bird monitoring records not yet reported</td>
<td>Vantage point surveys of dump leach facility, TSF and camp sewage lagoon</td>
<td>National ecologists and site environmental workers.</td>
</tr>
<tr>
<td>Helicopter March 2011</td>
<td>No report</td>
<td>Reconnaissance survey</td>
<td>International ecologists</td>
</tr>
<tr>
<td>Birds September 2011</td>
<td>URS Scott Wilson, 2011f</td>
<td>Bird transect and point counts. Desert, dump leach facility, TSF and sewage lagoons Includes survey training for national ecologists</td>
<td>International, national ecologists and site environmental workers.</td>
</tr>
<tr>
<td>Eco risk walkover and mapping of tree locations, verification of</td>
<td>Ismail, 2011c</td>
<td>Mapping of target ecology features using GPS</td>
<td>National ecologist</td>
</tr>
</tbody>
</table>
## 10.2.2 Protected Sites and other Biodiversity Designations

The main protected areas within Mauritania are:

- Two National Parks (located on the Atlantic coast) - PNBA and Parc National du Diawling;
- Réserve de faune: four Faunal Reserves (located to the south and southeast, distant from the mine) - Réserve de Mouflons, Guelber Richât, El Aft au Gorgol and Tilemsi;
- Réserve intégrale: two Strict Reserves (located on the Atlantic coast) - Cap Blanc or Baie du Lévrier which includes Nouâdhibou port and Iles Mauritaniènnes;
- Réserve partielle de faune: one Partial Faunal Reserve – El Auger; and
- Birdlife International has identified a suite of 'Important Bird Areas' (IBA) for Mauritania.

The Mine site is located in an area that is remote from all of the nationally protected biodiversity conservation sites summarised above. There are no forests associated with the Mine. The closest protected site and IBA (Important Bird Area) is the PNBA, which is located 65 km to the west of the Mine site. Protected sites are therefore not relevant to the assessment of Phase 2.

## 10.2.3 Habitats, Vegetation and Flora

The Mine is located within the Saharan-Sindian bioclimatic zone (biome), which occupies up to three-quarters of Mauritania and is of low floristic diversity. More specifically the location falls within the North Saharan steppe and woodlands eco-region (World Wildlife Organisation Eco-region PA1321). The eco-region forms the north and western border of the greater Sahara Desert region, extending across northern Africa and covers parts of Western Sahara, Mauritania, Morocco, Algeria, Tunisia, Libya, and Egypt.

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 site are typical of a desert location and of much of the middle, north and north east of Mauritania, which is dominated by this habitat. The predominant physical habitat type comprises a flat area of land formed mainly of gravelly regs and localised superficial sand deposits with one main dune area (dune field). Locally there are small rock and boulder extrusions as well as lower lying wadis. Vegetation cover is typically sparse, intermittent and it is not uniformly distributed. As such, vegetation is clustered in and around the beds of minor depressions and wadis as well as areas of sandy deposit.

---

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

2 Gullies or stream beds that are predominantly dry but that collect water during rainfall events.
Figure 10-1 shows the broad distribution of habitats across the Mine site that is dominated by desert, but also includes the areas which are already affected by the Mine workings, classed as “disturbed” along with the open water bodies created as part of the operation of the Mine for example the office block sewage lagoon and one area with a number of sand dunes.

A total of 56 species of plant have been recorded at the Mine site during the February 2011 survey in contrast to the 2009 field survey when only 19 plant species were recorded. Appendix 5 provides a list of all flora species identified during the two field surveys. The surveys undertaken in February 2011 coincided with the end of a period of higher than average rainfall during mid to late 2010 and early 2011 (see Figure 10-3) providing an unprecedented opportunity to identify and record, in best case conditions, the range of flora associated with the Mine’s location. Accordingly the plant records made during the 2011 surveys give a better indication of the species richness and range of species present on the Mine site than the 2009 survey data set.

The most common species recorded during the 2011 survey were herbaceous plants, particularly *Fagonia oliveri*, *Aerva javanica*, *Aristida spp.*, *Astragalus vogeli*, *Chrozophora brochiana*, *Citrullus colocynthis*, *Corchorus depressus*, *Farsetia ramosissima*, *Hyoscyamus muticus*, *Monsonia nivea*, *Nucularia perrinii*, *Panicum turgidum*, *Pulicaria incisa*, *Seetzenia lanata* and *Stipagrostis pungens*.

There were also five woody species (trees and shrubs), namely *Acacia ehrenbergiana*, *A.radiana*, *Calotropis procera*, *Capparis decidua*, and *Maerua crassifolia*. Of these, *Acacia ehrenbergiana* was the most common being widespread throughout the Mine site. Tree cover across the Mine site was generally very low, typically being less than 5 trees/km². The estimated relative local tree cover based on the results of the baseline survey is given in 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 site (see Photographs 10-1 to 10-3);

- A wadi assemblage dominated by *Panicum turgidum* and *Citrullus colocynthis*, 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 and satellite imagery the most extensive dune systems lie in the south eastern corner of the Mine site.

Figure 10-3 summarises the relative diversity of flora found at the survey sites during the 2011 survey, expressed as the number of species recorded there, grouped into five classes. For the purposes of this discussion, areas with 0-3 species are classed as having low diversity, those with 4-9 or 10-14 species are classed as having medium diversity and those with 15 or more species are classed as having high diversity. The maximum number of species recorded at any point was 24 species. It is important to note that the designations and use of terms such as “high”, “medium” and “low” refers to relative diversity within the site at the time of the survey, which in turn will have been influenced by preceding rainfall conditions. The data indicate that although there was much local variability, certain areas were more consistently diverse than others.
Overall, survey points located on the north of the site and near to the new airport area appear to have consistently higher levels of diversity compared with other areas. Areas in the south and south east of the site were generally characterised by low plant diversity. Throughout the rest of the site, plant species diversity displayed significant local 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 (wadis) during wet weather, along with soil and subsoil capacity for holding water.

It is understood that none of the plant species identified are rare or threatened and are not designated by local, national or international standards as such. However, the trees *Acacia tortilis radiana*, *Maerua crassifolia* and *Capparis decidua* are protected by national forestry legislation.

The areas where Phase 2 Project components are to be located within the Mine site involve a greater land area than earlier development phases. Accordingly, it is not physically possible to avoid all areas where high plant diversity records have been made apart from the north east corner and western edge of the site that respectively held 5 and 4 sites out of a total of 39 sites where medium to high (15 to 24 species per survey point) plant diversity was recorded during the baseline survey.

The 2011 ecological baseline conditions were exceptionally good due to above normal precipitation enabling the collection of an excellent plant data set. 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 as such. However, three trees species recorded on-site, *Acacia raddiana*, *Maerua crassifolia* and *Capparis decidua*, are protected by national forestry legislation.

10.2.4 Birds

Mauritania supports two bird species/subspecies which are believed to be endemic to Mauritania. These are the Mauritanian heron (*Ardea monicae*) and Eurasian spoonbill (*Platalea leucorodia balsaci*). Both of these birds are primarily restricted to coastal wetland habitats within the Baie d’Arguin which is located approximately 65 km west of the Mine site, and are therefore unlikely to occur in desert areas. For this reason these species are not relevant to Phase 2 of the Project.

The Project 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 including the Near Threatened (IUCN Red Data List) Nubian bustard (*Neotis nuba*) (Shine et al. 2001) and the endangered (IUCN Red Data List) Egyptian Vulture (*Neophron percnopterus*) (Islemann et. al.). Only a single observation of the latter species has been recorded at the Mine during migration but it is not unique to the Mine site.

Also of significance is that the Mine site is situated adjacent to the West African bird flyway and as a consequence it has the potential to attract large numbers of Western Palaearctic10 migrants because of the artificial water bodies that exist on this site.

---


10 Relating to or denoting a zoogeographical region comprising Eurasia north of the Himalayas, together with North Africa and the temperate part of the Arabian Peninsula.
Several types of bird habitat occur within the Mine site. During bird surveys conducted between February and September 2011 a total of 70 bird species were recorded (see Appendix 6). The dominant habitat on-site is typical desert vegetation (reg) often characterised by *Fagonia* sp. These areas tend to support very few birds such as occasional short toed lark (*Callandrella brachydactyla*), cricket warbler (*Spiloptila clamans*) and wintering or migrant Northern wheatears (*Oenanthe oenanthe*).

Wadis and smaller areas with denser green vegetation, support a higher density of birds and a more diverse range of desert bird species and, in addition to the above species, cream-coloured courser (*Cursorius cursor*), bar-tailed desert lark (*Ammomanes cinctura*), thick-billed lark (*Rhamphocoris clotbey*), hoopoe lark (*Alaemon alaudipes*) are relatively common. The number of bird species and birds numbers recorded at each survey point during the baseline survey is given in Figure 10-4.

Large numbers of migrants were observed in the desert areas during the September 2011 surveys, with species such as whinchat (*Saxicola rubetra*), woodchat shrike (*Lanius senator*), common redstart (*Phoenicurus phoenicurus*) and chiffchaff (*Phylloscopus collibita*) being widespread across the Mine site.

The Mine site also contains several features including buildings, fence-lines, equipment and vehicles that are likely to attract birds looking for shade or shelter from the wind. The Mine site accommodation camp plays temporary host to numerous migrating birds including the aforementioned Palaearctic migrants.

However the most attractive of all features are the on-site man-made water features which are attractive to large numbers of migrating and resident species to drink and feed. Photographs 10-4 to 10-6 illustrate birds observed in these areas.

Although there are no natural water bodies on-site, there are several artificial water features including the TSF 2 pond and the dump leach ponds where audio bird deterrents are deployed to deter birds from birds from their potentially unsuitable contents. There is also a raw water pond and 2 waste water ponds.

Based on the February to September 2011 survey data sets (URS Scott Wilson, 2011f) the most important site for migrating water birds is within the treated sewage pond that serves the Mine offices. It is the main bird drinking site in the area and for its size attracts large numbers of birds. As well as providing water for the more common desert species, it acts as a regular drinking site for approximately 250 spotted sandgrouse (*Pterocles senegalensis*) (see Photograph 10-5 and 10-6), which arrive from all directions each morning to drink. Birds of prey also use this water body to drink; during the September 2011 survey osprey (*Pandion haliaetus*), long-legged buzzard (*Buteo rufinus citensis*), notably a migrant Egyptian vulture and several lanner falcons (*Falco biarmicus*) were all observed drinking there. Importantly this pond appears to attract birds away from the operational TSF 2, which contains much less palatable water.

The final water feature on-site is the accommodation camp waste water facility that attracts only a limited number of species to drink, although good numbers of mostly short-toed lark were recorded in numbers of approximately 200 per hour during the September 2011 survey. It is not known why this water feature is less attractive to birds than the equivalent pond for the offices, but it may be related to water quality or human disturbance.

Additional species of bird, which are rare in Mauritania, observed within the Mine site include:

- Bronze-winged courser (*Rhinoptilus chalcopterus*) recorded within the desert;
• Common quail (*Coturnix coturnix*), this species is likely to be overlooked in Mauritania and was recorded in the desert habitats;

• Egyptian vulture (IUCN Endangered), but will only be a migratory record and was observed drinking at one of the sewage lagoons; and

• Mallard (*Anas platyrhynchos*), only five records for Mauritania up until 2009 (Isenmann et al. 2009) that was recorded both within the desert and drinking from one of the lagoons and will be another migratory species.

10.2.5 Mammals

The desk study identified no threatened mammal species associated with the desert regions of Mauritania, but it should be noted that there is no comprehensive dataset available. The only endemic desert mammal species within Mauritania is the Mauritanian gerbil (*Gerbillus mauritaniae*), but its definitive genetic status, geographical range and population status is poorly understood (and the only known specimen of the type has been lost) (Wilson, DE and Reeder, Dee AnnM (2005) and so it has been scoped out of further consideration. Also on the basis of its known distribution, the Red List Barbary sheep (*Ammotragus lervia*) is not relevant as it is restricted to the region around the Réserve de Moufllons, a faunal reserve designated for this species some 300 km inland from the Mine site (Shackleton, 1997)\(^1\).

Based on the limited information available, the Red Data List threatened and nationally rare dorcas (*Endorcas rufifrons*) and addax (*Adax nasomaculatus*) gazelles (East, 1990) could have some potential to occur in association with the Mine as they are recorded for the desert regions of Mauritania. However, the vegetation around and on the Mine site lacks certain tree species necessary to support the presence of the two gazelle species. Coupled with the effects of disturbance from grazing, the Mine site perimeter fence and current mining activities, it is considered that these shy species would not occur within the Mine site. No evidence was found to indicate their presence.

Given the large size of the Mine and the current, disturbed habitat conditions associated with it, 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. Investigations into the mammal fauna associated with the Mine were undertaken in February 2011.

Small mammal trapping recorded the presence of a species of a spiny mouse of the genus *Acomys* (Photograph 10-7). 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.

Within the Mine site there has been one sighting made of a fennec fox (*Vulpes zerda*) within its den and, although not confirmed, based on the size of the den complex and evidence of activity near the den this species is assumed to breed within the Mine site. Anecdotal records from Mine site workers also report sightings of fennec fox within the Mine site providing further confirmation of this species presence 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 10-8 and 10-9).

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.

No bat survey undertaken as part of the baseline survey. The habitats present on-site are not expected to support large numbers of bats or bat roosts.

### 10.2.6 Other Fauna

A limited number of direct observations of reptiles were made (see Figure 10-4), these being of Moorish gecko (*Tarentola mauritanica*) and oscillated skink (*Chalcides ocellatus*). Neither of these species is rare, threatened or specialist in its 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.

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 (unconnected to each other) and as such it is unlikely that the site would support any invertebrate species of high biodiversity conservation importance.

### 10.2.7 Relative Biodiversity Value of the Recorded Flora and Fauna

Based on definitions provided by IFC Performance Standard 6, the Mine site contains no legally protected areas or critical habitats. Further, land that has been adversely affected by previous Mine activity is definable as modified habitat and areas less affected and remote from the Mine workings, including land that will be affected by the Project, can be defined as natural habitat (see Figure 10-1).

None of the plant communities identified during the surveys are rare or unusual in a national or international context and none of the component plant species found are rare or unusual within Mauritanian desert systems. Additionally, none of the plant species recorded is included as threatened in the IUCN Red List.

None of the resident bird species recorded on-site during the baseline surveys are of international conservation concern or are included as threatened in the IUCN Red List. One observation of an Egyptian vulture was recorded during the baseline studies, which is included on the IUCN Red List. None of the other faunal records made during the baseline surveys includes any species listed as threatened within IUCN Red List. No potential invasive species issues were raised by any of the survey data sets (see URS Scott Wilson, 2011f).

The desert habitats present within the Mine site are capable of supporting only a limited suite of species, maximising the niche available to those species that are present. In addition the natural habitats present are common and widespread and the associated species would be expected to occur wherever suitable habitat conditions are present.
Three tree species *Acacia tortilis radiana* (*Talh*), *Maerua crassifolia* (*Atil*) and *Capparis decidua* (*Egnin*) are protected by national forestry legislation. This legal protection is not an indication of rarity or biodiversity value but is intended to protect vegetation as a natural resource of regional socio-economic importance. The requirements of the relevant national legislation for protected trees. The relevant articles from the Forestry Code are detailed below:

- Article 17...Any new clearing is subject to written authorisation from the territorially competent Administration, on advice from the competent technical services;
- Article 44 ...the pulling out, felling or mutilation of these forest species is prohibited except with authorisation from the Minister in charge of Forests; and
- The existing development includes permission for the removal of trees.

Mitigation planting is not included within the requirements of the legislation but negotiation of requirements with the relevant Ministries is proposed.

### 10.3 Potential Impacts

#### 10.3.1 Construction and Operation

Potential impacts may be temporary or permanent, direct or indirect and can occur either throughout the life of the Project or can be restricted to either the construction or operational phases. In the context of Phase 2, while it is entirely practical to separate out construction and operational impacts independently, there is little merit in doing so given the nature of the established ecological baseline and these are therefore presented together.

Phase 2 potential adverse impacts on the biodiversity of the Mine site are as follows:

- **Habitat loss:** This is a direct impact arising from Phase 2. The significance of this is related to the area lost, the proportion of the total and the ecology and biodiversity value of that habitat;
- **Habitat fragmentation:** Expanded areas for mining infrastructure can sever habitats, leaving areas too small to support viable populations, and create physical barriers to the movement of animals and plant propagules between areas cut off by the Project. 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; and
- **Cumulative impacts:** These are considered in two ways; firstly, the cumulative effect of the Project on the collective resource of particular habitats or species in the study area, or part of it; secondly, the cumulative impact of the Project in conjunction with other development projects expected to occur near the Project over a similar time period.

The potential impacts on biodiversity as a result of Phase 2 may include:

During construction:

- Clearance of vegetation and loss of habitat;
- Loss of protected trees;
• Soil erosion and dust impacts on vegetation;
• Noise and dust disturbance to wildlife;
• Involvement of wildlife in accidents with vehicles along N2 highway and Mine access road; and
• Changes to surface water drainage patterns.

During operations:
• Ongoing clearance of vegetation and loss of habitat;
• Loss of protected trees;
• Ongoing soil erosion and dust impacts on vegetation;
• Ongoing disturbance to wildlife due to noise and dust;
• Involvement of wildlife in accidents with vehicles along N2 highway and Mine access road, or bird strike to structures such as transmission lines;
• Changes to surface water drainage patterns; and
• Risk of wildlife death as a result of cyanide levels in tailings and solution circuit ponds.

Following Mine closure:
• Drying out of sewage lagoons; and
• Vegetation restoration.

Some impacts can be beneficial and some adverse but the majority of the impacts identified are negative.

10.3.1.1 Trees

The spatial area that will be potentially be affected by the proposed development within the perimeter fence is approximately 12,300 ha which includes 1,351 ha of land that is already very disturbed by previous and on-going mining activities.

Some of the habitats within this spatial area include three tree species which were recorded at low density across much of the Mine site (Acacia raddiana, Capparis decidua and Maerua crassifolia) which 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.

The approved EIA for the Mine site authorises tree removal, but suitable mitigation measures are subject to discussions with appropriate ministries.

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

10.3.1.2 Tailings Specific Impacts

During operations there is the low risk possibility for cyanide levels to be elevated above a critical threshold (i.e. above 50 ppm WAD cyanide). This could result in poisoning of resident and migratory wildlife drinking from water on Tailings Storage Facility 3 (TSF 3). However, the
The design of the tailings circuit for TSF 3 has been amended to include a cyanide destruction unit (CND) so this likelihood should be minimised.

The impacts associated with any unplanned elevated concentrations of cyanide in the tailings, given the introduction of the cyanide destruction unit, on fauna is assessed as adverse, medium to long term but of low significance.

During operations there is a low risk of wildlife poisoning following ingestions of water within the ponds associated with the dump and heap leach facilities by wildlife. The impact associated with the elevated levels of cyanide in the ponds is assessed as adverse, medium to long term.

10.3.2 Closure

Following cessation of operations, rehabilitation and closure activities will be undertaken as per the Rehabilitation and Closure Plan (Section 19).

Initial minor impacts 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 closure activities.

The majority of restoration will be passive (natural non-interventional). The removal of the infrastructure will enable natural restoration processes to proceed and for the landscape to return to a state, where practicable, which is in-keeping with the surrounding conditions.

The existing and waste water treatment lagoons will dry out over time removing a watering point for wildlife, for birds in particular, and the habitats dependent upon them. Not all water bodies used by wildlife are perennial and wildlife is adaptive in taking advantage of wetlands when they are around. For example, in early 2011 based on observations by workers, large numbers of wetland birds were seen using the site after the very high rainfall events resulted in areas of standing water.

Birds will travel long distances in the desert to find water and so it is assumed that they will learn over time that the current artificial water bodies no longer exist and find alternative wetland habitats. Other wildlife groups such as macro-invertebrates that may also be dependent on the wetlands will include groups that can fly in the adult life stage and so they also, will have the potential to disperse to other habitats.

The impact of closure on biodiversity is assessed as adverse, short to medium term and of low significance.

Good practice mitigation measures are given in Section 10.4.

10.4 Mitigation and Monitoring Measures

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 national legislation. A Biodiversity Management Plan shall be developed to incorporate the required mitigation and monitoring actions and shall be implemented by the Mine.
10.4.1 Construction and Operation

10.4.1.1 Verification of the Existing Baseline Conditions

At an agreed time prior to site clearance for the construction of the Phase 2 Project components, an ecologist should undertake a walkover or drive-by survey of the relevant land areas, as appropriate (i.e. depending on size of the relevant land areas, seasonal issues such as nesting or breeding seasons) This survey will allow a check for the presence of any newly established ecological constraints requiring mitigation as part of good practice e.g. active mammal dens, bird nests, etc. This will provide a final check to ensure that any new constraints are identified. The ecologist would advise on the appropriate course of action to be agreed with the Mine’s Environment Department for the Mine site, as necessary.

10.4.1.2 Habitat and Tree Loss

The mitigation requirements for Phase 2, primarily relate to the need to ameliorate direct and indirect losses of protected trees.

Habitat loss will be mitigated in part through natural regeneration of some of the development site at closure. TMLSA will implement agreed mitigation measures for the loss of trees protected under the Forestry Code (Acacia raddiana, Capparis decidua and Maria crassifolia) which are subject to discussion with the appropriate ministries.

10.4.1.3 Tailings/Cyanide Management

Kinross is a signatory to International Cyanide Management Code (ICMC) code and plans to certify the Mine as compliant with the code’s requirements (See Section 2.5). This will be the primary mechanism whereby the risks to fauna will be ameliorated.

The Project includes measures to reduce concentrations of weak acid dissociable (WAD) cyanide to acceptable values prior to tailings deposition. The strategy includes a tailings wash thickener arrangement that recovers cyanide back into the milling circuit; this helps to minimise the amount of liquid containing cyanide and other reagents required for the mineral extraction process entering the TSF. Additionally, a cyanide destruction (CND) circuit will be installed. Collectively, the cyanide recovery and destruction circuits will maintain WAD cyanide levels in accordance or below the Cyanide Code’s thresholds for open process water bodies.

The total cyanide levels in the final tails is designed with a maintenance level of 50 ppm with a target level of level of 10 ppm which is well below the critical level injurious to wildlife indicated in levels above 50 ppm WAD cyanide.

As a precaution, 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. It is not possible, to net large scale lagoons such as TSF 3. This approach is already used on-site for TSF 2.

As a precaution to minimise wildlife access to the dump leach process, the existing dump leach ponds were netted earlier in 2011, but due to wind damage there have been problems in maintaining the netting. Alternatives to the netting system are being investigated for the proposed ponds for Phase 2. The ponds that form part of the proposed dump and heap leach facilities will, where practically possible, utilise netting to prevent birds accessing these new water bodies. Audible and visual bird scares will also be used as an additional deterrence to birds using these water bodies.
Wildlife monitoring is already used to determine the numbers of birds and animals accessing the tailings and dump leach ponds. 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 Mine site will be assumed, as a precautionary measure to have suffered from cyanide poisoning and will be buried (although it is possible that birds have died of natural causes). Any wildlife incidents will be investigated and reported in accordance with the Mine’s existing procedures.

### 10.4.1.4 Other Mitigation Measures

During construction, apart from during the main excavation activities dust generation will be reduced as ground preparation includes some moistening the soil, in order to improve compaction properties. This will generally reduce the generation of dust and any associated effects on vegetation in the immediate vicinity of the relevant disturbing activities (see Section 7).

During construction and 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. Speed restrictions and driver training will also result in reduced levels of disturbance to wildlife and the generation of dust (see Section 7 and 14).

There is a potentially slightly higher risk of injury to wildlife and also domestic beasts such as camels in relation to construction traffic from the port through Nouâdhibou to the Mine as speed limits are higher on the open roads than within the Mine site.

### 10.4.2 Closure

At closure, where appropriate, infrastructure will be removed and a strategy will be implemented via the Rehabilitation and Closure Plan (see Section 19) to optimise conditions for the natural re-establishment of native biodiversity

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

### 10.4.3 Monitoring

A monitoring protocol will need to be developed to provide an auditable record of the success of the mitigation completed.

Monitoring should be undertaken on the vegetation and tree populations within the Mine site to identify any changes that can be attributed to effects resulting from the Project, such as changes to surface water drainage patterns. The monitoring of the predicted outcomes of an EIA is part of good ecological practice.

The TMLSA Environmental Department shall complete inspections to ensure compliance with Project requirements for biodiversity mitigation. As appropriate, the TMLSA Environmental Department shall advise the contractor and/or specify when an ecologist needs to be used for a walkover or drive through of areas of new disturbance prior to site clearance.

The TMLSA Environmental Department shall expand its routine monitoring of existing facilities to include the new infrastructure, in particular, TSF 3, dump and heap leach facilities and monitor any avian or mammalian mortality at these facilities and apply its investigation and
notification procedure to all incidents. Records will be kept of all other animal mortalities (e.g. road kill, bird collisions with transmission wires / fences, and any snakes killed by workers).

It is recommended that regular inspections are undertaken to identify signs of any invasive flora and fauna so that suitable eradication measures can be instigated at an early stage when eradication efforts are more likely to be successful. This could be implemented at least in part of their routine surveillance of the site. Only World Health Organisation (WHO) approved poisons or pesticides and/or suitable traps should be used for eradication of invasive, alien species.

In addition to the on-going ecology surveys, the TMLSA Environmental Department shall record any incidental sightings of wildlife made outside of their normal monitoring work. Relevant information on flora and fauna may also be provided by other members of the Mine site workers and these should be followed up by the TMLSA Environmental Department.

10.5 Cumulative Impacts

Some changes in land use and minor disturbance have occurred as part of Phase 1 but most of this has been undertaken in areas already disturbed by existing Mine activities. No other development projects are expected to occur near the Mine over a similar timeframe.

The assessment of cumulative effects can be restricted to those effects that could be a major factor in determining the acceptability of the development from a biodiversity standpoint and hence may affect the eventual planning decision. Given this, the assessment of potential cumulative effects need only consider certain types of species and habitats. These are:

• Species and habitats considered of high biodiversity conservation importance; and/or
• Species and habitats considered to be vulnerable by virtue of their behaviour or ecology.

In addition to the above, the attributes of species populations that increase their vulnerability to cumulative effects are:

• Individuals with large home or feeding ranges in relation to the area affected;
• Populations suffering from other sources of habitat loss;
• Rarity and/or scale and rate of decline;
• Limited capacity to replace ‘lost’ individuals due to, for example, low breeding rates or the absence of a surplus pool of non-breeding animals; and
• Regularity of use of flight lines between feeding and roosting areas.

No such species or habitats have been identified as a result of the studies undertaken to date. As a consequence, no adverse cumulative effects are predicted, with or without mitigation.
10.6 Evaluation of Mitigated Impacts

10.6.1 Construction and Operation

The overall significance of the residual biodiversity impacts associated with construction and operation are assessed to be adverse, medium to long term and of negligible to low significance.

Given the lack of any predicted significant biodiversity effects as a result of the Project, and taking account of the proposed mitigation, Phase 2 can be undertaken in accordance with the requirements of IFC Performance Standard 6.

10.6.1.1 Habitats and Vegetation

The total requirement for new development land is approximately 8,000 ha of already disturbed habitat. These areas include: the expansion of the open pit; waste rock dumps; TSF 3; accommodation camp; CIL process plant; power plant; heap leach and dump leach facilities; expanded waste management facility and internal roads.

Clearance of vegetation and associated loss or changes to vegetation due to changes in surface water drainage patterns (for the latter see Section 10.4.3) will be the main impacts during construction and operation. None of the habitats and vegetation communities that will be impacted are threatened or of limited extent (locally, nationally or internationally), or are otherwise considered as critical habitat (as defined in IFC Performance Standard 6) for rare or threatened flora and fauna.

None of the vegetation communities recorded are of high biodiversity value in their own right.

Given the above considerations, the predicted impact on habitats and vegetation, excluding protected trees, is assessed as adverse, long term and of low significance.

Most of the land within the Mine site is of a gravelly reg habitat type which would be relatively invulnerable to erosion (but they would still generate dust). Areas of looser sandy deposits only occur locally and while these could destabilise if disturbed this would only happen in limited areas with limited potential to spread and within the context of adjacent natural areas of mobile and stable dune habitats. Because such disturbances and dust deposition are likely to be comparable with the existing baseline situation, 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.

The predicted impact on habitats as a result of dust generation and deposition is assessed as adverse, medium term and of low/negligible significance.

10.6.1.2 Flora and Fauna

During construction, individual species of flora and fauna will be affected by the loss habitat. However, the total habitat resource is extensive throughout northern Mauritania and wider North Africa. The diversity of species associated with Mine site habitats is limited, none of the species identified within the Mine site apart from a single observation of an Egyptian vulture are threatened or rare and all would be expected to be widely distributed wherever there is suitable habitat. Given the relatively localised land requirements (in the context of the total available habitat resource at the regional level), a proportion of which is within the existing footprint of the active 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 an initial peak in human activity and associated disturbance but some considerable disturbance will continue into the operational phase due to the increased levels of production and associated increase in vehicle and equipment movements that accompanies the operation and maintenance of the Mine site. 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 hr operation, 365 days/a. 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. It must be acknowledged that the Project will mean that much of the Mine site will be affected by mining activities, potentially resulting in a reduction in the habitat available to wildlife relative to the baseline conditions. That said it is also reasonable to assume that some of this effect will be absorbed as the habitats within the site form part of a contiguous extensive desert ecosystem. The wildlife species present will gradually habituate due to the presence of large machinery and workers, particularly away from the footprint of the main Mine infrastructure, as they have already done in the context of the existing Mine infrastructure. Regardless, none of the species recorded were rare, otherwise notable or restricted to the Mine site, so any effects associated with the Project will only be measurable at the scale of the Mine site and will not affect the favourable conservation status of the relevant species in the wider region.

Based on the relatively low densities of fauna observed within the Mine site it is unlikely that accidents with vehicles and machinery would be any more than a rare occurrence. Many species, birds included, are more likely to be displaced by the noise of approaching vehicles and machinery before they would 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. Although there is a potentially higher risk of injury to wildlife (fairly uncommon), accidents involving domestic livestock animals are more likely. However, this risk is reduced by the fact that the traffic will travel along existing well defined roadways primarily during daylight hours. In the case of many native faunal species such as gerbils and owls these will not potentially be affected as they are nocturnal.

The predicted impact on fauna and flora as a result of disturbance and accidents is assessed as adverse, medium to long term and of low significance.

As a security measure a perimeter fence has been installed around the Mine and, while not part of the Project, it may benefit the flora within the Mine site as it excludes livestock grazing. This may allow a beneficial increase in tree cover and vegetation cover, structure and quality within undisturbed areas of the Mine site, potentially counteracting some of the habitat loss.

### 10.6.1.3 Surface Water Management

Phase 2 has the potential to disrupt surface water drainage patterns both on and off the Mine site, especially in the western and northern ends of the Mine site, resulting in indirect effects on vegetation and flora. The construction of diversion ditches and bunds will also result in a temporary loss of habitat and long term changes to habitat. Such affects will be localised and
the affected areas are still expected to be capable of supporting typical desert flora. Alterations in drainage patterns may alter the relative distributions of vegetation and flora typical of wadis and drier areas respectively, but there should be no material net loss of surface water as a whole and therefore the affects should manifest through a redistribution in vegetation types and individual plant species relative to the baseline conditions, but overall there should be no net long term loss of vegetation and flora as a result of changes in drainage patterns alone.

As identified in the previous section, vegetation and flora will be mainly affected as a consequence of land requirements for the Project against which minor redistributions due to changes in drainage patterns will be relatively inconsequential (see Section 6).

The predicted impact on vegetation and dependent fauna as a result of changes to surface water drainage is assessed as adverse, long term and of low/negligible significance.

10.6.1.4 Tailings/Cyanide Management

The significance of the impact of the solution recovery ponds of new dump and heap leach facilities and TSF is difficult to predict as the bird monitoring data collected through carcass recovery and observations of bird usage of the existing facilities was not available at the time of this assessment. Therefore extrapolation of the impact assessment of the existing facility on wildlife to the proposed facilities has not been possible.

While the level of cyanide within the tailings lagoons is to be managed via the design specifications and described operational mitigation measures, the possibility of an occasional exceedance cannot be entirely discounted. It is acknowledged that there have been some (historical) bird and livestock mortalities associated with the existing TSF 2. Although, the Mine site monitoring data for bird usage of the tailings lagoons and dump leach facility and faunal mortalities on the Mine site was not available for this assessment.

The theoretical likelihood of impacts occurring is considered limited, on the basis of the mitigation standards already adopted at the Mine (see Section 10.5) the implementation of the new cyanide destruction circuit and larger mammals (camels and livestock) continuing to be excluded from the Mine site by the perimeter fence. Audio-bird scaring strategies are currently deployed to deter birds from using the existing TSF 2, heap and dump leach facility. Additionally, visual deterrents to birds will also be used for Phase 2.

The mitigated impact associated with elevated concentrations of cyanide in the tailings, heap and dump leach facilities ponds on fauna is assessed to be of potentially of low significance.

10.6.2 Closure

The significance of the residual biodiversity impacts occurring during and post closure are assessed to be low as the aim is to return the site to conditions broadly comparable to the baseline conditions.

No adverse cumulative effects are predicted, with or without mitigation.

10.7 Summary

A summary of the potential impacts on biodiversity, with mitigation applied, as a result of the construction, operation and decommissioning of the Project is presented in Table 10-2.
### Table 10-2: Summary of Potential Residual Impacts\(^1\) - Biodiversity

<table>
<thead>
<tr>
<th>Location</th>
<th>Nature of Impacts</th>
<th>Mitigation Measure</th>
<th>Project Phase(^1)</th>
<th>Nature(^2)</th>
<th>Duration(^2)</th>
<th>Significance(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mine site</td>
<td>Clearance of vegetation and loss of habitat</td>
<td>Implementation of mitigation program to be agreed with appropriate ministries</td>
<td>C       O</td>
<td>Adverse</td>
<td>Medium term</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Disturbance and displacement of wildlife.</td>
<td>Vehicle movements will be in accordance with Mine guidelines and speed limits</td>
<td>C       O       D</td>
<td>Adverse</td>
<td>Short to medium term (depending on the sensitivity of individual fauna)</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Wildfire (bird) mortality as a result of cyanide poisoning.</td>
<td>Treatment of tailings to Kinross-adopted ICMI standards to remove cyanide. Monitoring to verify lack of harm to wildlife and usage of TSF and dump leach facility by birds Precautionary bird scaring</td>
<td>O</td>
<td>Adverse</td>
<td>Short to Medium term</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Invasive / alien species</td>
<td>Survey for presence and destroy / remove as appropriate No non-native plant stock to be brought onto the site</td>
<td>C       O       D</td>
<td>Adverse</td>
<td>Medium term</td>
<td>Low</td>
</tr>
</tbody>
</table>

\(^1\)Project Phase: C = Construction, O = Operation, D = Decommissioning and Closure

\(^2\)Duration and significance refer to the predicted impact after the implementation of proposed mitigation measures and is based on the ratings provided in 5.2.
11 **Socio-Economic**

This Section presents the methodology and baseline conditions used to assess the potential socio-economic impacts resulting from implementing Phase 2 of the Project. In addition, this Section proposes mitigation measures which aim to avoid, reduce, remediate or compensate for potential impacts and includes an assessment of the residual impacts (impacts after mitigation measures are implemented).

This Section is structured as follows:

- **Section 11.1** – Defines the area of influence for the assessment of Phase 2 socio-economic impacts;
- **Section 11.2** - Details the methodology and approach taken for the assessment;
- **Section 11.3** - Provides quantitative baseline data covering the national and local economy; demographics, employment, education; and living conditions. In addition this Section summarises qualitative baseline data on perceived impacts and attitudes to the Project;
- **Section 11.4** – overviews the approach to mitigation, including relevant embedded mitigation measures and committed TMSLA/Kinross actions which are already part of the Project design.;
- **Section 11.5** - outlines the potential impacts of Phase 2 of the Project;
- **Section 11.6** – Evaluates the predicted direct and indirect socio-economic impacts for construction, operation and closure phases of the Project taking account of the embedded mitigation. This Section also outlines the cumulative impacts of the existing Mine operations for Phase 1 and Phase 2 of the Project;
- **Section 11.7** – Examines cumulative impacts of Phase 2; and
- **Section 11.8** - Presents a summary of potential residual socio-economic impacts of Phase 2 of the Project.

### 11.1 Area of Influence

The Phase 2 Project components described in Section 3 will all be located within the perimeter fence that surrounds the existing Mine site; however, the potential socio-economic impacts may extend beyond the boundaries of the Mine site.

The Mine site is located within the Inchiri Wilaya. The area of influence of the Project will include the commune of Bennichab and, Akjoujt, the administrative centre of the Wilaya.

In addition, the area of influence will include areas near the Mine site and along the access routes including areas within the Dakhlet Nouâdhibou Wilaya:

- **Zone A**: Is an area within daily travel distance to the Mine and is located within an approximate 30 km radius of the Mine site (located within Inchiri Wilaya). There are no established communities within this area, although there are three named settlements with a mixture of tents and simple wooden shacks, without established government or services.
- **Zone B**: Includes the Mine access road and from its junction with the Nouakchott-Nouâdhibou N2 highway and the N2 highway from 170 km to 300 km north of Nouakchott (located predominantly within Inchiri Wilaya). There are several informal settlements in this area.
zone, including a few families living at the junction of the Mine access road and the N2 highway.

- **Zone C:** Includes the Nouakchott-Nouâdhibou N2 highway, from the junction of the Mine access road to the entrance of Nouâdhibou city (located within Dakhlet Nouâdhibou Wilaya). In addition to several informal settlements, this zone includes the Boulenouar, a village of approximately 1,500 that has an elected mayor.

- **Zone D:** Nouâdhibou city including the port area (within the Dakhlet Nouâdhibou Wilaya).

The area of influence for Phase 2 was defined using Geographic Information System (GIS) mapping, site visits, discussions with stakeholders and knowledge gained during previous assessments (SNC Lavalin, 2004, Scott Wilson 2008a, b, c, d, 2009a, b, 2010a, URS Scott Wilson 2011h) as well as a specific community study undertaken by a local sub-consultant on the nomadic/semi-nomadic community 30 km around the Mine site (ONG-AFE, 2011c).

The area of influence is shown in Figure 11-1.

### 11.2 Methodology

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

This Section draws on primary data gathered from community surveys, a survey of workers on the Mine site, stakeholder interviews, community meetings undertaken by the TMLSA Community Relations (CR) Team, feedback obtained during consultation exercises (including public meetings forming part of the EIA permitting process), as well as secondary data obtained through a review of published sources. The following stages were followed for this assessment:

- **Review of existing socio-economic data at national and regional level:** 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 (WHO) data and the national Strategic Framework to Combat Poverty 2011-2015;

- **Primary data collection:** Quantitative and qualitative socio-economic data were obtained for the communities that could be either directly or indirectly affected by the Project. Primary data collection involved the following activities:
  - Qualitative social surveys: Four community and stakeholder engagement exercises were conducted by a local sub-consultant and TMLSA’s Community Relations team as part of the qualitative social surveys. These included: initial qualitative survey in the area near the Mine (April 2011); community relations team missions between October and November 2011; stakeholder consultations (at various times between May and November 2011); public consultations (May and November 2011); and focus groups (November 2011). Qualitative data was collected through semi-structured interviews and focus groups with community members. The qualitative surveys aimed to raise local community awareness regarding the Project and to collect socio-economic information on the communities residing in the area of influence.
  - Detailed quantitative social surveys were undertaken working with a local sub-consultant team, covering 1,446 households and 196 Income Generating Activities (IGAs) across Zones A, B, C and D. Data was collected using three surveys between May and July, 2011: -Household survey: Collected data regarding: (i) the population’s
socio-demographic characteristics, (ii)- housing conditions and standard of living and (iii)- the population’s perception of the impacts of mining activities on their daily life and economy.

- Income Generating Activities (IGA) survey: Collected data regarding: (i)- the IGA characteristics, (ii)- production conditions and employment and (iii)- the IGAs managers’ perception of the mining activities impacts.

- Infrastructure survey: Collected data regarding the basic infrastructures available in the visited villages.

- **Public consultation**: As part of the EIA permitting process public meetings were held to outline the Project components and the likely environment and social impacts within each Phase. The public meetings were also a forum to seek comment on stakeholder concerns. Comments raised during these meetings have provided insight into community concerns and those relevant to socio-economic impacts have been acknowledged in the baseline and assessment of impacts for Phase 2 of the Project. A full description of the stakeholder consultation for the Project is outlined in Section 20.

- **Labour assessment**: A review of current and proposed employment numbers, recruitment processes, training and welfare provisions including transport and accommodation, terms and conditions of employment for both TMLSA and contractor workforces was undertaken. Separately TMLSA have commissioned a limited survey of Mine workers, contractor workers and employment seekers. Semi-structured interviews and focus groups were undertaken to canvas views from permanent workers both on and off the Mine site, workers employed by contractors and some wives of workers. Questions were asked on worker conditions, health and safety, living conditions and contractual arrangements. Preliminary findings of the workers survey have been included in this assessment where relevant.

- **Social impact assessment (SIA)**: Based on the above, baseline data and Phase 2 Project components were analysed to determine likely impacts. The SIA considered the potential socio-economic impacts resulting from both environmental and social changes due to Phase 2 of the Project 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.

### 11.3 Baseline Conditions

#### 11.3.1 National Baseline

##### 11.3.1.1 National Economy

Mauritania’s gross domestic product (GDP) was an estimated US $3.799 billion in 2009 with a Gross National Income (GNI) per capita of US$2,100 (World Bank, 2009). In 2010, the Mauritanian economy grew by an estimated 4.7%, compared to a contraction of 1.2% in 2009.

Mauritania’s GDP is currently made up by agriculture (12.5%), services (40.7%) and industries (46.7%). 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 (FAO, 2009).

Mauritania remains among the world’s poorest countries, ranked 136th of 169 countries in the United Nations Human Development Index in 2010. Currently 20.8% of the urban population and 59% of the rural population are below the poverty line (ONS, 2008). However, the
The proportion of the total Mauritanian population whose income is less than US$1 a day has decreased from 57% in 1990 to 42% in 2008 (see Table 11-1).

The current government plan for improving the economy is to reduce the levels of poverty. Mauritania’s Strategic Framework for the Fight against Poverty (2011-2015) based on Law No. 050-2001 (25 July 2001) aims to fight poverty at a national and regional level. The main objectives are:

- To reduce the overall incidence of poverty to 25% (of which rural poverty is reduced to 35%);
- To increase the GDP per capita to more than US$ 1,374, the rate of GDP growth to 4.7% and the rate of investment (% of GDP) to 28.1%;
- Maintain the inflation rate at 5%;
- Ensure universal access to education and reduce the illiteracy rate among adults over the age of fifteen years to 15%; and
- Increase percentage of population with access to water connections (rural and urban) to 74%.

The MDG used by the United Nations (UN) and leading development institutions to assess progress toward poverty reduction are a useful framework to characterise the socio-economic situation in Mauritania. Table 11-1 provides a summary of key MDGs indicators for Mauritania, including past performance (1990 and 2008) and the targets for 2015.

### Table 11-1: Relevant MDG Indicators for Mauritania – Including Past Performance and Future Targets

<table>
<thead>
<tr>
<th>Millennium Development Goal (MDG)</th>
<th>Past Performance</th>
<th>MDG Target 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goal 1. Eradicate extreme poverty and hunger</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Target 1.A Halve the % of people with income of &lt; US$1-a-day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proportion of population below the poverty line</td>
<td>56.6%</td>
<td>42%</td>
</tr>
<tr>
<td>Target 1.B Achieve full and productive employment and decent work for all, including women and young people</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total proportion of employment/ population</td>
<td>n/a</td>
<td>27%</td>
</tr>
<tr>
<td>Unemployment rate</td>
<td>n/a</td>
<td>31.2%</td>
</tr>
<tr>
<td>Target 1.C Halve, between 1990 and 2015, the proportion of people who suffer from hunger</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proportion of children under 5 that are underweight</td>
<td>47%</td>
<td>39.4%</td>
</tr>
<tr>
<td><strong>Goal 2. Provide primary education for all</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Target 2.A. Ensure that all children complete primary school</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary school net enrolment</td>
<td>49%</td>
<td>71.6%</td>
</tr>
<tr>
<td>Percentage of pupils finishing primary school</td>
<td>73.8%</td>
<td>49.3%</td>
</tr>
<tr>
<td>Literacy rates (15-24)</td>
<td>45.8%</td>
<td>77.5%</td>
</tr>
<tr>
<td><strong>Goal 3. Promote gender equality and empower women</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Target 3.A. Eliminate gender disparity in primary and secondary education, preferably by 2005, and in all levels of education no later than 2015</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Millennium Development Goal (MDG)

<table>
<thead>
<tr>
<th>Between 1990 and 2015</th>
<th>Past Performance</th>
<th>MDG Target</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1990</td>
<td>2008</td>
</tr>
<tr>
<td><strong>Ratio of girls/boys in primary school</strong></td>
<td>0.72%</td>
<td>1.02%</td>
</tr>
<tr>
<td><strong>Proportion of seats held by women in parliament</strong></td>
<td>n/a</td>
<td>17.8%</td>
</tr>
</tbody>
</table>

#### Goal 4. Reduce child mortality

**Target 4.A.** Reduce by 2/3 the under-five mortality rate

- **Under-five mortality rate (per 1,000):**
  - 1990: 137.0
  - 2008: 135.0
  - MDG Target: 45.7

- **Infant mortality rate (per 1,000):**
  - 1990: 126.0
  - 2008: 87.0
  - MDG Target: 42.0

#### Goal 5. Improve maternal health

**Target 5.A.** Reduce by 3/4 the maternal mortality ratio (per 100,000 births)

- **Maternal mortality ratio (for 100,000 births):**
  - 1990: 930
  - 2008: 686
  - MDG Target: 232

**Target 5.B.** Achieve universal access to reproductive health

- **Proportion of married women (15-49) using a contraceptive method:**
  - 1990: 5%
  - 2008: 9%
  - MDG Target: 100%

#### Goal 6. Combat HIV/AIDS, malaria and other diseases

**Target 6.** Halt and begin to reverse HIV/AIDS

- **HIV prevalence (%):**
  - 1990: 0.6%
  - 2008: 0.6%
  - MDG Target: ≤ 6%

- **Number of deaths among children (under 5) due to malaria:**
  - 1990: -
  - 2008: 6%
  - MDG Target: ≤ 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:**
  - 1990: 37%
  - 2008: 62%
  - MDG Target: 68.5%

- **Population with access to sanitation facilities:**
  - 1990: n/a
  - 2008: 21.8%
  - MDG Target: ≤ 0.5%

### 11.3.1.2 Population and Demographics

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 Mauritanian National Statistics Office (ONS, 2008), the annual population growth rate is stable at 2.4%.

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 cities 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 ONS, 2008) (see Table11-2). Rural population growth is expected to decline as migration to urban areas increases.

Demographically, Mauritania is young, with 70% of the population under the age of 29. Mauritania’s population pyramid for 2008 is typical of an ‘expanding’ population that is...
characterised by a high birth rate, a high mortality rate and low life expectancy. The pyramid also shows that a high proportion of the population is in working age (Figure 11-2).

**Figure 11-2: Mauritania’s Population Pyramid**

For Mauritanian males, life expectancy at birth is 55 years; females have a slightly higher life expectancy of 60. The adult mortality rate is on the other hand significantly lower in comparison with the WHO African Region, with Mauritania’s mortality rate (per 1,000) at 325 for males and 246 for females. The infant mortality rate has decreased to 87 per 1,000 in 2008 compared with 126 per 1000 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 Table11-1). 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.

### 11.3.1.3 Employment

The labour market is dominated by the agriculture and trade sectors. As shown in Figure 11-3, over half of the employed population is engaged in activities related to agriculture or trade. The agricultural sector alone accounts for 27% of total employment in Mauritania, 34% when including livestock activities. Trade, with 24% of the employed, is the second biggest sector. Services and the administration represent respectively 10% and 8% of total employment. The fishing and mining sectors, which provide virtually all of the country’s export revenues, together employ only 4% of all workers. However, on aggregate, the tertiary sector of the economy absorbs the greatest number of people in Mauritania.
Mauritania’s labour market is characterised by lower participation rates, lower employment-to-population rates, and relatively higher unemployment rates than in neighbouring countries. Women systematically earn less than men independently of their sector and type of employment and controlling for other factors, such as education. Young adults face considerable difficulties in entering the labour market: more than half of the population aged 15–24 is neither studying nor participating in the labour force (World Bank, 2009).

11.3.1.4 Education

Mauritania’s literacy rate is 57% with an average of 4.4% of the GDP being invested in the education system. The literacy rate among young people aged 15 to 24 is higher at 78%, this has risen from 45.8% since 1990 (see Table11-1). 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 Table11-1). The ratio of girls/boys in primary school is now roughly 1 to 1, an increase from 0.72 in 1990 (see Table11-1). 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% (ONS, 2008). The Université de Nouakchott, the only university in the country, has an enrolment of roughly 10,000 students (A.C.A, 2007).

11.3.1.5 Health

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). Table11-2 below shows numbers of health facilities and health professionals in Mauritania.
Table 11-2: Health Facilities and Health Professionals

<table>
<thead>
<tr>
<th>Health</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Health Facilities</td>
<td>443</td>
<td>433</td>
<td>478</td>
<td>478</td>
<td>493</td>
</tr>
<tr>
<td>Health Posts</td>
<td>379</td>
<td>367</td>
<td>411</td>
<td>411</td>
<td>426</td>
</tr>
<tr>
<td>Health Centres</td>
<td>64</td>
<td>66</td>
<td>67</td>
<td>67</td>
<td>67</td>
</tr>
<tr>
<td>Geographical Accessibility to facilities (5km radius -%)</td>
<td>58.7</td>
<td>55.4</td>
<td>65</td>
<td>65</td>
<td>...</td>
</tr>
<tr>
<td>National Hospital Capacity (beds)</td>
<td>389</td>
<td>389</td>
<td>368</td>
<td>430</td>
<td>430</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Medical Staff</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Doctors</td>
<td>N/A</td>
<td>N/A</td>
<td>426</td>
<td>426</td>
<td>458</td>
</tr>
<tr>
<td>Number of Pharmacists</td>
<td>62</td>
<td>73</td>
<td>82</td>
<td>82</td>
<td>81</td>
</tr>
<tr>
<td>Number of Dentists</td>
<td>47</td>
<td>72</td>
<td>77</td>
<td>77</td>
<td>84</td>
</tr>
</tbody>
</table>

According to the Annual Health Survey, the main health problems in Mauritania include malaria, tuberculosis, measles, dysentery, and influenza. Pregnancy complications are common due to unhygienic conditions and lack of medical care. The incidence of people living with HIV/AIDS is low. In 2009, 14,000 people (adults and children) were living with HIV/AIDS and the adult prevalence rate was 0.7% (UNAIDS, 2009).

11.3.1.6 Access to Water

According to data obtained from the ONS (2008), the percentage of the local population that have access to drinking water increased from 37% in 1990 to 62% in 2008. Residents have expressed an increase in the satisfaction of water services and facilities as of 2008, with 87% of the population expressing an improvement in the services (a 29% increase from 2004). Within the Nouakchott Wilaya, approximately 90% of the population have access to water services and facilities, however in rural areas the rate significantly decreases to approximately 15%.

11.3.1.7 Access to Electricity

Within the municipalities of Nouâdhibou (92%), Nouakchott (76%), Tiris-Zemmour (91%) and Inchiri (54%) there is a significantly high rate of electrification. According to national statistical data, there is a growing trend in access to electricity as the primary source of lighting of households. This is largely dependent on income however, as only 3.7% of the poorest household have access to electricity, while 60.8% of households with a higher income benefit from electricity. The main sources of lighting for rural households are the torch (78%) and the candle (10%) (ECFA, 2010) (see Figure 11-4).
11.3.2 Local Baseline Data

11.3.2.1 Local Economy

The economy of the Inchiri Wilaya where the Mine is located is largely based on agriculture and mining. In addition to the Mine, there is an operating copper-gold mine near Akjoujt (the Guelb Moghrein mine operated by Mauritanian Copper Mines MCM a subsidiary of First Quantum Minerals Ltd.) Other deposits that have been identified and which may be developed in the future include the Lebtheinia (Xstrata) iron ore deposit near the Mine, the Tirjit gold project and Akjoujt copper/gold project (Gryphon), and the Tomagat iron ore target near Akjoujt (Bumi).

Additional industries within Inchiri Wilaya include a water bottling plant in Bennichab 130 km south east of the Mine site.

Based upon the 2008 survey of living conditions in Mauritania, about 19.6% of the households in Inchiri Wilaya, and 31% of individuals are living below the poverty line. In the same study, poverty levels within the Dakhlet Nouâdhibou Wilaya were 12.4% and 22.1% for households and individuals, respectively. Poverty levels are high within the area of influence of the Project; respondents to the quantitative study reported average household expenditure per capita below $2/day (BEAS, 2011).

<table>
<thead>
<tr>
<th>Currency</th>
<th>Zone A</th>
<th>Zone B</th>
<th>Zone C</th>
<th>Zone D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ouguiya</td>
<td>395</td>
<td>449</td>
<td>455</td>
<td>548</td>
</tr>
<tr>
<td>US$</td>
<td>1.40</td>
<td>1.60</td>
<td>1.70</td>
<td>2.00</td>
</tr>
</tbody>
</table>

11.3.2.2 Regional and Local Population Baseline

The Mine site is based in the Inchiri Wilaya, a region covering approximately 41,700 km² (SNC Lavalin, 2004). The region has a very low population density, with approximately 9,936 inhabitants (approximately 0.3% of the total population of Mauritania) (ONS, 2008). The Wilaya is made up of the administrative capital, Akjoujt Moughataa and two main communities, Akjoujt and Bennichab.
Inchiri has the lowest population of all the regions in the country, and according to ONS 2008, the population is projected to decline in the region (see Table 11-4).

The area of influence also includes the Dakhlet Nouâdhibou Wilaya. Most of the population of the Wilaya is concentrated in Nouâdhibou, with larger settlements Boulenouar and Nouamghar. There is a water bottling plant in Boulenouar.

Based on the Office for National Statistics census data from 2000, demographic and population data has been extrapolated at the regional level for the three districts in the Project’s study area to compliment data obtained from the quantitative surveys.

**Table 11-4: Summary of population at the regional level**

<table>
<thead>
<tr>
<th>District</th>
<th>Total</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Male</td>
</tr>
<tr>
<td>Inchiri</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inchiri 2000</td>
<td>5946</td>
<td>5554</td>
</tr>
<tr>
<td>Inchiri 2008*</td>
<td>4283</td>
<td>5653</td>
</tr>
<tr>
<td>Dakhlet Nouâdhibou</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nouâdhibou 2000</td>
<td>46846</td>
<td>32670</td>
</tr>
<tr>
<td>Nouâdhibou 2008*</td>
<td>70684</td>
<td>47475</td>
</tr>
<tr>
<td>Nouakchott</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nouakchott 2000</td>
<td>294686</td>
<td>263509</td>
</tr>
<tr>
<td>Nouakchott 2008*</td>
<td>471243</td>
<td>375628</td>
</tr>
</tbody>
</table>

*2008 population projections based on ONS Census Data from 2000

The quantitative household survey conducted in June 2011 provides more detailed population data for the Project’s area of influence (in particular Zones A, B, C for which discrete census data are not available). The results show the continued transition away from nomadism, as the large majority of respondents stated that they were sedentary dwellers and only a very small minority of respondents (Zone B) characterised themselves as being nomad dwellers (16%). Table 11-5 below outlines information on the communities and populations assessed in the quantitative surveys in Zones A-D.

**Table 11-5: Surveyed Population within each Zone (A, B, C and D)**

<table>
<thead>
<tr>
<th>Village</th>
<th>Number of Households</th>
<th>Average per Household</th>
<th>Age</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Temporaty structure</td>
<td>Fixed Structure</td>
<td>0-14 years</td>
<td>15-64 years</td>
</tr>
<tr>
<td>Guelb Dawass</td>
<td>40</td>
<td>0</td>
<td>49</td>
<td>125</td>
</tr>
<tr>
<td>Ntalve</td>
<td>7</td>
<td>0</td>
<td>49</td>
<td>125</td>
</tr>
<tr>
<td>Emkebden</td>
<td>5</td>
<td>0</td>
<td>49</td>
<td>125</td>
</tr>
<tr>
<td>Sub-Total</td>
<td>54</td>
<td>0</td>
<td>5</td>
<td>75</td>
</tr>
</tbody>
</table>

*Numbers expressed as a %
<table>
<thead>
<tr>
<th>Village</th>
<th>Number of Households</th>
<th>Average per Household</th>
<th>Age</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Temporary structure</td>
<td>Fixed Structure</td>
<td>0-14 years</td>
<td>15-64 years</td>
</tr>
<tr>
<td>Zone B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Akoueyjatt</td>
<td>30</td>
<td>0</td>
<td>35</td>
<td>111</td>
</tr>
<tr>
<td>Um Lekaab</td>
<td>26</td>
<td>0</td>
<td>32</td>
<td>70</td>
</tr>
<tr>
<td>Nassri</td>
<td>21</td>
<td>0</td>
<td>23</td>
<td>67</td>
</tr>
<tr>
<td>Ghreid Goumyatt</td>
<td>12</td>
<td>0</td>
<td>9</td>
<td>33</td>
</tr>
<tr>
<td>Chami</td>
<td>1</td>
<td>2</td>
<td>103</td>
<td>145</td>
</tr>
<tr>
<td>Virage Tasiast</td>
<td>3</td>
<td>2</td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td>Sub -Total</td>
<td>143</td>
<td>4</td>
<td>210</td>
<td>437</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zone C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wad Chebka</td>
<td>16</td>
<td>11</td>
<td>35</td>
<td>86</td>
</tr>
<tr>
<td>Chalkha</td>
<td>21</td>
<td>0</td>
<td>30</td>
<td>69</td>
</tr>
<tr>
<td>Lehdeyba</td>
<td>17</td>
<td>0</td>
<td>23</td>
<td>41</td>
</tr>
<tr>
<td>Al Baragua</td>
<td>11</td>
<td>11</td>
<td>36</td>
<td>62</td>
</tr>
<tr>
<td>Boulenouar</td>
<td>40</td>
<td>261</td>
<td>543</td>
<td>950</td>
</tr>
<tr>
<td>Al Aywaj</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>28</td>
</tr>
<tr>
<td>Swayssi</td>
<td>17</td>
<td>15</td>
<td>42</td>
<td>130</td>
</tr>
<tr>
<td>Carriere</td>
<td>7</td>
<td>4</td>
<td>11</td>
<td>41</td>
</tr>
<tr>
<td>Sub -Total</td>
<td>133</td>
<td>304</td>
<td>722</td>
<td>1407</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zone D</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nouâdhibou</td>
<td>1,406</td>
<td>11,230</td>
<td>26,002</td>
<td>49,058</td>
</tr>
<tr>
<td>Sub -Total</td>
<td>12,836</td>
<td>6.0</td>
<td>26,002</td>
<td>49,058</td>
</tr>
<tr>
<td>TOTAL</td>
<td>14,201</td>
<td></td>
<td>27,009</td>
<td>51,069</td>
</tr>
</tbody>
</table>

In Zones A, B and C the survey covered 100% of the households. In Nouâdhibou (Zone D), a sample of 800 households were selected and interviewed. Where noted in the following sections, the data provided for Zone D are extrapolations for the entire population of Nouâdhibou based on the household survey conducted (BEAS 2011).
11.3.2.3 Regional and Local Employment & Livelihood

Within the Inchiri Wilaya, there is high unemployment among working age adults. According to census data from 2000, 21.7% of the total adult population in the Inchiri Wilaya are unemployed.

According to the data collected from the quantitative surveys, it is evident that the level of unemployment within the rural and remote areas is also relatively high, although significantly lower than in the Inchiri Wilaya. Zone A, B and C are characterised by relatively high rates of unemployment, which corresponds to the national average of 31.2%. Zone B has the highest level of unemployment and, as may be expected, the lowest level is in the urban area of Nouâdhibou in Zone D (see Table11-6).

Table11-6: Employment Data

<table>
<thead>
<tr>
<th></th>
<th>National Average</th>
<th>Zone A</th>
<th>Zone B</th>
<th>Zone C</th>
<th>Zone D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour Force</td>
<td>52.4%</td>
<td>67%</td>
<td>73%</td>
<td>58%</td>
<td>52%</td>
</tr>
<tr>
<td>Actively Employed</td>
<td>52.2%</td>
<td>35%</td>
<td>34%</td>
<td>26%</td>
<td>31%</td>
</tr>
<tr>
<td>Unemployment Rates</td>
<td>31.2%</td>
<td>32%</td>
<td>38%</td>
<td>33%</td>
<td>21%</td>
</tr>
<tr>
<td>Inactive</td>
<td>n/a</td>
<td>32%</td>
<td>24%</td>
<td>36%</td>
<td>33%</td>
</tr>
</tbody>
</table>

Mining is a major contributor to regional employment and livelihood. In Zone A, 56% (22) of the households surveyed stated that a member of their household is either currently employed or is a former employee of a mining company. The number of households reporting that someone from the household is or had been employed by a mining company was lower in Zone B (approximately 12% of households) and Zone C (approximately 27%). In Zone D, 24% of the respondents (3,438 people) reported that members of their households are currently employed or are former workers of mining operations (many of whom are either currently employed or are former workers of SNIM).

The qualitative survey undertaken in Zone A during April 2011 showed that typical employment among the families includes labourers, drivers, and pastoralists. Some of the respondents within Zone A earn a living tending others’ camels. The 54 families surveyed in Zone A stated that in total they shepherd approximately 50 camels and 200 goats. Livestock grazes in the pastures that are located towards the northwest and south west of the Mine site. The herding and shepherding of livestock provides vital resources for the families within Zone A.

The IGA survey identified only one IGA in Zone A - a small cooperative that sells camel milk and basic goods located in Guelb Dawass. In Zone B, 31 IGA representatives were interviewed, the majority based in Chami, Akoueyjatt and Virage Tasiast. These activities are mainly family run enterprises, with the vast majority (90%) being involved in selling camel milk and basic goods.

Within Zone C, 90 IGAs were interviewed, 70 of which are located in Boulenouar. The majority of the IGAs within Zone C are individual enterprises and cooperatives focusing mainly on the sale of food products and services.

In Zone D the survey covered 74 IGAs, which was estimated based on population data to represent 5.7% of all IGAs in Nouâdhibou. The IGAs cover a number of industries across the
economic capital from services, food products to industry and trade. Approximately 80% of the IGAs surveyed are individual enterprises and 3% are cooperatives.

### Table 11-7: Number and Type of IGAs within Zones A-D

<table>
<thead>
<tr>
<th>Income Generating Activities</th>
<th>Limited Company</th>
<th>Independent Enterprise</th>
<th>Family Enterprise</th>
<th>Cooperative</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Zone A</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guelb Dawass</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Ntarve</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Emkebden</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Zone B</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AKoueyjatt</td>
<td>0</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Um Lekaab</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Nasser</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Ghreid Goumyatt</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Chami</td>
<td>1</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Virage Tasiast</td>
<td>0</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>3%</td>
<td>61%</td>
<td>16%</td>
<td>16%</td>
<td>3%</td>
</tr>
<tr>
<td><strong>Zone C</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wad Chebkaa</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Chalkha</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Lehdeyba</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Al Baragui</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Boulenouar</td>
<td>0</td>
<td>46</td>
<td>5</td>
<td>19</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>0%</td>
<td>68%</td>
<td>6%</td>
<td>26%</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Zone D</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nouâdhibou</td>
<td>9</td>
<td>59</td>
<td>4</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>12%</td>
<td>80%</td>
<td>5%</td>
<td>3%</td>
<td>0%</td>
</tr>
</tbody>
</table>

#### 11.3.2.4 Employment Provided by the Mine

In January 2012, the combined Project construction and operation workforce at the Mine was approximately 3,300 workers (of which approximately 80% are Mauritanian). The Mine employed approximately 1,300 workers directly and approximately 700 workers are employed by third parties for operations and approximately 1,300 workers are employed by third parties for Project construction activities.

Workers employed directly by TMLSA originate from all around Mauritania, including about one-third from Nouakchott and about 41% from the area of direct influence (Inchiri: 4%; Dakhlet Nouâdhibou: 10%; and Nouakchott: 27%). As noted above, within Zone A, 56% (22) of the households surveyed stated that a member of their household is either currently employed or is a former employee of the Mine. No information is currently available regarding the origin of workers employed by third parties. Table 11-8 below provides a percentage breakdown of the
Mauritanian workers working at the Mine by Wilaya of origin (not domicile); refer to Figure 1-1 for location of the Wilayas.

**Table 11-8: Breakdown of Mauritanian Workforce at the Mine by Wilaya**

<table>
<thead>
<tr>
<th>Wilaya</th>
<th>October 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adrar</td>
<td>6%</td>
</tr>
<tr>
<td>Assaba</td>
<td>7%</td>
</tr>
<tr>
<td>Brakna</td>
<td>14%</td>
</tr>
<tr>
<td>Gorgol</td>
<td>9%</td>
</tr>
<tr>
<td>Guidimagha</td>
<td>3%</td>
</tr>
<tr>
<td>Hodh chargui</td>
<td>3%</td>
</tr>
<tr>
<td>Hodh gharbi</td>
<td>1%</td>
</tr>
<tr>
<td>Inchiri</td>
<td>4%</td>
</tr>
<tr>
<td>Nouâdhibou</td>
<td>10%</td>
</tr>
<tr>
<td>Nouakchott</td>
<td>27%</td>
</tr>
<tr>
<td>Tagant</td>
<td>2%</td>
</tr>
<tr>
<td>Tiris zemour</td>
<td>6%</td>
</tr>
<tr>
<td>Trarza</td>
<td>8%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

11.3.2.5 Education

Within the Inchiri Wilaya there is a high rate of illiteracy (44%), 25% have basic reading and writing skills, 12% have a primary level education, 8% completed secondary school; 8% have some college education and 3% attended university (ONG AFE, 2011).

The lack of a formal education was also common factor amongst respondents in Zones A, B and C. In Zones A and B, the size of the population lacking formal education is higher than the national average, with Zone B being significantly higher. In Zone D, education levels in Nouâdhibou are significantly higher than those in rural Zones A, B and C, with approximately 72% of the population benefiting from a formal education (see Table 11-9).

**Table 11-9: Education Data**

<table>
<thead>
<tr>
<th></th>
<th>National Average</th>
<th>MDG 2015</th>
<th>Zone A</th>
<th>Zone B</th>
<th>Zone C</th>
<th>Zone D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Population</td>
<td>43%</td>
<td>0%</td>
<td>48%</td>
<td>70%</td>
<td>39%</td>
<td>28%</td>
</tr>
<tr>
<td>Lacking Formal Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

11.3.2.6 Living Conditions

Dwellings in the Inchiri region range from concrete structures, to mud huts, to tents and stone buildings (ONG AFE, 2009).
In the remote and rural areas, particularly Zones A and B, essentially all dwellings were tents and huts, while in the relatively urban areas, Zones C and D, the majority of the inhabitants live in more permanent structures. In all areas, owner-occupied dwellings are prevalent and approximately 75% or more of inhabitants own their homes.

**Figure 11-5: Type of dwelling**

![Type of Dwelling Chart]

### 11.3.2.7 Local Public Infrastructure

The quantitative survey collected data on the basic infrastructures available to the residents of Zones A-D. Zone A is almost devoid of any kind of infrastructure: the zone contains no schools, no health facility, no electricity, no pipe-borne water and no public services. The only infrastructures available are the GSM phone network and one local borehole. The GSM network covers the three villages of zone A (Guelb Dawass, Ntalve and Emkebden), while the only local borehole is located in the village of Emkebden.

Zone B is relatively better equipped with infrastructures than Zone A, with access to certain public services, interurban transportation, inns and GSM phone network. It also contains several local boreholes/wells. Nevertheless, Zone B is lacking most of the essential infrastructures: it contains no schools, no health facility, no electricity and no pipe-borne water service.

Within Zone C, the results show disparities in terms of infrastructures between the village of Boulenour on one hand, and the seven other villages on the other hand. Boulenour is the most populated village in Zone C and is equipped with electricity, pipe borne water, GSM phone network, interurban public transport, one hotel, four inns and one stadium. It has three health facilities (two primary health care centres and one drugstore), one primary school and one secondary school. On the other hand, seven other villages of the Zone C are practically devoid of basic infrastructures, but for GSM phone network. Not a single village has electricity or pipe borne water, and there is no education or health facility in any of these seven villages.

The port city of Nouâdhibou (Zone D) is fully equipped with basic infrastructures: electricity, pipe borne water, GSM network, land phone, internet, public transportation, health and education facilities. For the population estimated at 77,301 inhabitants, the city is equipped with six police centres, ten hotels, one stadium, two youth centres and six educational units. The
health services in the city are provided by about 25 health units (hospitals, primary health care units and pharmacies).

11.3.2.8 Access to Water and Electricity

Within the Inchiri Wilaya, the only distribution networks for drinking water are in the urban centres of Akjoujt and Bennichab (ONG AFE, 2009). In these areas there have been improvements to the access of potable water as a result of investments by Mauritania Copper Mines (MCM), particularly in Bennichab where 100% of the water system was established by the MCM.

Access to electricity in Inchiri Wilaya is also limited and varies significantly in the urban and rural areas. Approximately 51% of households in Inchiri have electricity; 22% use candles and solar energy is 2%. Over 27% of households are without lighting.

Near the mine, the majority of the households in Zone A get water from the water reservoirs built by TMLSA in the localities of Guelb Dawass and Imkebden. These are supplied with 450 tonnes of water each month during the hot season from April to September and 300 tonnes per month during the remaining cooler months. The majority of households in Zone B purchase water from tankers. In Zone C, households typically obtain water from a standpipe while most households in Nouâdhibou have a piped water supply. Note that the results of the quantitative survey indicate access to water exceeds the targets set in the Millennium Development Goal for 2015 for Zones B, C and D (see Table 11-10).

<table>
<thead>
<tr>
<th></th>
<th>National Average</th>
<th>MDG 2015</th>
<th>Zone A</th>
<th>Zone B</th>
<th>Zone C</th>
<th>Zone D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to electricity</td>
<td>n/a</td>
<td>n/a</td>
<td>0</td>
<td>0</td>
<td>65%</td>
<td>93%</td>
</tr>
<tr>
<td>Population with access to a safe water supply</td>
<td>62%</td>
<td>68.5%</td>
<td>63%</td>
<td>91%</td>
<td>80%</td>
<td>71%</td>
</tr>
</tbody>
</table>

There are no electrified households in Zone A, as the majority of the households in Zones A and B are reliant on torches, oil lamps and candles. The electrification rate is significantly higher in Zones C and D where over half of all households have electricity.

11.3.3 Project-specific Issues: Attitudes and Perceptions of Mining Activity

One important aspect of the baseline analysis was to characterise the general level of understanding about mining among residents living near the Mine site and along the access routes. As part of the quantitative survey, all the residents surveyed were asked their personal views with regards to the main impacts they expected mining activities would have on the national economy, the local economy, employment prospects, the environment, human health and livestock health.
11.3.3.1 Perceived Impacts of Mining on National and Local Economy and Employment

Depending on where they live, between 30 to 40% believed that mining has beneficial impacts on the local and national economy. Of note, within Zone A (30 km radius around the Mine site), more respondents perceive positive impacts on the local economy than they do on the national economy. In Zones B, C, and D most respondents perceived no impact on the local economy and were unsure of the impacts that the mining activities would have on the national economy.

In particular, mining operations were widely perceived as having a beneficial impact on employment.

Figure 11-6 highlights the population's perceptions with regards to the mining impacts on the national and local economy in all zones surveyed.

Figure 11-6: Perceived Impacts on National and Local Economy

11.3.3.2 Human and Livestock Health

The biggest concern respondents had with regards to their perception related to human health, livestock health and the general environment. Female respondents tended to associate mining with negative impacts on health more so than male respondents. Only a few respondents viewed mining operations as having a positive impact on health and the environment. Figure 11-7 highlights the population’s perceptions with regards to the mining impacts on health and environment.

Those living closest to the Mine site (Zone A), had the highest percentage of respondents who believed that the impacts of the mining activities on the environment and health would be negative. Those living furthest away to the Mine site (Zone D) tended to believe that the negative impacts on the environment and health would not be significant.
11.3.3.3 Access to Health

Access to health facilities and health coverage including vaccinations, not only for workers at the Mine but for women, children, and families with disabled members, was cited as a key issue of concern amongst many of those interviewed. There was a strong perception that there is inadequate healthcare support in place in the area. Participants expressed a desire for increased access to health care within the area of influence.

11.3.3.4 Access to Education

During public consultation, several respondents expressed a concern that there was limited access to education and training in the area as well as a lack of available scholarships for locals.

11.3.3.5 Transport

Access to transport was an important concern amongst respondents. Respondents also mentioned a lack of emergency vehicles in the local community and that either an ambulance or similar motorised vehicle was needed for medical emergencies.

It was clear during stakeholder consultations that there is a strong desire in the local community and local authorities for improved roads within the Project’s area of influence.

During consultation communities also expressed concerns about community safety from potential accidents as a result of increased traffic.
11.4 Approach to Mitigation

11.4.1 Overview of Embedded Mitigation

Mining generates benefits for society; however adverse social impacts can occur if proper mitigation measures are not incorporated in the Project. This could include pressure on community services due to changes in population, impacts on health and safety, and so on.

Best-practice management standards developed by Kinross Gold Corporation as part of its Corporate Responsibility Management System (see Section 2.4) are being introduced to the Mine and will apply to the construction, operations and closure / rehabilitation phases of the Project as appropriate. These management controls are incorporated in any Project undertaken by Kinross and are referred to within this EIA as ‘embedded mitigation’.

The following embedded mitigation measures (Table 11-11) are considered relevant to social and economic impacts and are briefly outlined in the sections below.

Table 11-11: Embedded Mitigation Measures Identified Through Kinross Best-Practice Management Standards

<table>
<thead>
<tr>
<th>Potential Impact Area</th>
<th>Embedded Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recruitment</td>
<td>Increase access to employment for those living in the area of influence:</td>
</tr>
<tr>
<td></td>
<td><strong>Selection Process</strong></td>
</tr>
<tr>
<td></td>
<td>• Establish fair selection process to ensure transparency in the way job applicants are screened, selected, and recruited</td>
</tr>
<tr>
<td></td>
<td>• Establish recruitment offices in national and regional centres</td>
</tr>
<tr>
<td></td>
<td>• Coordinate with community representatives and authorities to ensure job seekers from local areas are considered for jobs for which they are qualified</td>
</tr>
<tr>
<td></td>
<td>• Require contractors to coordinate their recruiting efforts with TML-SA to ensure job seekers from remote areas are considered for jobs for which they are qualified</td>
</tr>
<tr>
<td></td>
<td><strong>Mauritanisation Plan</strong></td>
</tr>
<tr>
<td></td>
<td>• Implement Mauritanisation Plan to improve the capabilities and experience of the national workforce at the Mine and thus reduce reliance on expat workforce over time</td>
</tr>
<tr>
<td>Employee Well-Being</td>
<td>Ensure the well-being of workers through the following:</td>
</tr>
<tr>
<td></td>
<td><strong>Training and Skills Development</strong></td>
</tr>
<tr>
<td></td>
<td>• Job training</td>
</tr>
<tr>
<td></td>
<td>• Skills development training</td>
</tr>
<tr>
<td></td>
<td><strong>Occupational Health and Safety</strong></td>
</tr>
<tr>
<td></td>
<td>• Health and safety training</td>
</tr>
</tbody>
</table>

Phase 2 Environmental Impact Assessment

March 2012
### Potential Impact Area

<table>
<thead>
<tr>
<th>Embedded Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Implementation of comprehensive Health and Safety Management programs</td>
</tr>
<tr>
<td>• Implementation of occupational health and industrial hygiene management programs</td>
</tr>
<tr>
<td>• Establishment of emergency response, Mine rescue, and crisis management capabilities at the Mine site</td>
</tr>
</tbody>
</table>

#### Employee Relations

<table>
<thead>
<tr>
<th>Embedded Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Enforcement of policies to ensure fair employment practices for both TMLSA workforce and Contractor/Sub-contractor workers</td>
</tr>
<tr>
<td>• Enforcement of non-discrimination, anti-harassment, and other policies</td>
</tr>
</tbody>
</table>

#### Worker Accommodation

<table>
<thead>
<tr>
<th>Embedded Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Provision of clean and comfortable accommodations for workers while they are on-site</td>
</tr>
<tr>
<td>• Provision of food, water, access to medical care while on-site</td>
</tr>
</tbody>
</table>

#### Contractor Standards

<table>
<thead>
<tr>
<th>Embedded Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure contractors provide for the well-being of their workers:</td>
</tr>
<tr>
<td>• Ensure contractors comply with applicable employment laws and regulations</td>
</tr>
<tr>
<td>• Require contractors to use accommodation that meets applicable standards</td>
</tr>
<tr>
<td>• Require contractors to implement Occupational Health and Safety management systems that meet the standards of TML.Sa</td>
</tr>
</tbody>
</table>

#### Community Well-being

<table>
<thead>
<tr>
<th>Embedded Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure the Project contributes to the well being of communities in the area of influence:</td>
</tr>
<tr>
<td>• Establish open channels of communication and consultation</td>
</tr>
<tr>
<td>• Invest in project and programs that improve the quality of life in the communities</td>
</tr>
</tbody>
</table>

#### Economic Development

<table>
<thead>
<tr>
<th>Embedded Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encourage development of in-country businesses with the capacity to participate in economic opportunities generated by the Project;</td>
</tr>
<tr>
<td>• Establish local business initiatives</td>
</tr>
</tbody>
</table>

### 11.4.2 Improved Access to Employment

In order to facilitate access to these newly created construction and operations jobs, the Mine is implementing a range of measures through recruiting and Human Resource programmes as improved access to employment through TMLSA offices in Nouakchott, Nouâdhhibou and Akjoujt; and particular consideration for members of local communities and residents of...
Bennichab and Akjoujt. These actions are necessary because many people living within the Project's area of influence live in basic or temporary dwellings and have low household incomes, low literacy levels and high levels of unemployment.

11.4.2.1 Selection Process

TMLSA’s selection process uses competency profiles, which can accommodate those with low or no literacy or numeracy skills, and other recognised professional tools to source labour. Various communication means are being used to attract applicants, including the Mine website, radio and newspapers. Prospective candidate names and contact details are also being collected by the Community Relations team during community sensitisation exercises/field trips. TMLSA is also working in partnership with government to establish a database of available skills in Mauritania. Information centres are being established in Nouakchott, Nouâdhribou (opening December 2011) and Akjoujt (planned opening 2012).

TMLSA is currently facilitating contractor recruitment in line with a standard protocol for contractor and sub-contractor operations. Whilst each contractor and sub-contractor is independently responsible to recruit their own personnel, TMLSA is assisting with testing of candidates in company testing centres (Nouakchott and the soon to open centre in Nouâdhribou), and, for selected candidates, provision of transport and ‘per diems’ during the testing process.

To date, TMLSA’s Human Resource initiatives have resulted in the hiring of more than 400 Mauritanian since September 2010, including the recent hiring of 25 people from the local communities around the Mine site, Bennichab and Akjoujt. In July 2011, 56% of the households within 30 km of the Mine site reported that a member of the household works for, or has worked for, TMLSA or its contractors.

All local Mauritanian workers who are selected must be medically tested and proven medically fit to take up the position.

11.4.2.2 Mauritanisation Plan

A Mauritanisation Plan for the operations workforce is being developed with the aim of progressively reducing the number of expatriates working at the Mine throughout its operational life. The first phase of this Plan covering the period from 2011 to 2012 has been already been discussed with the Government. Once the Feasibility study is completed, the Mauritanisation Plan will be developed on a rolling basis for subsequent three-year periods. A responsible, rigorous and flexible plan has been initiated and will be continuously monitored in conjunction with the Labour Ministry.

11.4.3 Care for Employee Well-being

Workers are considered to be an important group of stakeholders which may be subject to a range of direct impacts, potentially both positive and adverse, in terms of access to employment, the terms and conditions of that employment, and their health, safety and welfare whilst working at the Mine.

Employees include those workers already working at the Mine, for TMLSA and its contractors, and future workers, including both new workers employed by construction phase contractors / subcontractors and new workers engaged directly by TMLSA to expand its operations.
11.4.3.1 Training and Skills Development

**Job Training**

Upon employment, new Mine workers undergo mandatory general induction (3 days) and, where appropriate, general supervisory training modules. Transitional training is also given on topics such as basic hygiene, finance, computer studies, language upgrading, work area responsibility/housekeeping and punctuality. Thereafter, trades training apprenticeship programs combine classroom training (15 to 28 weeks depending upon trade) with hands-on training and practice under supervision (up to three years depending upon achievement of required competency levels).

In order to deliver this extensive, on-going training program, a professional team is being assembled and a permanent Training and Development Campus is being established at the Mine site. The campus will comprise the following facilities:

- A multi-trade workshop, warehouse, tools storage and repair shop;
- Classrooms, offices and laboratories;
- Library, print room, data room, covered outdoor area for breakout sessions;
- Conference room, reception area and open concept workstations; and
- Welfare facilities for men and women including canteen and prayer area.

In the meantime a testing and training centre was opened in Nouakchott to look after the shorter term training needs. In addition a 4 classroom temporary training facility is now operational on the Mine site.

**Skills Development Training**

TMLSA has undertaken to develop the skills base of its existing workforce in preparation for expanded Mine operations. Existing workers will benefit from career planning and will be offered both general and skills development training, including as appropriate:

- Topics such as basic hygiene, finance, computer studies, language upgrading, work area responsibility / housekeeping, punctuality, working and cultural / social transition studies;
- Basic industrial skills training for any workers who do not yet meet the minimum skills requirement;
- Technical trades top-up training and employment-specific/plant-specific training; and
- Supervisory skills and leadership techniques.

**Operations Safety**

Mining activities present inherent health and safety hazards. The physical environment where Project activities take place presents additional potential health and safety impacts, such as:

- Damage to the respiratory tract from the inhalation of some airborne dusts, gases and aerosols;
- Heat exhaustion / thermal stress and various other health effects from exposure to sun and extremes of temperature.
- Musculoskeletal disorders;
- Noise-induced hearing loss from excessive noise exposure;
Skin disorders and/or damage to internal organs from contact with a wide range of chemicals including acids, alkalis, solvents, fuels, lubricants and resins;

Damage to internal organ systems from the absorption of chemicals and metals through the skin, respiratory and digestive tracts; and

Physical injury from accidents involving machinery, movement of construction materials and, especially, when working in difficult conditions.

To address these potential impacts, a comprehensive Corporate Responsibility Management System that includes policies, standards and procedures for occupational health and safety is being implemented at the Mine.

The Mine will continue to develop and implement its overarching health and safety management system in regard to the various risks and hazards associated with its operational activities. Operational phase management will be consistent with the Kinross Standards dealing with occupational health and safety, including Hazard Identification, Risk Assessment, Emergency Preparedness and Occupational Health and Safety Operational Controls. Further robust standards are being applied to the anticipated hazards associated with work at the Mine, including Occupational Health Program, Industrial Hygiene, Hearing Conservation, Respiratory Protection, Thermal Stress, and Vaccination, Antimicrobial and Screening.

The following arrangements are considered particularly pertinent:

- **Health and Safety Training**: Health and Safety will be an integral part of Job Training and Skills training, described above. Safety induction and ongoing refresher training will be required for all new workers, contractors and visitors that addresses significant occupational hazards and management practices. Each participant’s awareness of all presented materials will be evaluated and documented. In addition, general communication of health and safety topics will be achieved through the use of notice boards, pre-job meetings and daily safety task instructions, toolbox meetings and through awards and recognition programs aimed at promoting safe and healthy behaviours within the workforce. All documents will be available in English, French and Arabic.

- **Health and First Aid Facilities**: Given its remote location and the lack of any external medical support nearby, the Mine has health and first aid facilities in place for both workers and members of the local community. These arrangements will be expanded and enhanced in line with the anticipated increase in the TMLSA workforce and will include health screening for the common skin and respiratory disorders associated with working in the desert environment. The full range of anticipated medical, first aid and emergency response services and the associated resources is outlined in Section 3.2.6.6 above.

- **Emergency Team**: An emergency response team will be professionally trained and equipped to respond to all probable emergencies within the Mine site, at the airstrip and – potentially – in response to any serious off-site road traffic accidents involving Project related vehicles. Accordingly, additional resources (fire trucks, aerial fire tuck, rescue vehicle and ambulance) are being provided. These vehicles will be kept on-site along with trained operators and/or emergency response teams, who will undertake regularly planned drills and simulations to refine procedures and improve response capabilities.

- **Cyanide Code**: TMLSA recognises the need to establish and maintain robust standards in the management of the increased quantities of process reagents needed to achieve the Mine’s expansion program’s production targets. To this end, TMLSA has committed to developing a Cyanide Management Plan for the Mine and to achieving certification against the International Cyanide Management Code (ICMC) specification for gold mining. TMLSA
will also be implementing appropriate controls over transportation and handling of cyanide as part of the implementation of the cyanide code. In addition, TMLSA’s reagent handling and transport contractors are also subject to ICMC certification requirements.

**Fair employment**

TMLSA has contractual agreements with all its direct workers and these arrangements will be extended to new workers. There are different types of contracts including examples for probationary workers engaged for a trial period and workers hired on either a fixed term or indeterminate period. Terms and conditions of contract are supplemented by Site Rules (Règlement Intérieur) and the Staff Regulations (Statut du Personnel).

Currently, there is no site specific labour or collective agreement in place at the Mine. In lieu of a site specific collective agreement, there is site specific contractual documentation that binds both parties, including staff regulations and site rules plus minutes of various meetings between management and workers representatives. Terms and conditions meet or exceed Mauritanian legal requirements, and any variances on topics like overtime hours and the rotation schedule are negotiated and agreed with the appropriate government authorities.

**Accommodation**

The Mine’s new accommodation will consist of secure living facilities with housing, dining and sanitary facilities for all workers in accordance with applicable laws and international guidelines including the requirements of the IFC / European Bank for Reconstruction and Development Guidance Note: “Workers’ accommodation: process and standards”. Recreational facilities, sports amenities, mosque and prayer rooms will also be located at the main accommodation camp.

11.4.4 Enforcement of Standards for Contractor / Subcontractor Workers

**Labour relations**

In regard to third parties, the Mauritanian Labour Code requires that all contractors and outsourced services, including any people engaged for piecework / jobbing (tâcheronnats) comply with applicable employment laws and regulations.

In particular, all contractors and sub-contractors must have appropriate human resources policies and practices to ensure that there is no engagement or other support for any forms of child or forced or bonded labour or human trafficking as defined in Mauritanian legislation and relevant international standards. In addition, no young persons (defined as anyone less than 18 years old) shall be employed for work at the Mine.

TMLSA also requires that all contractors and sub-contractors treat their workers with fairness, respect and decency, and that they address the following requirements:

- An equal opportunities policy will be in place and be monitored. All workers 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 workers, both permanent and temporary. Workers will know how and when their remuneration is determined. Pay shall match or exceed national minimum wage levels and take account of the location of the Mine and prevailing working conditions. Migrant and non-migrant workers are to be paid the same wages for equivalent work. Where applicable, overtime will be voluntary and paid at an agreed rate;
• There will be a worker consultation process in regards to matters of mutual concern such as workplace health and safety, accommodation, hygiene and food standards, etc;

• There must be no barriers to legitimate freedom of association through trade union membership and/or collective bargaining;

• Workers are to have appropriate vocational and environmental / health and safety training for their work. TMLSA will provide site induction training to contractors’ workers, but contractors shall be responsible for any literacy / numeracy and skills training for their workers;

• Workers are to be issued with identification badges;

• There will be a clear disciplinary procedure and an effective worker grievance procedure to respond to their valid concerns and any accusations of workplace discrimination, harassment or bullying;

• The terms for leaving employment are to be explicit (i.e. in terms of voluntary cessation of work, retirement, or as a consequence of justified disciplinary action).

TMLSA will directly monitor contractor performance in regard to compliance with human resource policies and fair employment practices throughout the Mine expansion program. In this regard, contractors and sub-contractors will be contractually obliged to provide human resource data and information (such as workers’ social security numbers, age and normal working hours) and facilitate workplace inspections and/or compliance audits as appropriate.

Accommodation

TMLSA will require that all workers of contractors and subcontractors be housed in accommodations that meet TMLSA standards. Space for contractor workers will be included in the expanded accommodations that will be built at the Mine site.

Occupational Health and Safety

In accordance with Kinross Standards, TMLSA only engages reputable contractors and subcontractors that can demonstrate compliance with the Mauritanian Labour Code. All contracted organisations are required to comply with the Mine’s site rules and are contractually bound to conform with TMLSA’s General Health and Safety Requirement for Contractors and its General Environmental Compliance Procedures for Contractors.

Under this standard, all contractors are required to submit for review an EHS Management Plan that adequately identifies the health and safety hazards and control measures applicable to their scope of work. In addition they are required to:

• Appoint competent person(s) to coordinate the management of health and safety and ensure compliance to applicable Mauritanian laws and the Mine’s site rules, including provisions for site security, handling hazardous substances and reporting potential hazards and actual incidents;

• Provide appropriate training, information and personal protection equipment to workers likely to be affected by site hazards and risks. Personal protective equipment shall include the following minimum:
  o Approved hard hats;
  o Approved safety glasses with side shields;
  o Approved safety footwear appropriate for the conditions (hard toecap); and
Seat belts when operating or travelling on or about the Mine property in any vehicle or other mobile equipment.

- Convene a weekly formal safety meeting for all workers and subcontractors;
- Undertake pre-use checks of vehicles, plant and equipment, a daily walk-through and a weekly inspection of the job site; and
- Submit a Contractor’s Monthly Safety Report to TMLSA.

TMLSA has appointed an Engineering, Procurement and Construction (EPC) Contractor to oversee all on-site construction activities up to commissioning. TMLSA’s role is to conduct inspections to ensure the EPC Contractor’s Health and Safety Departments are managing contractors’ and subcontractors’ safety arrangements and performance.

11.4.5 Investment in Community Well-being

11.4.5.1 Community Engagement

The Kinross Standards (see Section 2) require that TMLSA develop a Site Responsibility Plan (SRP) which includes a range of measures designed to establish open channels of communication with local communities. The objective is to maintain long-term relationships with community stakeholders based on trust, respect, and partnership. These partnerships are the basis for creating a thoughtful and congruent long-term strategy to help ensure that the positive impacts of the Project contribute to improvement in the quality of life for those living in the area of involvement. Table 11-12 outlines these on-going community engagement measures.

<table>
<thead>
<tr>
<th>Objective</th>
<th>Specific Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Engagement:</strong> Maintain broad community support through an ongoing dialogue as a partner in the community</td>
<td>Stakeholder Register, Commitment Register, Community Coordination Committees, Stakeholder Grievance Mechanism, Site Engagement Strategy, Plan, Schedule, Stakeholder Engagement Training, Workers as community ambassadors</td>
</tr>
<tr>
<td><strong>Evaluation:</strong> Understand how our activities can contribute to sustainable opportunities for the communities</td>
<td>Socio-economic studies – baseline and updates, Social impact &amp; community risk assessment, Evaluation of Stakeholder Feedback, Local economic capacity analysis, Benefit footprint analysis, Supply chain and local procurement analysis</td>
</tr>
<tr>
<td><strong>Action:</strong> leverage the value generated by our operations to create opportunities and reduce dependency</td>
<td>Community Investment Strategy &amp; Plans, Site-specific impact management plans, Employee participation, In-kind community support</td>
</tr>
<tr>
<td><strong>Monitoring:</strong> Measure not only the inputs, but the results and effectiveness of CR actions</td>
<td>Relevant indicators of socio-economic status, Public Perception Surveys, KPIs for specific community interventions, Grievance frequency and resolution</td>
</tr>
</tbody>
</table>

11.4.5.2 Community Investment

Community investment activities will be closely coordinated with local stakeholders and authorities, to ensure that the selected programs create opportunities for the community.

Three categories of community investment are being targeted:
- Benefit Footprint: Programs that increase participation in Project-related economic opportunities, including local recruitment, local training and local procurement

- Long-Term Sustainability Development – Multi-stakeholder driven projects aimed to develop sustainable capacity, focusing in areas such as health, education, capacity building and livelihoods.

- Donations and Sponsoring – Support for local organisations and causes on a one-time amount/organisation/year.

Examples of initiatives that may be proposed within each of the sector priorities for further development in partnership with the communities are set out in Table 11-13 and Table 11-14 below.

**Table 11-13: Community Investment Projects - Benefit Footprint Initiatives**

<table>
<thead>
<tr>
<th>Sector Priority</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Employment</td>
<td>• Open Information and Community Relations Offices in Akjoujt, Bennichab and Nouâdhibou to facilitate contact with the local community and register relevant personal and professional information of aspiring candidates in an Employment database which will be made available to the Operations and Constructions teams as well as all contractors.</td>
</tr>
<tr>
<td>Technical Training</td>
<td>• Implement a long term development program for selected groups of 25 local people to increase their academic level. The goal is to bring their competency level similar to the one of a Baccalauréat Technique, meaning a basic technical high school over a period of 18 to 24 months.</td>
</tr>
<tr>
<td>Local Procurement/Local Business Initiatives</td>
<td>• Carry out an assessment/ study of current small &amp; medium enterprises.</td>
</tr>
<tr>
<td></td>
<td>• Implement a capacity building program to optimise the viability of their business case to participate in economic opportunities created by the Mine.</td>
</tr>
<tr>
<td>Commercial Development and Household Economy</td>
<td>• Implement a capacity building program for the women’s cooperatives in the area focusing on entrepreneurial development, financial management and organisation based on auto-management, association and strengthening of solidarity ties in partnership with a specialised NGO.</td>
</tr>
<tr>
<td></td>
<td>• Provide capacity building in credit attribution through specialised financial institutions.</td>
</tr>
<tr>
<td></td>
<td>• Identify other income generating activities through a specialised NGO.</td>
</tr>
</tbody>
</table>
### Table 11-14: Community Investment Projects – Social Development Initiatives

<table>
<thead>
<tr>
<th>Sector Priority</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Social Development</strong></td>
<td></td>
</tr>
</tbody>
</table>
| **Water**                       | • Improve provisions of water to communities within the area of influence.  
                                        • Support the Parc National Banc d’Arguin in their efforts to facilitate access to water for the Imraguen population.                                |
| **Health**                      | • Provision of medical equipment to health centers in coordination with the Ministry of Health.  
                                        • Implementation of a mobile clinic in coordination with the Ministry of Health and a specialised NGO for Zones A, B and C.  
                                        • Support of government initiatives through the Ministry of Health to conduct vaccination campaigns.  
                                        • Support the creation of awareness-raising and capacity building workshops on other transmissible diseases such as water borne diseases, child nutrition, and prevention of common and infectious diseases, reproductive health and maternity without risks. |
| **Education**                   | • Implementation of adult literacy programs in coordination with the appropriate Ministries and specialised NGOs.                                                                                         |
| **Environmental Education**     | • Support environmental awareness-raising programs in collaboration with the Parc National Banc d’Arguin.                                                                                                  |
|                                 | • Support campaigns in alliance with entities, public organisations and specialised NGOs in public hygiene.                                                                                                 |
| **Pastoralism**                 | • Provide support for the vaccination of animals and treatment of illnesses through a specialised NGO.                                                                                                       |
| **Promotion of Civic Organisations** | • Support the creation and capacity building of other community–based organisations (women’s associations, health facilitators, water-users associations, environmental committee, recreational and sports organisations). |
within the capacity and capability of local businesses. This includes review of in-country capabilities compared with Project needs, characterisation of all purchasing requirements based on potential source location, communicate with potential local suppliers, and training / capacity building programs for local business based on identified needs.

Under the program, the major, non-local, contractors and suppliers will likewise follow the same principles and procedures in increasing local opportunity and participation when sourcing and managing their sub-contractors and sub-suppliers. This objective would specifically include the Mines prime EPC contractor for the Project (2012-2015).

11.5 Potential Impacts

This Section identifies potential social impacts of Phase 2, which are defined as the direct and indirect effects on the Mauritanian society and economy, the communities and businesses located within the Project’s area of influence, and the Mine’s workforce.

As all Phase 2 Project components are to be located within the Mine site, there will be no additional land requirement and there are no land tenure impacts at the Mine. There are no artisanal mining activities in the area of influence and none are anticipated to be triggered as a result of the Project. Some industrial land may be acquired in the Nouadhibou Port area for the temporary storage and assembly of equipment and materials for the Mine, but no land tenure issues are anticipated with that possible development.

The following potential social impacts have been identified:

- Generation of government revenues through payment of Mining royalties / company taxes and taxation of TMLSA workers;
- Creation of both temporary and permanent jobs during construction (as outlined in Section 3.2.9) until Mine closure;
- Improvement of national skills base for the mining sector through provision of training and acquisition of experience in the application of modern technologies and best industrial practice;
- Commitment to the Mauritanisation of the Mine’s workforce at all levels, with a target minimum of 85% of the operational workforce to comprise of Mauritanian nationals;
- Continuing improvement in terms and conditions of employment, including health, safety and welfare provisions, through compliance with TMLSA’s human resource and occupational health and safety policies and practices;
- Local community access to employment;
- Generation of new businesses opportunities for new and existing Mauritanian enterprises to provide goods and services to the Mine in accordance with local procurement / business initiatives.
- Creation of indirect employment through local procurement policies and provision of stimuli for businesses;
- Increased demand for consumer goods and services resulting from expenditure by the Mine’s workforce;
- Improvements in the provision of water supplies, medical services, education and other community benefits through TMLSA’s Community Investment and Social Development plans;
• Strengthening of civil society sector including targeted support for community based organisations such as women’s cooperatives, water users’ associations, etc. including capacity building on entrepreneurship, livelihoods, health, education, etc.;

• Potential for inward migration in the vicinity of the mine, and along the access road and N2 highway;

• Potential increase in accidents involving communities and/or livestock resulting from increased traffic on access road and N2 highway;

• Loss of support services provided by TMLSA upon closure of the Mine’s operations; and

• Loss of employment as consequence of eventual Mine closure.

In some cases, additional measures are recommended to supplement the embedded mitigation. The additional mitigation measures are based upon practical considerations for full implementation, stakeholder feedback and site-specific baseline conditions. These measures are discussed in Section 11.6.

11.6 Evaluation of Mitigated Impacts

This section evaluates the nature, duration and significance of the predicted impacts taking into consideration the embedded mitigation described in Section 11.4. The magnitude, significance and duration of impacts have been outlined in Table 5-2 and are the same criteria used for socio-economic impacts.

11.6.1 Generation of Government Revenues

The Project will generate increased revenues for the Mauritanian government in the form of corporate income taxes, royalties, VAT and other fees and payments over the Project life-span. In addition to the revenue generated directly from the Mine itself, revenue will be generated indirectly from ancillary business and general business development that will be stimulated by the Project. This additional revenue generated from the Project is considered to be a long term benefit of high significance.

11.6.2 Job Creation at TMLSA

The operation of the expanded Mine will generate significant employment opportunities at the regional and national level. Figure 3-6 provides an indication of the numbers of jobs being created for the construction phase, whilst Figure 3-7 shows how the operational workforce will develop through to the year 2026.

New employment for construction is projected to be between 1,300 (at January 2012) and 5,000 (at peak) employment opportunities. Around 50% of these employment opportunities are proposed to be filled by Mauritians. Although these positions are temporary in nature, ending in 2015, the number of jobs being created is significant in the medium term. Monetary benefits will be significant but temporary, but non-tangible benefits such as increased national capacity and the acquisition of new skills will present medium to long term advantages to the national economy and workforce.

New employment for operations will begin to increase immediately and is projected to peak in 2016 at approximately 4,800 workers as illustrated in Section 3.2.9. These jobs will continue over the operational life of the mine, including jobs both in core mining and processing positions with the Mine as well as in various long term outsourced services. Employment of a
A large proportion of Mauritanians at the Mine will boost domestic wages, increase domestic employment, foster transfer of skills and technology, and enhance labour productivity.

The ongoing implementation of the Mauritanisation Plan will ensure that the portion of the Mine operations workforce that is Mauritanian nationals will progressively increase from the current levels of 85% of workers.

The predicted impacts on employment at the national level are considered to be beneficial, medium term for construction posts and long term for operational jobs, and of high significance.

11.6.3 Improvement in Workforce Well-Being

In addition to the positive economic benefits that the workforce will experience as the result of the wages they will earn, it is expected that the Project will have a positive impact on workforce well being as a result of the accommodation, health, and safety measures implemented at the Mine.

As shown in the embedded mitigation section, TMLSA is implementing a robust health and safety policy and management system that builds upon the Kinross Standards that involve health screening, hazard identification, risk assessment and the application of mitigation, control and monitoring measures for all the above health and safety hazards.

Further, TMLSA is obligated by the Mauritania Labour Code to ensure that all contractors and out-sourced services adopt similar standards for health and safety management for their activities. Whilst the consequences of any work-related injury or illness can be significant for those concerned, imposing and enforcing modern safety systems should result in an overall safe working environment and the proposed arrangements are therefore deemed to be suitable and sufficient in regard to the potential hazards and risks.

Existing contractual arrangements are being extended to new workers and remuneration levels will be appropriate to site conditions, worker skills/grades and performance. Worker welfare provisions (camp accommodation and facilities, sports / recreational facilities, mosque, etc.) are being upgraded as part of the overall Project, and workers will have access to health care at the Mine.

Some further mitigation measures are however recommended:

- TMLSA should monitor labour compliance amongst the various contractors and subcontractors. This may require the provision of resources, either through the acquisition of additional workers / skills or through the use of external specialists (NGOs or consultants); and

- In addition, TMLSA should define a Retrenchment Plan that sets out provisions for managing any temporary lay-offs caused by 'unforeseen circumstances'. This Plan should be prepared prior to the operational stage of the expansion program and take account of the IFC’s Good Practice Note on Managing Retrenchment.

Subject to full implementation of the controls described in the Embedded Mitigation and the above recommended measures, occupational health and safety impacts and employment impacts upon both construction and operational workers are considered to be beneficial, short term for construction / medium term for operations, and of high significance.
11.6.4 Improvement in National Skills Base

To overcome the limited availability of necessary mining skills in Mauritania, TMLSA has undertaken to establish an extensive training programme to develop those skills amongst existing and future workers in preparation for the expanded Mine operations. The embedded mitigation described in Section 11.4 Recruitment and Training – including the commissioning of the Training and Development Campus described in Section 3.2.6.1 - will ensure that the Mine’s workers will receive extensive training in a range of technical disciplines upon recruitment. Thereafter, workers will benefit from both the working experience gained and from any refresher or additional skills training. Both mining and general skills such as driving can be transferred to other companies and industrial sectors so that the benefits will be long term.

The investment in training resources to support the Project, and the long-term enhancement of skills of the large number of Mauritans who will benefit from the training are considered to be beneficial, of long term duration and of moderate to high significance.

11.6.5 Stimulation of Business Development

The Project will result in increased demand for goods and services. This includes freight, power, transportation, and other services and goods. Over time, it is expected that more businesses will be created to support Mauritania’s growing mining industry. Taking account of the programs to stimulate local business described in section 11.4.1.3 above, it is considered that business stimuli will have a moderate beneficial impact on the national economy, for a medium to long term duration and of moderate to high significance.

11.6.6 Indirect Employment Creation

The generation of new businesses opportunities for new and existing Mauritanian enterprises to provide goods and services to the Mine is likely to create additional, indirect employment in the supply chain and wider business sectors. Although it is difficult to quantify the effects of this upon local and national economies, it is anticipated that the impact will be beneficial in the short to medium term and of moderate significance.

11.6.7 Stimulation of Consumer Markets

Projection of the wages that will be paid annually to Mauritanian workers of TMLSA and its contractors during operation will generate indirect benefits by stimulating demand for consumer goods and services such as food, transportation, housing and communications. The predicted indirect impacts of increased consumer demand on the local economy are considered to be moderate beneficial, medium term and of moderate/high significance.

11.6.8 Strengthening of Civil Society

The community engagement and investment strategies outlined in Table 11-13 and Table 11-14 are based on a strategic commitment to close collaboration between TMLSA, NGOs and community based organisations such as cooperatives. By working with civil society, instead of working in place of civil society, TMLSA intends to support development of independent capacity that can become self-sustaining.

The activities are expected to strengthen civil society through:

- Supporting the creation of coordination committees within local communities to facilitate the communities’ abilities to monitor the development of the Mine and to participate in the benefits generated by that development;
- Involvement of other community–based organisations in community development programs, to build the capacity of groups such as women’s associations, health facilitators, water-users associations, environmental committee, recreational and sports organisations;

- The long term engagement of NGOs in TMLSA’s Community Investment and Social Development programs (including health, education, environmental education, sustainable businesses, etc.) and some Project monitoring.

The impacts of community engagement initiatives are expected to strengthen civil society and such impacts will be beneficial in the long term and of moderate significance.

11.6.9 Improved Access to Water, Health, Education

TMLSA will continue current practice of providing drinking water for the communities living in proximity to the Mine. In addition, the Mine will also continue to provide access to health care for local residents at the Mine clinic and potentially through a mobile clinic program. Support for education programmes is also proposed as part of community investment initiatives.

Further community investments and social development initiatives planned by TMLSA are set out in Section 11.4.1.7 above. In conjunction with mitigation measures set out below regarding sustainable community management initiatives, these are expected to bring significant benefits to the local community and be medium term.

11.6.10 Potential for Inward Migration

There is some evidence that the provision of water has induced some people to move into the area around the Mine. If this inward migration increases beyond the capacity of what can be reasonably accommodated with provision of water and other amenities, rapid changes in local demographics can occur, resulting in a number of undesirable pressures and consequences such as:

- **Pressure on existing resources and infrastructure:** Any influx of migrants would add to existing pressure on already limited shared resources such as, water, pasturage and public services such as health and education;

- **Security:** An influx of people can create security issues and increase crime leading to impacts on the workforce and/or the local community;

- **Impacts on local communities, culture and health:** An influx of people from outside the Project area can create health problems through transmission of contagious and other diseases and an increase in the consumption of alcohol and drugs. Any influx of sex workers, often associated with construction activities that place a large number of men in a remote area, could lead to a rise in HIV/AIDS and other sexually transmitted diseases. Such influxes can also lead to an erosion of cultural identity, disruption of existing social networks and potential conflicts; and

- **Increased demand for consumer goods and raise in inflation:** Any influx of people to the Project area could result in an increase in the demand of food and other consumer goods increasing prices.

TMLSA is currently taking action to limit the extent of in-migration. TMLSA has deliberately set up recruitment centres away from the Mine site to ensure people are not attracted to the area seeking work. Additional accommodation is being constructed and to allow all workers and contractor workers to be housed within the Mine’s perimeter fence. This will minimise the incentive for job-seekers to move to the contractor camps.
However, given the scale of employment associated with the Mine’s the potential of immigration and spontaneous settlements is expected to increase and further mitigation is recommended. These actions should involve:

- Working with Government to coordinate regional rural strategies for the remote regions adjacent to the mine; and
- Engagement with local communities to ensure that provision of community water supply and other services is appropriate for the needs of the local community, and do not encourage immigration that exceeds the long-term self-sufficient capabilities of the local area.

With mitigation the impact of inward migration is expected to be slightly adverse, short to medium term and of low significance.

11.6.11 Impacts from Increase in Road Traffic

Increased traffic on public roads may result in some potential for elevated risks in regards to road traffic. This includes the potential for off-site accidents involving reagents, both at the handling facilities in Nouakchott and during transport to the Mine.

Embedded mitigation to minimise the likelihood of these accidents is described in Section 11.4. Additional mitigation is recommended in the form of community awareness training and sensitisation with regards to the increase in traffic potential for accidents along the Nouakchott – Nouâdhibou N2 national highway and along the access road and within the Mine site.

Further mitigation in ensuring a transparent grievance procedure and compensation mechanism is widely known and accessible to the community should also be in place should an accident occur with either pedestrians, vehicles and their occupants and/or livestock.

Taking account of planned mitigation and mitigation outlined above, the impacts from increased traffic are considered to be adverse, short term from construction / medium for operations and of moderate to low significance.

11.6.12 Cessation of Support Services upon Mine Closure

While job creation and improved community access to health care, water, and education are seen as positive impacts that will result from expansion of the mine, when after approximately 16 years the Mine closes there may be negative socioeconomic impacts if the local communities become dependent on TMLSA.

Development of self-sustaining capacity within the communities will be encouraged by the community engagement and business development initiatives described in Section 11.4. As additional mitigation, it is recommended that TMLSA work with the government and the local communities to develop specific plans to phase in sustainable management of support services.

Impacts associated with Mine closure and the potential loss of service provision to local communities is considered to be adverse, but with appropriate mitigation as outlined above these impacts will be short term and of low to moderate significance.

11.6.13 Loss of Employment upon Mine Closure

The Mine currently has an anticipated 16 year operational lifespan (following the three year construction period) with potential to further extend the Mine life after 2030.
Whilst some managerial and skilled personnel may find employment elsewhere with Kinross or other mining companies and some workers may be kept on for rehabilitation and monitoring work, many of the jobs will terminate. As additional mitigation, it is recommended that TMLSA develop retrenchment plans to ensure that the downsizing of the workforce is subject to appropriate standards, applicable laws, and consideration of worker re-training.

Impacts associated with the eventual loss of employment when the Mine closes are considered to be adverse, however, with appropriate mitigation as outlined above these impacts will be of short term and of low significance.

11.6.14 Summary of Further Recommended Mitigation

This section summarises the mitigation measures recommended in the preceding sections that are additional to the embedded mitigation arrangements, which are described in Section 11.5 above, and are transposed into Section 18’s Commitments Register:

- On-going monitoring and review of existing embedded mitigation measures including periodic internal and external auditing of performance;
- Monitoring of labour compliance amongst the various contractors and subcontractors and the provision of resources to undertake the monitoring, either through the acquisition of additional workers / skills or through the use of external specialists (NGOs or consultants);
- Defining a Retrenchment Plan that sets out provisions for managing any temporary lay-offs caused by ‘unforeseen circumstances’. This Plan should be prepared prior to the operational stage of the expansion program and take account of the IFC’s Good Practice Note on Managing Retrenchment;
- Working with Government to coordinate regional rural strategies for the remote regions adjacent to the mine;
- Engaging with local communities to ensure that provision of community water supply and other services is appropriate for the needs of the local community, and don’t encourage in-migration that exceeds the long-term self-sufficient capabilities of the local area;
- Community awareness training and sensitisation with regards to the increase in traffic potential for accidents along the Nouakchott – Nouâdhibou N2 national highway and along the access road and within the Mine site;
- Transparent community complaints / grievance procedure;
- Notification of convoy movements, improved road signage and driver training;
- Working with the government and the local communities to develop specific plans to phase in sustainable management of support services; and
- Developing retrenchment plans to ensure that the downsizing of the workforce is subject to appropriate standards (i.e. consultation, adequate notice / severance pay, etc.) and consideration of worker re-training and other forms of assistance (e.g. help to set up small businesses as a means of alternative livelihood).

11.7 Cumulative Impacts

The cumulative socio-economic impacts resulting from the whole of the Project will provide an overall increase in the wealth and access to livelihoods of the national population if well managed. As a result, the net effect will be positive. The main national level benefit is increased government revenues from mining royalties, taxes and other fees and payments,
which could contribute to improved social services, infrastructure, or debt reduction, depending on how the Government elects to invest the revenue.

In addition, provided workers are recruited from Mauritania’s national labour pool wherever possible, the skills base of the national population should increase, providing a more skilled workforce for future mining projects and increasing employment opportunities for those benefiting from skills enhancement either at home in mining or other sectors or even abroad.

Furthermore, if goods and services are sourced locally within Mauritania, the effects on indirect employment and cash flows into the local economy should be beneficial.

It is also important to note that the Project’s lifespan from construction to closure will provide many opportunities for increased capacity building. The identification of meaningful, long-term community investment initiatives through consultation with stakeholders will help to build local capacity over time, enhance the Project’s benefit footprint, and improve the sustainability of the local economy.

11.8 Summary

Table 11-15 overleaf summarises the potential impacts after mitigation measures have been implemented.

### Table 11-15: Summary of Potential Residual Impacts1 - Socio-Economics

<table>
<thead>
<tr>
<th>Location</th>
<th>Nature of Impacts</th>
<th>Mitigation / Enhancement Measure</th>
<th>Project Phase</th>
<th>Nature</th>
<th>Duration</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nationally</td>
<td>Generation of Government revenues through payment of Mine royalties and taxes</td>
<td>None required.</td>
<td>C, O</td>
<td>Beneficial</td>
<td>Medium / Long term</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Creation of substantial numbers of jobs at regional and local level during construction and operation</td>
<td>No additional mitigation required.</td>
<td>C, O</td>
<td>Beneficial</td>
<td>Medium / Long term</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Improvement of the national skills base for the mining sector</td>
<td>No additional mitigation required.</td>
<td>C, O, D</td>
<td>Beneficial</td>
<td>Long term</td>
<td>Moderate / High</td>
</tr>
<tr>
<td></td>
<td>Improvements in workforce wellbeing and satisfaction</td>
<td>Monitoring contractors’ and subcontractors’ compliance with national labour laws and TMLSA HR / OHS policies, standards and procedures</td>
<td>C, O</td>
<td>Beneficial</td>
<td>Short/ Medium term</td>
<td>High</td>
</tr>
<tr>
<td>Location</td>
<td>Nature of Impacts</td>
<td>Mitigation / Enhancement Measure</td>
<td>Project Phase</td>
<td>Nature</td>
<td>Duration</td>
<td>Significance</td>
</tr>
<tr>
<td>----------</td>
<td>------------------</td>
<td>----------------------------------</td>
<td>--------------</td>
<td>--------</td>
<td>----------</td>
<td>--------------</td>
</tr>
<tr>
<td>Locally</td>
<td>Improved access to water, health and education</td>
<td>No additional mitigation required.</td>
<td>C, O</td>
<td>Beneficial</td>
<td>Medium term</td>
<td>High</td>
</tr>
<tr>
<td>Locally</td>
<td>Potential for inward migration in the vicinity of the mine, and along the</td>
<td>Strict enforcement of existing mitigation Working with government on rural development</td>
<td>C, O</td>
<td>Slightly Adverse</td>
<td>Short / Medium term</td>
<td>Low</td>
</tr>
<tr>
<td>Generation of business opportunities for new and existing Mauritanian enterprises to provide goods and services to the Mine</td>
<td>No additional mitigation required.</td>
<td>C, O</td>
<td>Beneficial</td>
<td>Medium / Long term</td>
<td>Moderate / High</td>
<td></td>
</tr>
<tr>
<td>Creation of indirect employment</td>
<td>No additional mitigation required</td>
<td>C, O</td>
<td>Beneficial</td>
<td>Short / Medium term</td>
<td>Moderate</td>
<td></td>
</tr>
<tr>
<td>Stimulation of consumer markets</td>
<td>No additional mitigation required</td>
<td>C, O</td>
<td>Moderately Beneficial</td>
<td>Medium term</td>
<td>Moderate / High</td>
<td></td>
</tr>
<tr>
<td>Strengthening of civil society sector</td>
<td>No additional mitigation required.</td>
<td>C, O</td>
<td>Beneficial</td>
<td>Long term</td>
<td>Moderate</td>
<td></td>
</tr>
</tbody>
</table>

(including capacity building for contractors if needed).
Defining a Retrenchment Plan that sets out provisions for managing any temporary lay-offs caused by ‘unforeseen circumstances’. This Plan should be prepared prior to the operational stage of the expansion program and take account of the IFC’s Good Practice Note on Managing Retrenchment.
<table>
<thead>
<tr>
<th>Location</th>
<th>Nature of Impacts</th>
<th>Mitigation / Enhancement Measure</th>
<th>Project Phase</th>
<th>Nature</th>
<th>Duration</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>access road and N2 highway</td>
<td>strategies&lt;br&gt;Engaging with local communities to ensure that provision of community water supply and other services is appropriate for the needs of the local community and does not encourage immigration that exceeds the long-term self-sufficient capabilities of the local area.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased traffic on access road and N2 highway and potential increase in accidents involving communities and/or livestock</td>
<td>Notification of convoy movements, improved road signage and driver training&lt;br&gt;Transparent community complaints / grievance procedures&lt;br&gt;Community awareness training and sensitisation with regards to the increase in traffic potential for accidents along the Nouakchott – Nouadhibou N2 national highway, the access road and within the Mine site.</td>
<td></td>
<td>C O</td>
<td>Adverse</td>
<td>Short / Medium Term</td>
<td>Low / Moderate</td>
</tr>
<tr>
<td>Loss of services support at Mine closure</td>
<td>Working with the government and the local communities to develop specific plans to phase in sustainable management of</td>
<td></td>
<td>D</td>
<td>Slight Adverse</td>
<td>Short Term</td>
<td>Low / Moderate</td>
</tr>
<tr>
<td>Location</td>
<td>Nature of Impacts</td>
<td>Mitigation / Enhancement Measure</td>
<td>Project Phase$^2$</td>
<td>Nature$^3$</td>
<td>Duration$^3$</td>
<td>Significance$^3$</td>
</tr>
<tr>
<td>----------</td>
<td>------------------</td>
<td>----------------------------------</td>
<td>-------------------</td>
<td>------------</td>
<td>-------------</td>
<td>------------------</td>
</tr>
<tr>
<td></td>
<td>Loss of employment at Mine closure</td>
<td>Retrenchment Plan</td>
<td>D</td>
<td>Adverse</td>
<td>Short Term</td>
<td>Low</td>
</tr>
</tbody>
</table>

$^1$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

This Section presents the methodology and baseline conditions used to assess the potential impacts on archaeology and cultural heritage resulting from Phase 2. In addition mitigation measures which avoid, reduce, remediate or compensate potential impacts are proposed and the residual impacts (impacts after mitigation measures implemented) assessed.

12.1 Methodology

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

12.1.1 Standards and Guidance

All tangible cultural heritage is the public property of the State and is protected by Framework Law No. 2005-046 on the Protection of Tangible Cultural Heritage (25 July 2005), Law No. 2000-045, relating to the Environment Code (26 July 2000), and in Chapter IV, Art 79, which details the protection of historic monuments. Law No. 99-013, relating to the Mining Code (23 June 1999), stipulates in its Article 54, Paragraph 1 that research work or exploitation must respect regulations and obligations relating to the protection of cultural heritage. Muslim burials are protected both by Framework Law No. 2005-046 and by Sharia law. Such sites are respected by local populations.

The assessment of significance of cultural heritage sites and potential impacts, mitigation measures proposed and criteria for evaluating mitigated impacts follows international best practice and national legislation. The assessment has been developed with reference to International Finance Corporation (IFC) Performance Standard 8 (IFC, 2006) and accompanying guidance notes (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 Environmental Design Criteria (Hatch, 2011a).

12.1.2 Baseline Methodology

12.1.2.1 Cultural Heritage Baseline Studies

A number of archaeological studies have been undertaken at and in the vicinity of the Mine in order to inform the Environmental Impact Assessment (EIA) and Project design (see Table 12-1). The present EIA draws on the inventories of archaeological sites, monuments and findspots, knowledge of historic landscapes and the wider archaeological and cultural heritage context established in the course of these studies.
Table 12-1: Overview of archaeological survey stages and sites identified within the Mine site

<table>
<thead>
<tr>
<th>Area</th>
<th>Results</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>El Ghaïcha area</td>
<td>High-level area scoping survey</td>
<td>Vernet &amp; Naffé, January 2004</td>
</tr>
<tr>
<td>January 2004</td>
<td>180 sites in an area of c.600 km² around the Mine site. Sites included Palaeolithic tool scatters, Neolithic occupation areas, Protohistoric tombs, metalworking hearths and Muslim graves</td>
<td></td>
</tr>
<tr>
<td>Tasiast, West Branch</td>
<td>Baseline archaeological field inventory</td>
<td>Kaber, January 2011</td>
</tr>
<tr>
<td>January 2011</td>
<td>8 archaeological sites (which may contain more than one asset), comprising:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 Neolithic dune-top occupation area with burials (WB01, WB02 &amp; WB04)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 Protohistoric tombs (WB03, WB05 &amp; WB08)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 stray finds (WB06 &amp; WB07)</td>
<td></td>
</tr>
<tr>
<td>Tasiast, Mine site</td>
<td>Baseline archaeological field inventory</td>
<td>Kaber, March 2011</td>
</tr>
<tr>
<td>March 2011</td>
<td>44 archaeological sites, (which may contain more than one asset)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>comprising:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>16 Neolithic occupation areas (TE25, TE26, TE27, TE27B, TE28, TE29, TE30, TE31, TE32, TE33, TE34, TE35, TE36, TE37, TE38)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>27 Protohistoric tombs or tomb groups (TE02, TE03, TE04, TE05, TE07, TE08, TE09, TE10, TE11, TE12, TE13, TE15, TE16, TE17, TE18, TE20, TE21, TE22, TE23, TE24, TE25, TE32, TE39, TE40, TE41, TE42, TE43, TE44)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 Muslim graves or groups of graves (TE06, TE14, TE21, TE24)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 stray finds (TE01, TE19)</td>
<td></td>
</tr>
<tr>
<td>Tasiast, Mine site</td>
<td>Review of known sites in baseline archaeological field inventory</td>
<td>Kaber &amp; O’Brien, May 2011</td>
</tr>
<tr>
<td>May 2011</td>
<td>1 extensive Neolithic occupation area (TE47)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 Protohistoric tomb (TE45)</td>
<td></td>
</tr>
<tr>
<td>Tasiast, Mine site</td>
<td>Further baseline archaeological field inventory informing Phase 2 ESIA</td>
<td>Kaber &amp; O’Brien 2011</td>
</tr>
<tr>
<td>September 2011</td>
<td>12 Protohistoric tombs (TE49, TE52, TE53, TE54, TE55, TE57, TE58, TE59, TE62, TE64, TE65, TE66)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 Muslim tombs (TE48, TE50, TE51, TE56, TE61, TE63)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 unidentified site (circular stone setting) (TE60)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 stray find (TE46)</td>
<td></td>
</tr>
<tr>
<td>Tasiast, Mine site</td>
<td>Pre-construction site clearance related to Phase 1b TSF 1 Starter Cell</td>
<td>Tasiast Environment Team, O’Brien &amp; Copp</td>
</tr>
<tr>
<td>October to December 2011</td>
<td>2 Muslim tombs (CF001, CF010)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 Possible camp fire (CF003)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 Single Protohistoric tombs (CF004, CF005, CF006, CF007, CF008 &amp; CF009)</td>
<td></td>
</tr>
</tbody>
</table>

These surveys began with a brief, high-level field survey of the El Ghaïcha concession area, which identified over 180 sites in an area of c.600 km² surrounding the Mine site and associated infrastructure (Vernet & Naffé, Nouakchott University, January 2004). This overview formed the cultural heritage baseline for the first 2004 EIA (SNC Lavalin, 2004) and subsequent EIAs (Scott Wilson, 2008a, b, c, d and 2009a, b, 2010a).

A more detailed field inventory of archaeological sites in the West Branch area was carried out in order to inform the mitigation programme (Kaber, BEE/IMRS, January 2011). This study identified eight archaeological sites (WB01-WB08).
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). This baseline study identified 44 archaeological sites (TE01-TE44).

The West Branch and Mine site baselines were reviewed in the field in May and September 2011. The May review identified a further two sites (TE45 & TE47), and the September review, which concentrated on areas potentially impacted by Phase 2, identified a further 20 sites (TE46 & TE48-TE66). The results of these reviews are contained in an on-site baseline report (URS Scott Wilson, 2011g).

All relevant baseline survey reports are available on request.

12.1.2.2 Field Research Method

A baseline archaeological desk-based and field survey was undertaken in March 2011. The baseline survey was undertaken by a qualified and experienced Mauritanian archaeologist, on behalf of URS Scott Wilson. Following best practice, the baseline survey was carried out 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 archaeological field survey was undertaken using proven, standard, terrain-appropriate field research techniques appropriate to identifying and investigating surface archaeological remains in desert areas. The baseline survey was undertaken using a 4x4 vehicle driving transects across the Mine site. Sites of interest were identified based on visual identification from a moving vehicle at ground level. Following initial visual identification, the sites were visited on foot, a Geographical Positioning System (GPS) point or polygon was recorded, and photographs were taken (see Photographs 12-1 to 12-21). No seasonal or climatic constraints impeded the survey work.

The baseline survey results were subsequently reviewed in the field by the Mauritanian archaeologist accompanied by a qualified and experienced international archaeologist in May and September 2011 (see Table 12-1), with a particular focus on areas impacted by Phase 2 Project components. The standard, terrain-appropriate field research method described above was also applied during these review surveys.

12.1.2.3 Cartographic and Satellite Imagery

Cartographic sources reviewed during the May 2011 site visit comprised 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). This data assisted in understanding the wider topographical context of the Mine site.

Orthorectified satellite imagery (<1m resolution) was obtained from DigitalGlobe (Quickbird/WorldView) and Geoeye-1. This data was used in the May and September 2011 baseline survey reviews. It proved useful in providing an overview of the topography and vegetation of the area and indicating former watercourses, but was of lesser use in distinguishing archaeological sites and monuments, which frequently resemble and/or coincide with areas of natural geological rocky outcrops.
12.1.3 Impact Assessment Methodology

12.1.3.1 Assessment of Magnitude of Impact

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 determination of magnitude of impact is based on an understanding of how, and to what extent, the proposed development would impact on the assets. The magnitude of impact can be judged on a five-point scale (see Table 12-2).

Table 12-2: Factors in the Assessment of the Magnitude of Impact (Archaeology/Cultural Heritage)

<table>
<thead>
<tr>
<th>Factors in the assessment of magnitude of impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major</td>
</tr>
<tr>
<td>Change to most or all key archaeological elements such as the resource is totally altered</td>
</tr>
<tr>
<td>Comprehensive changes to setting</td>
</tr>
<tr>
<td>Moderate</td>
</tr>
<tr>
<td>Changes to many key archaeological elements, such that the resource is clearly modified</td>
</tr>
<tr>
<td>Considerable changes to setting</td>
</tr>
<tr>
<td>Minor</td>
</tr>
<tr>
<td>Changes to key archaeological elements, such that the receptor is slightly altered</td>
</tr>
<tr>
<td>Slight changes to setting</td>
</tr>
<tr>
<td>Negligible</td>
</tr>
<tr>
<td>Very minor changes to elements or setting</td>
</tr>
<tr>
<td>No change</td>
</tr>
<tr>
<td>No change</td>
</tr>
</tbody>
</table>

12.1.3.2 Assessment of Significance and Research Agendas

National and regional research agendas are currently being developed by Mauritanian cultural heritage institutions, but have not yet been formalised. Research agendas are important in establishing the significance and value of sites, which when correlated to the magnitude of impact, produces the magnitude of effects (see Table 12-3 to Table 12-5). They are also key to guiding the Mitigation Project Design, as they ensure that fieldwork output is scientifically valid, targeted and robust. This assures a research dividend and feeds constructively into capacity building and effective mitigation.

General research agendas include:

- Establishing the character, location, extent, quality and state of preservation of the surviving cultural heritage 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 their influence on settlement patterns, communication networks and land use;
- Recognising and interpreting spatial or functional continuity (or discontinuity) between any phases of activity;
- 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 drawing 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 (aelolian 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.

The impact assessment methodology set out below draws on the standard model for EIA assessment & cultural heritage produced by the United Kingdom (UK) Department for Transport with regard to European Union Directive (85/337/EEC) and the guidance of the Institute for Archaeologists12.

12.1.3.3 Assessment of Significance/Value of Archaeological Sites

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, representativeness, 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 (see Assessment of Significance and Research Agendas above), 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

<table>
<thead>
<tr>
<th>Significance / value</th>
<th>Key characteristics of archaeological receptor</th>
</tr>
</thead>
</table>
| 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, including stray finds. |
| Unknown              | The importance of the resource cannot be ascertained                           |

12.1.4 Assessment of Significance of Effects

The criteria used to determine the significance of effects are set out in Table 12-4 which demonstrates how the significance of effect is assessed. These criteria refer to the physical and setting effects on archaeological sites and monuments. Other compensation factors, such as the public benefit of the dissemination of archaeological information, museum curation and display, capacity building and public awareness are not included in this assessment, which refers directly to the effects upon sites and monuments. These factors are discussed in Section 12.5.1.4, Mitigation (additional measures and off-set options).

Table 12-4: Criteria used to determine Significance of Effects (Archaeology/Cultural Heritage effects)

<table>
<thead>
<tr>
<th>Criteria used to determine significance of effects</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very large adverse</td>
<td>Complete removal of an archaeological site. Severe transformation of the setting or context of an archaeological monument or significant loss of key components in a monument group. Complete removal or transformation of deposits leading to complete loss of research knowledge (without mitigation).</td>
</tr>
<tr>
<td>Large adverse</td>
<td>Complete removal of an archaeological site. Severe transformation of the setting or context of an archaeological monument or significant loss of key components in a monument group. Loss of research resource to future investigation – archaeological investigation methods and analysis improve over time, and potential research knowledge will be lost to future generations (with mitigation using current best available &amp; appropriate techniques).</td>
</tr>
<tr>
<td>Moderate adverse</td>
<td>Removal of a major part of an archaeological site’s area and loss of research potential. Partial transformation of the setting or context of an archaeological site or partial loss of key components in a monument group. Partial removal or transformation of deposits leading to a loss of research knowledge to future investigators. Introduction of significant noise or vibration levels to an archaeological monument leading to changes to amenity use or, accessibility or appreciation of an archaeological site. Diminished capacity for understanding or appreciation (context) of an archaeological site.</td>
</tr>
<tr>
<td>Slight adverse</td>
<td>Removal of a minor part of an archaeological site’s area but the site retains a significant research potential. Minor change to the setting of an archaeological monument. Minor removal of deposits that form part of a wider surviving research resource.</td>
</tr>
<tr>
<td>Neutral</td>
<td>No physical impact or change. No observable change in setting or context. No impact from changes in use, amenity or access.</td>
</tr>
</tbody>
</table>
### Criteria used to determine significance of effects

<table>
<thead>
<tr>
<th>Slight beneficial</th>
<th>Decrease in visual or noise intrusion on the setting of an archaeological site or monument. Improvement of the wider landscape setting of an archaeological site or monument.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate beneficial</td>
<td>Significant reduction or removal of visual or noise intrusion on the setting of an archaeological site or monument. Reduction or removal of significant vibration levels. Improvement of the setting of an archaeological site or monument. Enhanced capacity for understanding or appreciation (context) of an archaeological site or monument. Improvement of the cultural heritage amenity, access or use of an archaeological site or monument.</td>
</tr>
<tr>
<td>Large/very large Beneficial</td>
<td>Exceptional enhancement of an archaeological site, its cultural heritage amenity and access or use.</td>
</tr>
<tr>
<td>Uncertain</td>
<td>The effect cannot be predicted.</td>
</tr>
</tbody>
</table>

The significance of the effects of the proposed development on archaeological remains is determined by the value of the receptor and the magnitude of impact. Table 12-5 provides a matrix to demonstrate how the significance of effect is assessed.

### Table 12-5: Significance of Environmental Effects (Archaeology/Cultural Heritage)

<table>
<thead>
<tr>
<th>Significance/ value</th>
<th>Very high</th>
<th>Neutral</th>
<th>Slight</th>
<th>Large</th>
<th>Very large</th>
<th>Very large</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>Neutral</td>
<td>Slight</td>
<td>Moderate</td>
<td>Large</td>
<td>Very large</td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>Neutral</td>
<td>Slight</td>
<td>Slight</td>
<td>Moderate</td>
<td>Large</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>Neutral</td>
<td>Slight</td>
<td>Slight</td>
<td>Slight</td>
<td>Moderate</td>
<td></td>
</tr>
<tr>
<td>Negligible</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Slight</td>
<td>Slight</td>
<td>Slight</td>
<td></td>
</tr>
<tr>
<td>No change</td>
<td>Negligible</td>
<td>Minor</td>
<td>Moderate</td>
<td>Major</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 12.2 Principles of Archaeological Mitigation

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 Project design or protected with fencing, 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 archaeological studies, documentation and protection. Any impacts on cultural heritage sites that are protected by national/Sharia law and customary practice, such as Muslim tombs, will be appropriately mitigated with the informed participation of national or local cultural heritage regulators, and, as appropriate, the affected communities and other key stakeholders.

In all cases, human remains and funerary objects shall be treated with due dignity and respect at all times, regardless of ethnic origins, cultural backgrounds or religious affiliations.
12.3 Baseline Conditions

12.3.1 Palaeoclimatic Background

Human activity in the 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 inland, and were followed by dune formation or expansion during intervening 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 BP).

The early Holocene Tchadian climate was humid, and the remains of large tropical animals, including ‘Ethiopian’ fauna, have been identified in northern Mauritania. Epipalaeolithic populations subsisted by hunting and fishing, particularly in the vicinity of watercourses and freshwater palaeolakes during this phase (c.11,000 to 9,000 BP), although no dried-out lake beds are located within or in the immediate vicinity of the Mine site. 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 3,000 BP when there was sufficient water to sustain it.

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 the dry phases, albeit in a more dispersed form.

A summary of the archaeology of the region is set out in Table 12-6.

Table 12-6: Archaeological/historical periods in north western Mauritania

<table>
<thead>
<tr>
<th>Name</th>
<th>Sub Name</th>
<th>Period/Dates</th>
<th>Climate</th>
<th>Key sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleistocene</td>
<td>Palaeolithic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oldowan Pebble Culture</td>
<td>c.700,000 – c.530,000 BP</td>
<td>Humid - Tafaritian Transgression</td>
<td>Adrar &amp; Tiris</td>
</tr>
<tr>
<td></td>
<td>Acheulean (H. habilis)</td>
<td>c.350,000 – c.70,000 BP</td>
<td>Humid - Aioujian Transgression</td>
<td>Adrar</td>
</tr>
<tr>
<td></td>
<td>Aterian</td>
<td>c.29,000 – c.18,000 BP</td>
<td>Hyper-arid – Trarzian; Inchirian wet period; Ogolian</td>
<td>Adrar, Tiris, Western Mauritania including regs of Tasiast &amp; Tirersioum</td>
</tr>
<tr>
<td></td>
<td>Upper Palaeolithic</td>
<td>c.11,000 – c.9,000 BP</td>
<td>Tropical – Tchadian</td>
<td>Tiris</td>
</tr>
<tr>
<td>Holocene</td>
<td>Neolithic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Early</td>
<td>c.8,500 – c.7,000 BP</td>
<td>Humid - Neolithic Sub-pluvial</td>
<td>North of Banc D’Arguin, Berouga (Tirersioum); Tasiast (Houeoutt, Mejhoula)</td>
</tr>
<tr>
<td></td>
<td>Middle</td>
<td>c.6,000 – c.5,000 BP</td>
<td>Nouakchottian; increasingly arid</td>
<td>South of Banc D’Arguin; Inchiri; Amatlich (Khatt)</td>
</tr>
<tr>
<td></td>
<td>Later</td>
<td>c.4,200 –</td>
<td>Arid Tafollen</td>
<td></td>
</tr>
</tbody>
</table>
### 12.3.2 Archaeological Background

#### 12.3.2.1 Palaeolithic Period (c.700,000 to 18,000 BP)

The 2004 EIA (SNC Lavalin, 2004) 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.

#### 12.3.2.2 Neolithic Period (c.8,500 to 2,000 BP)

Neolithic sites in western Mauritania include coastal shell middens, rock art and also 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. This material is typical of the early to middle Neolithic in the interior of Western Mauritania (Commelin et al., 1992; Vernet & Ould Mohamed Naffé, 2003).

There is a cluster of Neolithic sites in the south east and east of the Mine site, which forms part of a more extensive group of Neolithic dune-top occupation sites along the course of the former Khatt Atoui Wadi which crosses the Tasiast plain from north east to south west. There is one occupation site in the northwest of the Mine site, which also forms part of this group. There are further clusters of Neolithic sites outside the Mine site boundary along the Khatt Atoui to the south and south east, and to the north west, at the Houeouats Dunes and N’talfa Oglat. 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 (aeolian erosion). Burials are usually 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 which have scoured out the protective layers that once covered the burials.

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 sites in the Banc D’Arguin National Park), 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 pottery vessels, necklaces of ostrich eggshell, West African blood cockle shells (*Anadara senilis*) and pebbles placed in the mouth.

The later Neolithic is less well understood. Activity was concentrated in less dry areas, south of Nouakchott, towards the Senegal River (such as the 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 occupation sites, which may have comprised seasonally occupied structures with roofs made of perishable materials that were easy to dismantle.

12.3.2.3 Protohistoric Period (c.2,000 BP to 1,000 BP)

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 occupation areas on the tops and slopes of ogolian dunes in this area.

Many of the tombs in western Mauritania date to this long transitional period, which comprises the late Neolithic, the Chalcolithic, and the Protohistoric periods. The tombs at and around the Mine site form part of the Khatt Atoui group, associated with the former river. The northern part, and tombs to the north of the Mine site at Staïlet Yali and Khneffissat, were first investigated by Jean Spruytte and Louis Vincent-Cuaz in the 1950s (Spruytte & Vincent-Cuaz 1956 & 1957; Vernet 1993, 190).

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 once used as occupation sites in the preceding Neolithic period.

12.3.2.4 Historical Period (c.4th century AD to present)

The nomadic population has left little trace in the archaeological record. The 2004 EIA (SNC Lavalin, 2004) did identify an isolated metalworking site and several Muslim graves in the wider area. Approximately 30 km east of the proposed development at the Mine site, at the foot of the Guelb Fask, there is a Muslim cemetery, which developed around the tomb of Sidi Muhammas al-Kunti. That tomb remains an important site for the local population.

A series of Muslim tombs have been identified within the Mine site, 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, as well as a number of isolated Muslim tombs.
12.3.3 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 townsment 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 Hassāniya Arabic personal names, plant names or topographical metaphors. Mauritanian place-names occasionally contain some traces of Berber (Zênaga) 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.

12.3.4 Baseline Data

The baseline approach aimed to establish an inventory of archaeological and cultural heritage assets within the Mine site and its immediate environs. As noted in Table 12-1, a number of stages of field survey were undertaken to establish an inventory.

12.3.4.1 Statutory Constraints

There are no internationally recognised or legally protected cultural heritage features or areas (World Heritage Sites), or proposed critical cultural heritage features or areas (candidate World Heritage Sites), within the Mine site (IFC Performance Standard 8, 2012). All cultural heritage is protected by Mauritanian law. There are a number of historic Muslim tombs which are protected by national/Islamic law and customary practice. See Figure 12-1 for locations of archaeological sites within the Mine site.

The design of Phase 2 works incorporated careful consideration of the baseline data (Kaber, March 2011: sites WB01-WB08; Sites TE01-TE44). Subsequent clearance surveys, undertaken after Phase 1ai, 1aii and Phase 1b design and construction approval identified a number of additional sites (Sites TE44-TE66; Chance Finds CF001, and CF003 to CF010). Extensive design work has been undertaken for Phase 2, and, where appropriate and reasonably feasible, the design avoids direct impacts on archaeological sites.

12.3.4.2 Overview of Archaeological Sites

There is no evidence for extensive Palaeolithic or Epipalaeolithic sites within the Mine site, although a stray find of a Palaeolithic tool was noted in the West Branch area (WB07).

Neolithic sites identified within the Mine site comprise clusters of occupation sites located on ogolian dunes, situated mainly towards the eastern and south eastern edges of the Mine site (West Branch site WB01; Tasiast Project sites TE25-TE30, TE31, TE32-TE38 & TE47). 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 subsurface features will be shallow or will have been eroded away by seasonally shifting winds. Stray finds of Neolithic date include a pottery scatter (WB04), a saucer quern (WB06), quernstone fragments and pottery (TE01), broken quernstones (TE19), and a quern handstone (TE46).

Protohistoric period heritage assets identified within the Mine site comprise clusters of Protohistoric tombs, and a number of isolated tombs (WB03, WB05 & WB08; TE02, TE03, TE04, TE05, TE07, TE08, TE09, TE10, TE11, TE12, TE13, TE15, TE16, TE17, TE18, TE20, TE21, TE22, TE23, TE24, TE25, TE32, TE39, TE40, TE41, TE42, TE43, TE44, TE45, TE49, TE52, TE53, TE54, TE55, TE57, TE58, TE59, TE62, TE64, TE65, TE66, CF004, CF005, CF006, CF007, CF008 and CF009).

A series of historic Muslim tombs have been identified within the Mine site, comprising single tombs (Sites TE14, TE48, TE50, TE51, TE56, TE61, TE63, CF001, CF010), a pair of tombs (TE06, TE21), and a cluster of Muslim tombs (TE24). These sites are illustrated on Figure 12-1.

An undated possible camp fire or hearth (CF003) is located close to a group of Protohistoric tombs (TE20, TE21) and Muslim tombs (TE50, TE51).

12.3.4.3 Neolithic Sites

Neolithic sites comprise a number of major occupation areas on ogolian dunes. The directions of the desert winds change seasonally, resulting in generalised erosion of all aspects of these sites. The value of all the Neolithic occupation sites is assessed as high, as they are upstanding monuments which have the potential to contribute significantly to research and they form part of a coherent and complex multi-period historic landscape.

In the east of the Mine site, 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 TE25 & TE26; please see Table 12-7 for further details and comparison of characteristics of all Neolithic occupation sites). Finds included stone tools with evidence for manufacture on-site, pottery, ostrich eggshell and eroded 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 TE27, TE27b, TE28 & TE29).

In the south eastern corner of the Mine site is a further occupation site on the summit of, and around, a high ogolian dune. Lithics mainly comprise geometric microliths and pottery is cord-impressed; querns are not frequent (Site TE30).

In the south of the study area is a 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 WB01 & Project Sites TE31, TE32, TE33, TE34, TE35, TE36, TE37 & TE38). Human bone was noted at Site TE34. Site TE32 is particularly large, extending beyond the southern limit of the Mine site.

A further extensive occupation site, TE47, is located on an ogolian dune in the north western corner of the Mine site, and extends across gravels north west of the Mine site beyond the Mine site boundary. This site forms part of a separate cluster of occupation sites northwest of the Mine site, which, like the sites in the south and east of the Mine site, is associated with the former river courses of the Khatt Atoui Wadi.
In addition to the occupation sites, three isolated find spots have been identified. In the north west of the Mine site, pottery and quernstones (TE01) and a handstone (TE46) were recorded, and in the north east of the Mine site, broken quernstones were recorded (TE19).

**Table 12-7: Summary of Neolithic occupation sites on ogolian dunes within the Mine site, indicating cultural material identified on each site. All sites are of high value**

<table>
<thead>
<tr>
<th>Site number</th>
<th>Scale of site</th>
<th>High dune</th>
<th>Flat dune</th>
<th>Large dune</th>
<th>Pottery</th>
<th>Cord impressed</th>
<th>Stone tools</th>
<th>Stone tool manufacture</th>
<th>Imported flint blocks</th>
<th>Geometric microliths</th>
<th>Querns</th>
<th>Ottrich eggshell</th>
<th>Neolithic human remains</th>
<th>Protohistoric tombs</th>
</tr>
</thead>
<tbody>
<tr>
<td>WB01</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>+++</td>
<td>++</td>
<td>++</td>
<td>+++</td>
<td>+++</td>
<td>+</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>TE25/26</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>++</td>
<td>+++</td>
<td>+++</td>
<td>+</td>
<td>(2+)</td>
<td>(2+)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TE27</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>++</td>
<td></td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TE27b</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td></td>
<td>++</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TE28</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td>++</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TE29</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td>++</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TE30</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TE31</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TE32</td>
<td>+++</td>
<td>+</td>
<td>+</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TE33</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TE34</td>
<td>+++</td>
<td>+</td>
<td>+</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TE35</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TE36</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TE37</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TE38</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td>++</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TE47</td>
<td>+++</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+++</td>
<td>(3+)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1, +++, ++ = frequent/large size/quantities

**12.3.4.4 Protohistoric Sites**

There are a number of groups of protohistoric tombs, which are located:

- In the north east of the Mine site (Sites TE07, TE08, TE09, TE10, TE11, TE12, TE62, TE64, TE65, TE66, CF004, CF005); and north east of the Mine site in the new airport area (permitted in Phase 1b) (Sites TE13, TE15, TE16 & TE17);
- In the northern part of the Mine site (Sites TE02, TE03, TE04 & TE05, in the vicinity of the expanded open pit);
- In the eastern part of the Mine site (Sites TE20, TE21, TE22, TE23, TE24 & CF006 to the east of the proposed Accommodation Camp; and TE49 in the proposed accommodation camp area);
- In the south (Sites TE39, TE52, TE53, TE54, TE55, CF007, CF008, CF009 & TE59; West Branch Sites WB03, WB05 & WB08, in the waste rock dump and expanded open pit areas); and,
- In the south west (Sites TE40, TE41, TE42, TE43, TE44, TE45, TE57 & TE58, in the area of the Heap Leach Facility and Tailings Storage Facility (TSF).

These tombs generally comprise a single tomb or cairn of rocks raised over one or several inhumations. Crescent-shaped antenna tombs include Sites WB08 & TE18. In some cases,
there are central tombs with smaller satellite tombs (Sites TE11, TE20, TE21, TE42 & TE52). 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 TE20 – 24) and, in the south west of the Mine site, in the area of the proposed Heap Leach Facility (Sites TE40 – TE44).

The value of such tombs is assessed as medium (single/simple tombs) or high (elaborate or antenna tombs, and paired tombs and tomb fields which have enhanced ‘group’ value), as they are upstanding monuments which have the potential to contribute significantly to research and form coherent historic landscapes.

Table 12-8: Summary of value of Protohistoric tombs within Mine site ([ ]=tomb groups)

<table>
<thead>
<tr>
<th>Tomb type</th>
<th>Tomb reference numbers</th>
<th>Assessed value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protohistoric simple circular tombs (isolated)</td>
<td>TE04, TE05, TE13, TE17, TE39, TE45, TE49, TE57, TE58, CF006, CF007, CF008, CF009</td>
<td>Medium</td>
</tr>
<tr>
<td>Protohistoric tombs (two or more nearby tombs or related ritual monuments, with topographical relationship e.g. on same hill ridge)</td>
<td>[WB03 &amp; TE55], [WB05 &amp; TE54], [WB08 &amp; TE59], [TE02 &amp; TE03], [TE07, TE08, TE09, TE10, TE11, TE12, TE62, TE64, TE65, TE66, TE15, TE16], [TE20, TE21], [TE22 &amp; TE23], [TE24], [TE40, TE41, TE42, TE43, TE44], [TE52 &amp; TE53], [CF004, CF005]</td>
<td>High</td>
</tr>
<tr>
<td>Protohistoric antenna tombs</td>
<td>WB08, TE18</td>
<td>High</td>
</tr>
<tr>
<td>Protohistoric burials within Neolithic dune-top occupation area</td>
<td>WB01, [TE25 &amp; TE26], TE32</td>
<td>High (value conferred by surrounding Neolithic dune-top occupation site)</td>
</tr>
</tbody>
</table>

12.3.4.5 Historic Sites

Historic period heritage assets have been identified within the Mine site, and comprise isolated Muslim tombs in the north of the Mine site (TE14, TE63), located within clusters of earlier, Protohistoric tombs. There are single and paired Muslim tombs to the east of the proposed accommodation camp (Sites TE21, TE24, TE48, TE51), along a ridge also occupied by earlier burials. An isolated Muslim tomb is located in the centre of the Mine site (Site TE61), north of the area of the proposed Waste Rock Dump, which has been designed to avoid impacts. Another isolated Muslim tomb (CF010) is located to the south east in the area of the proposed waste rock dump. A Muslim tomb is also situated in the north of the site, TE06, located close to an earlier Protohistoric tomb (TE05) east of the proposed Expanded Open Pit and east of the waste rock dump. A further isolated Muslim tomb, TE56, is located in the south of the Mine site, close to the proposed route towards the expanded waste management facility. An isolated Muslim grave (CF001) was identified during pre-construction clearance works associated with Phase 1b (TSF 3 Starter Cell 1), and together with CF010 it will be relocated with the permission of and following the procedures of the Ministry of Islamic Affairs.

These tombs comprise a single burial beneath a sub-rectangular cairn of fairly flat stones or gravel, with an un-inscribed stone grave marker at one or both ends of the burial. The occupants of the graves are not known. Based on visual evidence no recent graves were identified. None of the graves are the subject of pilgrimages or particular devotions.

The value of such tombs is assessed as high. Burials are protected under Mauritanian statute law and Sharia law, and such sites are respected by local populations.
12.3.4.6 Undated Sites

There is an undated possible camp fire (CF003) to the east of the proposed Accommodation Camp and an undiagnostic arrangement of stones in the processing and power facilities area (TE60).

12.4 Potential Impacts

12.4.1 Overview

Potential impacts on Neolithic, Protohistoric and historic archaeological receptors across the overall assessment area, i.e. the entire area within the perimeter fence of the Mine site, include:

- Total or partial removal of sites (e.g. tombs) and surface scatters (e.g. occupation sites) due to groundworks and levelling, construction of access and permanent roads, construction of services/utilities routes, construction of buildings and processing facilities, blasting, mining and 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 potential impacts would result in a very large adverse and long term effect, as archaeological remains would be irreversibly removed, their setting or context transformed, and sites lost leading to complete loss of research knowledge. For this reason, appropriate mitigation (protection, relocation and/or archaeological investigation) will be carried out in advance of the proposed works.

12.4.2 Construction

During the construction phase, the activities summarised in Table 12-9 will completely or partially remove archaeological remains if present; this will be mitigated by the methods indicated below.

Table 12-9: Anticipated construction impacts – direct, indirect and temporary

<table>
<thead>
<tr>
<th>Direct construction impacts</th>
<th>Indirect construction impacts</th>
<th>Temporary construction impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground preparation activities, including building foundations and piling</td>
<td>Significant change to setting or context of archaeological site</td>
<td>The movement of traffic and transport across the site</td>
</tr>
<tr>
<td>Terracing and excavation work (ponds, embankments and bunds)</td>
<td>Potential illicit removal of archaeological artefacts from within the Mine site or the surrounding area</td>
<td>Increase in noise and visual intrusion</td>
</tr>
<tr>
<td>Diversion of utilities and drainage</td>
<td>Vehicle tracking</td>
<td>The use of temporary topsoil storage areas</td>
</tr>
<tr>
<td>Construction and realignment of roads</td>
<td></td>
<td>The installation and use of temporary road diversions</td>
</tr>
<tr>
<td>Blasting and excavation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rubble and waste dumping</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
12.4.2.1 Overview of Impacts and Proposed Mitigation Programme

Project components have been designed, where reasonably feasible, to avoid direct construction footprint impacts on archaeological sites, in accordance with IFC guidance (IFC 2006 & 2012), Kinross Standards (2004) and the Project Environmental Design Criteria (Hatch, 2011).

Despite careful design, the overall magnitude of impact of the Phase 2 activities on archaeological remains is assessed as major and the effects are judged to be very large adverse prior to mitigation, and large adverse following mitigation. The sites that would be impacted by Phase 2 include 15 high-value Neolithic occupation sites, of national quality and importance, which can contribute significantly to national-level research objectives. The Phase 2 works would also impact more than 20 high or medium value Protohistoric tombs. The present Phase 1b works will impact on one Muslim tomb (CF001). Direct and indirect impacts on archaeological sites are summarised in Table 12-9.

The magnitude of impact is judged as major as it will result in change to most or all key archaeological elements, such that the resource will be totally altered, and will lead to comprehensive changes to setting. The effect (without mitigation) is judged as very large adverse, as the Phase 2 works would result in the complete removal of archaeological sites, the severe transformation of the setting or context of archaeological monuments, and the significant loss of key components of monument groups.

In order to mitigate this significant adverse impact, it is proposed that a major programme of archaeological site protection and investigation be carried out (see mitigation discussion below). Where reasonably feasible, impacts on archaeological remains will be avoided by design, and sites will be preserved in situ and protected by fenced enclosures. Where appropriate, high-quality, visually sympathetic, long term gated enclosure fences equipped with an information panel would be specified and installed by the Ministry of Culture. This would provide physical protection and create an educational visitor resource.

Where impacts are unavoidable, archaeological recording would be undertaken in order to offset any significant loss of the archaeological resource with a robust, scientific research dividend. This Project would feed into national and international archaeological research and capacity-building in cultural heritage. A detailed scope of works, including a comprehensive archaeological research design, is currently being prepared by an expert Mauritanian archaeologist. All archaeological fieldwork, post-excavation analysis, publication, dissemination and finds curation would be funded by Tasiast Mauritanie Limited SA (TMLSA). Given the scale of the fieldwork and analysis required, it is proposed that this work be undertaken as a staged programme, proceeding well in advance of the proposed construction schedule.

Phase 2 will lead to moderate to major direct setting impacts across the entire Mine site. The historic landscape and its tranquility are already affected by existing development in terms of visual and noise intrusion; in the long-term (post-closure), some of these impacts are reversible. There will be cumulative visual intrusion in an area already affected by previous development.

Any potential revisions to the site layout within the perimeter fence and resulting impacts to archaeological sites will be addressed appropriately, following the procedures set out in this document and in the Cultural Heritage Management Plan. Chance finds will be treated in

---

13 Xi'an Declaration on the Conservation of the Setting of Heritage Structures, Sites and Areas Adopted in Xi'an, China, by the 15th General Assembly of ICOMOS on 21 October 2005 http://www.international.icomos.org/xian2005/xian-declaration.htm
accordance with the Chance Finds Procedure, which forms part of the Cultural Heritage Management Plan.

12.4.2.2 Direct Impacts

Impacts on archaeological sites are described prior to mitigation. The effects of impacts with mitigation applied are set out in Section 12.5 below.

Proposed Phase 2 components with no impact on archaeological remains

Based on cultural heritage baseline studies, detailed construction clearances and chance finds to date, a number of Phase 2 Project components will not have any direct construction impact, either because they have been designed to avoid impacts on archaeological remains, or because they are being built in areas which do not contain any known archaeological sites, or because they are in areas which contain only sites of low or negligible significance. These components comprise:

- Proposed waste rock dump (north east);
- Proposed waste rock dump (north west);
- Proposed waste rock dump (south west);
- TSF 3 Cell 2;
- Dump leach facility; and,
- Carbon-In-Leach (CIL) process plant and power plant, which will only impact low/negligible value sites WB06, WB07 & TE60.

Several archaeological sites within the Mine site will not experience any direct construction impacts due to the initial stage of Phase 2 expansion, including Neolithic stray find spots (Sites WB06, WB07, TE01, TE19, TE46), Protohistoric tombs (Sites TE07, TE08, TE09, TE10, TE11, TE12, TE13, TE15, TE16, TE17, TE18, TE20, TE23, TE24, TE39, TE57, TE62, TE64, TE65, TE66, CF006), and Muslim tombs (Sites TE06, TE14, TE21, TE24, TE48, TE50, TE51, TE56, TE61, TE63) (see Figure 12-1).

Waste Rock Dump (south east)

There are three groups of Neolithic occupation sites on ogolian dunes in the east (Sites TE26, TE27, TE27b, TE28, TE29), in the south east (TE30) and in the south (TE31, TE32, TE34, TE35, TE36, TE37, TE38) of the footprint of the proposed south eastern waste rock dump. They would undergo major direct adverse impacts with very large adverse effects (without mitigation) and large adverse effects (with mitigation) if the Waste Rock Dump were eventually to cover the entire proposed footprint area.

The West Branch area has been permitted (Scott Wilson, 2010a), but a series of post-permit archaeological mitigation works are required prior to construction. This area also coincides with part of the footprint of the proposed Phase 2 south eastern waste rock dump and expanded open pit.

There is one Neolithic dune-top occupation site (WB01, WB02, WB04 – all elements of one wider site) and there are also a number of sites that contain Protohistoric tombs in this area, either singularly or as part of a multi-period site (WB01, WB03, WB08, TE32, TE52, TE53, TE55, TE59, CF007, CF008, CF009), which will be adversely impacted by the construction of the Waste Rock Dump or permanently buried beneath it.
One Muslim tomb (CF010) will be adversely impacted by the construction of the waste rock dump and will be relocated, subject to permit.

**Expanded Open Pit**

A total of six Protohistoric tombs will be adversely impacted as a result of the expansion of the open pit; these comprise sites TE02, TE03, TE04, TE05, TE54 and WB05.

There are two Neolithic occupation sites on ogolian dunes at the southern end of the proposed expanded open pit (TE37 and TE33). The impact of mining would be major and the effect would be very large adverse without mitigation, and large adverse with mitigation.

Site TE06, a pair of Muslim tombs, would be subject to adverse indirect impacts on context and setting from the construction of the proposed Phase 2 expanded open pit immediately to the west and the waste rock dump to the east. The tombs may also be impacted by blasting (vibration and dust). The waste rock dump to the east has been designed to avoid impacts on-site TE06.

**Heap Leach Facility**

A series of Protohistoric tombs located on low hills in the south west of the Mine site would be adversely impacted by the Phase 2 heap leach facility. There would be a direct impact on Protohistoric tombs TE40, TE41, TE42, TE43, TE44 and TE58 and it is proposed that this be mitigated by archaeological excavation.

The installation has been designed to avoid isolated Protohistoric tomb site TE57 and Muslim tomb TE56, although there would be moderate indirect impacts on their context and setting. These sites would be protected by long term fencing.

**Accommodation Camp**

A series of Protohistoric tombs (TE20, TE21, TE22, TE23, TE24) and Muslim tombs (TE21, TE24, TE48, TE50, TE51) and an undated possible camp fire (CF003) located on ridges north east of the proposed Accommodation Camp would undergo indirect slight adverse impacts, due to their proximity to the proposed Accommodation Camp, changes in their context and setting, and increased population and vehicle traffic. The Phase 1b EIA proposed that these sites be surrounded by long term protective fencing as part of the mitigation.

**TSF 3/ Heap Leach Expansion Area**

Protohistoric tomb TE45, located south of the present Mine access road, lies within the footprint of the proposed Phase 2 TSF 3 / heap leach expansion area. Archaeological excavation will be undertaken under excavation permit prior to the construction of TSF 3 or any ancillary facilities. Muslim tomb CF001 will be relocated, subject to permit, prior to the construction of Phase 1b infrastructure.

**Expanded Waste Management Facility**

An isolated Muslim tomb (TE56) is located south of the proposed expanded waste management facility and west of a proposed waste rock dump, within the facility expansion area. Construction would have a moderate adverse indirect impact on the context and setting of the monument. It is proposed that in mitigation, the tomb be surrounded by a long term protective fence prior to the start of Phase 2 works. The Expanded Waste Management Facility has been designed to avoid direct impacts on Protohistoric tomb TE57.
Additional site protection

Protohistoric tomb site TE18 and Neolithic occupation/burial sites TE25, TE32 and TE47 are all located on or close to the Mine site boundary. In order to prevent any damage from vehicles as access tracks develop both within and outside the Mine perimeter fence, it is proposed that these sites be surrounded by long term fencing and that a one-track policy be developed and applied.

A series of ten Protohistoric tombs (TE07, TE08, TE09, TE10, TE11, TE12, TE62, TE64, TE65, TE66) and one Muslim tomb (TE63) are located west of the proposed road leading from the new airstrip (permitted in Phase 1b) towards the accommodation camp and offices. Increased Mine site population and traffic may impact on the area. The proposed mitigation for these sites is to limit any indirect impacts by installing long term protective fencing around the cluster of tombs. A further series of tombs (TE13, TE14, TE15, TE16, TE17), located in the vicinity of the proposed Phase 1b new airstrip, will each be surrounded by protective fencing as part of mitigation works.

The use of temporary soil storage areas, construction and materials compounds and the installation and use of temporary road and utilities diversions have the potential, if not mitigated, to result in moderate to high adverse direct permanent impacts on the cultural heritage resource.

Table 12-10: Summary of Phase 2 direct and indirect impacts on archaeological sites. Direct impacts are indicated in black and indirect impacts in italic and grey type

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Neolithic occupation sites</th>
<th>Protohistoric tombs</th>
<th>Muslim tombs</th>
<th>Undated</th>
<th>Stray finds (insignificant sites excluded from EIA assessment)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste Rock Dump (south east)</td>
<td>WB01, TE26*, TE27, TE27b, TE28, TE29, TE30, TE31, TE32*, TE34, TE35, TE36, TE37**, TE38</td>
<td>WB01, WB03, WB08, TE32, TE52, TE53, TE55, TE59, CF007, CF008, CF009</td>
<td>CF010 TE61</td>
<td>WB02, WB04</td>
<td></td>
</tr>
<tr>
<td>Expanded Open Pit</td>
<td>TE37**, TE33</td>
<td>TE02, TE03, TE04, TE05, TE54, WB05</td>
<td>TE06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heap Leach Facility</td>
<td>TE40, TE41, TE42, TE43, TE44, TE58</td>
<td>TE57</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accommodation Camp</td>
<td>TE49 TE20, TE21***, TE22, TE23, TE24***, CF006</td>
<td>TE21***, TE24***, TE48, TE50, TE51</td>
<td>CF003</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
12.4.2.3 Indirect Impacts

Without mitigation measures, the increase in the population of the Mine site related to construction activity may have a moderate to high adverse indirect impact from looting and accidental damage across the whole Mine site, not just in the vicinity of the proposed Project components.

All cultural heritage sites within the overall Mine site assessment area 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.

12.4.2.4 Temporary Impacts

The construction phase will involve a temporary increase in traffic and transport, noise and visual intrusion. It is judged that this would have a low to moderate impact on the setting of cultural heritage sites, as these factors are reversible.

The use of temporary topsoil storage areas, construction and materials compounds and the installation and use of temporary road and utilities diversions have the potential, if not mitigated, to result in moderate to high adverse direct impacts on cultural heritage resource.
12.4.3 Operation

During the operational phase, the following activities have the potential to completely or partially impact upon archaeological remains, if present:

- Movement of vehicular and human traffic over undisturbed areas of the Mine site;
- Further expansion of infrastructure in the future (e.g. addition of a third cell for TSF 3);
- Illicit removal of archaeological artefacts from within the Mine site or the surrounding area.

12.4.3.1 Direct Impacts

The expanded open pit and the waste rock dump will continue to develop incrementally during the operational phase. It is possible that the proposed waste rock dump may not reach some of the sites close to the Mine site boundary, distant from the open pit. It is also possible that the more remote sites may only be impacted in the next 8 to 15 years. The impacts, and the associated mitigation, of such Project components are considered to form part of the construction activity stage (see above). Operational impacts are described below.

The operation of the Phase 2 components will lead to moderate to high 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, and an increase in dust. The proposed developments will increase the existing industrial landscape with man-made topography in the form of high waste rock dumps and deep open pits, disrupting the intervisibility of sites and natural palaeo-topography, and diminishing the understanding of previous historic land use and significance of the historic landscape. This visual intrusion is cumulative, as the Mine area has already been transformed by previous development (see Section 13).

12.4.3.2 Indirect Impacts

Without mitigation measures, the increase in the population of the Mine site related to construction activity may have a moderate to major indirect impact of increasing looting across the whole Mine site, not just in the vicinity of the proposed Project components.

All cultural heritage sites (visible or buried) 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 large indirect impact.

12.4.4 Closure

It is not anticipated that Mine closure would result in any additional impacts. Sites will remain vulnerable to looting and to vehicle damage, as well as ongoing natural impacts such as wind and sand erosion and drifting sands.
12.5 Mitigation and Monitoring Measures

12.5.1 Overview of Mitigation Measures

12.5.1.1 Mitigation (Preservation by Design, Site Protection and Archaeological Investigation)

Without mitigation, the construction impacts would result in a very large adverse and long term effect, as archaeological remains would be irreversibly removed, their setting or context transformed, and sites lost leading to loss of research knowledge. Three forms of archaeological mitigation are proposed – preservation by design, protection and recording (archaeological investigation).

With appropriate mitigation (preservation by design) to avoid impacts where reasonably feasible and the installation of long-term protection, archaeological receptors can be avoided and protected. This would result in a direct moderate adverse effect, as the setting or context of the archaeological sites would be significantly changed from largely open desert, or desert with occasional views of Mine infrastructure in the distance, to that of a large-scale operational mine.

In cases where impacts on archaeological remains cannot be avoided, appropriate mitigation would be undertaken in the form of archaeological recording by a programme of scientific excavation, recording, museum curation and public dissemination of information (publication). The resulting research dividend would off-set the significant loss of archaeological remains to some extent, slightly reducing the long-term effect from very large to large adverse.

All known archaeological sites in the Mine site are surface sites, and are therefore sensitive to looting, 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, date and location’. Particularly vulnerable sites include those in the vicinity of the workers camps and access roads, and prominent, highly visible ogolian dunes (e.g. sites WB01, TE25-TE28 & TE31-TE38). Extensive sites with surface scatters including pottery and stone tools (e.g. 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 (operation) duration, with lesser impacts during the closure phase. It is judged that any opportunistic looting could result in a moderate to major impact, due to the alteration of the archaeological resources. With appropriate mitigation, such as workers awareness training, temporary fencing, archaeological excavation and/ or long term enclosure fences, the impact can be reduced to a minor long-term impact.

12.5.2 General Archaeological Mitigation Measures

Where the Project involves adverse impacts on physical cultural heritage, appropriate measures for avoiding, minimising, mitigating and compensating these impacts will be applied. The following general archaeological mitigation measures are proposed, applicable during the construction, operation and closure phases.

In summary, the mitigation and compensation strategy for cultural heritage adheres to the following principles:

- Avoid or minimise impacts by design where reasonably feasible;
• 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 long term protection; and
• Undertake technical and institutional capacity building.

The proposed mitigation measures comprise the following, in order of priority:

1. Preservation by design if possible, otherwise undertake permanent removal (archaeological excavation) of historical and archaeological sites, including artefacts and structures (Neolithic occupation sites and Protohistoric tombs);

2. Where no other option is reasonably feasible or appropriate, relocate monuments (Muslim tombs) to a carefully selected and safe area outside the Mine site but within the concession area;

3. Test excavation to determine whether further work is required (possible Protohistoric tombs);

4. Systematic representative sampling (Neolithic occupation sites); and

5. No further archaeological work required (stray finds).

Archaeological site protection (fencing) works and archaeological fieldwork should be approved, permitted and supervised by the Ministry of Culture. The outline mitigation proposals set out below contain input from a national archaeological expert. Outline recommendations are as follows:

**Avoid or minimise impacts by design:**

• Where reasonably feasible, design Project components to avoid or minimise impacts on cultural heritage identified in baseline studies (IFC Performance Standard 8 2012, para 11).

**Avoid impacts during construction and operation:**

• Flag vulnerable sites (temporary flagging); and
• Fix traffic routes (one-track or single-track policy) to avoid vehicle rutting. Carefully consider the movement of traffic across the Mine site, to avoid tracking across known sites, e.g. Neolithic dune-top sites and burials of all periods. Where reasonably feasible, limit vehicles to signposted, flagged and fixed routes in order to prevent cross-country driving and the use of shortcuts.

**Ensure the systematic stewardship of cultural heritage:**

• Put in place management, monitoring and reviewing systems, by developing and implementing a Cultural Heritage Management Plan (CHMP) and Chance Find Procedures (CFP) as part of the site Environmental Management Plan (EMP);
• The CHMP and CFP will be developed in collaboration with the Ministry of Culture; and
• All chance finds will be reported, adequately protected and promptly assessed by a qualified archaeologist. CFP shall apply to any archaeological sites of interest that may be
discovered during Mine construction or 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 will be recorded prior to and in the course of Mine development. Sites may require long term protective fencing, to be installed to the specification of and under the supervision of the Ministry of Culture; and

- The Mine will provide appropriate on-site worker training on the protection and reporting of archaeological sites and objects, with particular emphasis on the legal context (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 reasonably feasible alternatives to permanent direct impacts to cultural sites, cultural heritage would be removed using the best available techniques; and

- Appropriate techniques including sample excavation (Neolithic dune-top sites); detailed scientific excavation prior to construction (Protohistoric tombs); targeted watching brief alongside construction (if CFP triggered); assessment, analysis and reporting of finds assemblages/human remains; public dissemination of information.

**Give sites long term 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. Fencing would be of a sympathetic design, in materials specified by and installed under the supervision of the Ministry of Culture;

- It is acknowledged that such enclosures will themselves have a setting impact, and may draw attention to the location of sites. This has been discussed with IMRS staff, who advise that this is the preferable mitigation method; and,

- Once mitigation measures have been applied, in the form of long term protective fencing, workers training and a single-track policy, remaining archaeological sites will experience a minor to moderate indirect operational impact, due to the greater proximity of an increased Mine population.

12.5.2.1 Disclosure of sensitive sites

The guidance of IFC Performance Standard 8 Guidance Note 2007, paragraph G12 relating to the disclosure of sensitive sites has 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 liable to looting, IMRS staff indicated in May 2011 that the preferred method of physical site protection was temporary flagging, to be followed by long term fenced enclosure.

A CHMP will be prepared, setting out the system for minimising impacts on cultural properties and developing a clear cultural heritage alert process (CFP). This will also be accompanied by a worker training programme and cultural heritage awareness that will be integrated into the site induction process.
12.5.3 Mitigation during construction phase

12.5.3.1 Waste Rock Dump (south east)

Sites within the footprint of the proposed waste rock dump (southeast) comprise Neolithic occupation sites WB01 (including WB02, WB04), TE26, TE27, TE27b, TE28, TE29, TE30, TE31, TE32, TE34, TE35, TE36, TE37, TE38; Protohistoric tombs WB03, WB08, TE52, TE53, TE55, TE59, CF007, CF008, CF009; and Muslim tomb CF010.

In order to mitigate this significant adverse impact, it is proposed that a major programme of archaeological site protection and investigation be carried out. A programme of archaeological investigation will maximise the scientific research dividend in order to offset the considerable loss of the archaeological resource. The detailed scope of works, including a comprehensive archaeological research design, will be prepared.

It is proposed that Neolithic occupation sites be mitigated by archaeological excavation, as part of the staged programme of archaeological protection and investigation outlined above. It is important to note that it is possible that the proposed Waste Rock Dump may not reach some of the sites close to the Mine site boundary, distant from the open pit. It is also possible that the more remote sites may only be impacted in the next 8 to 15 years. For this reason, it is proposed that these sites are first protected with either temporary protection or long term fencing, and if a direct impact cannot be avoided, to obtain permits and undertake excavation well in advance of the construction and expansion of the Waste Rock Dump.

It is anticipated that for the mitigation of Site WB01 (Neolithic occupation and burials, including sites WB02 and WB04), permits will be applied for excavation and this work will be undertaken prior to the construction of the Phase 2 waste rock dump.

Depending on the construction programme for the Phase 2 WRD, the proposed mitigation for the Protohistoric tomb sites (WB03, WB08, TE52, TE53, TE54, TE55, TE59, CF007, CF008 and CF009) is to install either temporary protection or long term fencing, and if direct impacts cannot be avoided, to obtain permits and undertake excavation prior to the construction and expansion of the waste rock dump.

In addition an isolated Muslim tomb (CF010) will be protected in a similar way with either temporary or long term fencing, but if direct impacts are unavoidable then the grave will be relocated with the permission of and following the procedures of, the Ministry of Islamic Affairs.

The proposed waste rock dump has been designed to avoid impacting a Muslim tomb (TE61) and a Protohistoric tomb (TE39) and long term protective fencing will be installed around the monuments.
### Table 12-11: Proposed Mitigation for Waste Rock Dumps

<table>
<thead>
<tr>
<th>Proposed Mitigation, Waste Rock Dump (South East)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Protection of archaeological sites</strong></td>
</tr>
<tr>
<td>TE61 &amp; TE39 (long term fencing); WB01 (WB02, WB04), TE26, TE27, TE27b, TE28, TE29, TE30, TE31, TE32, TE34, TE35, TE36, TE37, TE38, WB03, WB08, TE52, TE53, TE55, TE59, CF007, CF008, CF009 (fencing prior to excavation); CF010 (fencing prior to relocation, if necessary).</td>
</tr>
<tr>
<td>- Depending on the construction schedule, either temporary protection will be installed in order to protect sites prior to archaeological investigation or relocation, or long term fencing will be installed.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Mitigation of archaeological sites by archaeological recording</strong></td>
</tr>
<tr>
<td>WB01, TE26, TE27b, TE28, TE29, TE30, TE31, TE32, TE34, TE35, TE36, TE37, TE38, WB03, WB08, TE52, TE53, TE55, TE59, CF007, CF008, CF009</td>
</tr>
<tr>
<td>- Where direct impacts cannot be avoided, subject to the permission and authorisation of the Ministry of Culture, systematic scientific archaeological excavation will be undertaken well in advance of the construction of the Phase 2 waste rock dump (south east).</td>
</tr>
<tr>
<td>- The fieldwork stages will be followed by finds processing and conservation, assessment, analysis, reporting, illustration, publication, dissemination of results and long-term curation of the archaeological excavation archive (e.g. pro forma records, photographs, plans, sections, project design &amp; interim reports) and the museum curation and display of finds.</td>
</tr>
<tr>
<td><strong>Mitigation of Muslim tomb by relocation</strong></td>
</tr>
<tr>
<td>CF010</td>
</tr>
<tr>
<td>Where direct impacts cannot be avoided, and subject to the permission of and following the procedures of, the Ministry of Islamic Affairs the grave will be relocated to a designated area.</td>
</tr>
</tbody>
</table>

### 12.5.3.2 Expanded Open Pit

Sites within the footprint of the proposed Expanded Open Pit comprise Neolithic occupation sites TE37 and TE33, and Protohistoric tombs TE02, TE03, TE04, TE05, TE54, WB05. Muslim tomb TE06, is located slightly outside the current economic pit limits. It is proposed that it be protected by long term fencing, but if the pit limit increases or enlarges it may be necessary to relocate the tomb.

As in other areas of the Mine site, mitigation takes the form of avoidance (preservation by design), protection and, where no other development option is feasible, mitigation by archaeological investigation and recording or relocation. The impacted sites within the proposed expanded open pit (TE37, TE33, TE02, TE03, TE04, TE05, TE54, WB05) would form part of the proposed major programme of archaeological site investigations.
It is proposed that the loss of Neolithic occupation sites TE37 and TE33 would be mitigated as part of a major programme of archaeological protection and investigation works outlined above.

Depending on the pit expansion schedule, either temporary protection or long term fencing to protect Protohistoric tombs (TE02, TE03, TE04, TE05, TE54 and WB05) prior to excavation will be necessary. If direct impacts cannot be avoided, excavation permits would be applied for and archaeological excavations would be undertaken prior to the expansion of the open pit.

The proposed mitigation for a pair of Muslim tombs (TE06) would be to install a long term, gated enclosure fence with an information panel (to be installed by the Ministry of Culture). If appropriate, any blasting impact can be monitored.

**Table 12-12: Proposed Mitigation for the Expanded Open Pit**

<table>
<thead>
<tr>
<th>Proposed mitigation, expanded open pit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Protection of archaeological sites</strong></td>
</tr>
<tr>
<td>TE06 (long term fencing and if appropriate, eventual relocation subject to the permission of and following the procedures of, the Ministry of Islamic Affairs)); TE37, TE33, TE02, TE03, TE04, TE05, TE54, WB05 (fencing prior to excavation)</td>
</tr>
<tr>
<td>• Depending on the construction schedule, either temporary protection will be installed in order to protect sites prior to archaeological investigation, or long term fencing will be installed.</td>
</tr>
<tr>
<td>• A one-track policy will be established to limit vehicle rutting.</td>
</tr>
<tr>
<td>• The CHMP and CFP will be implemented.</td>
</tr>
</tbody>
</table>

**Mitigation of archaeological sites by archaeological recording**

TE37, TE33, TE02, TE03, TE04, TE05, TE54, WB05

• Where direct impacts cannot be avoided, subject to the permission and authorisation of the Ministry of Culture, systematic scientific archaeological excavation will be undertaken well in advance of the construction of the Phase 2 expanded open pit.

• The fieldwork stages will be followed by finds processing and conservation, assessment, analysis, reporting, illustration, publication, dissemination of results and long-term curation of the archaeological excavation archive (e.g. pro forma records, photographs, plans, sections, project design & interim reports) and the museum curation and display of finds.

**12.5.3.3 Heap Leach Facility**

Sites directly impacted by the proposed Heap Leach Facility area comprise Protohistoric tombs TE40, TE41, TE42, TE43 and TE58. Sites in the vicinity of the Heap Leach Facility area comprise a Protohistoric tomb, TE57, and a Muslim tomb, TE56; it is proposed that these sites be protected by long term fencing and that a one-track policy be developed and applied.

The impacted sites within the proposed Heap Leach Facility area (TE40, TE41, TE42, TE43, TE44 and TE58) would form part of the proposed programme of archaeological site investigation.
Table 12-13: Proposed Mitigation for Heap Leach Facility

<table>
<thead>
<tr>
<th>Proposed mitigation, Heap Leach Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection of archaeological sites</td>
</tr>
<tr>
<td>TE56 and TE57 (long term fencing); TE40, TE41, TE42, TE43, TE44 and TE58 (fencing prior to excavation)</td>
</tr>
<tr>
<td>• Depending on the construction schedule, either temporary protection will be installed in order to protect sites prior to archaeological investigation, or long term fencing will be installed.</td>
</tr>
<tr>
<td>• A one-track policy will be established to limit vehicle rutting.</td>
</tr>
<tr>
<td>• The CHMP and CFP will be implemented.</td>
</tr>
<tr>
<td>Mitigation of archaeological sites by archaeological recording</td>
</tr>
<tr>
<td>TE40, TE41, TE42, TE43, TE44 and TE58</td>
</tr>
<tr>
<td>• Where direct impacts cannot be avoided, subject to the permission and authorisation of the Ministry of Culture, systematic scientific archaeological excavation will be undertaken well in advance of the construction of the Phase 2 Heap Leach Facility.</td>
</tr>
<tr>
<td>• The fieldwork stages will be followed by finds processing and conservation, assessment, analysis, reporting, illustration, publication, dissemination of results and long term curation of the archaeological excavation archive (e.g. pro forma records, photographs, plans, sections, project design and interim reports) and the museum curation and display of finds.</td>
</tr>
</tbody>
</table>

12.5.3.4 Accommodation Camp

A series of groups of Protohistoric tombs (TE20, TE21, TE22, TE23 & TE24) and Muslim tombs (TE21, TE24, TE48, TE50 & TE51) and an undated camp fire (CF003) are located on a ridge north east of the proposed accommodation camp; it is proposed that they be protected by long term fencing.

Table 12-14: Proposed Mitigation for the Accommodation Camp

<table>
<thead>
<tr>
<th>Proposed mitigation, Accommodation Camp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection of archaeological sites</td>
</tr>
<tr>
<td>TE20, TE21, TE22, TE23, TE24, TE48, TE50, TE51 &amp; CF003 (long term fencing)</td>
</tr>
<tr>
<td>• Long term fencing will be installed in order to protect sites.</td>
</tr>
<tr>
<td>• A one-track policy will be established to limit vehicle rutting.</td>
</tr>
<tr>
<td>• The CHMP and CFP will be implemented.</td>
</tr>
</tbody>
</table>

12.5.3.5 TSF 3 Cell 1 and 2

An isolated Muslim tomb (CF001) was identified during pre-construction clearance works associated with Phase 1b TSF 3 Starter Cell 1, and will be relocated with the permission, of and following the procedures of, the Ministry of Islamic Affairs (this forms part of the Phase 1b mitigation works).
Table 12-15: Proposed Mitigation for TSF 3 Cell 1 and 2

<table>
<thead>
<tr>
<th>Proposed mitigation, TSF 3 Cell 1 and 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mitigation of Muslim tomb by relocation</td>
</tr>
<tr>
<td>CF001</td>
</tr>
<tr>
<td>• Subject to the permission of and following the procedures of, the Ministry of Islamic Affairs the grave will be relocated to a designated area.</td>
</tr>
</tbody>
</table>

12.5.3.6 TSF 3 / Heap Leach Expansion Area

Protohistoric tomb **TE45** is located on the southern edge of the proposed TSF 3 expansion area, archaeological excavation would be undertaken in order to mitigate the impact of the development on the archaeological resource.

Table 12-16: Proposed Mitigation for TSF 3/ Heap Leach Expansion Area

<table>
<thead>
<tr>
<th>Proposed mitigation, TSF 3 Heap Leach Expansion Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection of archaeological sites</td>
</tr>
<tr>
<td><strong>TE45</strong> (fencing prior to excavation)</td>
</tr>
<tr>
<td>• Temporary protection will be installed in order to protect the site prior to archaeological investigation.</td>
</tr>
<tr>
<td>• A one-track policy will be established to limit vehicle rutting.</td>
</tr>
<tr>
<td>• The CHMP and CFP will be implemented</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mitigation of archaeological sites by archaeological recording</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TE45</strong></td>
</tr>
<tr>
<td>• Subject to the permission and authorisation of the Ministry of Culture, systematic scientific archaeological excavation will be undertaken well in advance of the construction of the Phase 2 TSF 3.</td>
</tr>
<tr>
<td>• The fieldwork stages will be followed by finds processing and conservation, assessment, analysis, reporting, illustration, publication, dissemination of results; long-term curation of the archaeological excavation archive (e.g. pro forma records, photographs, plans, sections, project design &amp; interim reports) and the museum curation and display of finds.</td>
</tr>
</tbody>
</table>

12.5.3.7 Expanded Waste Management Facility

The only sites in the vicinity of the expanded waste management facility area are a Muslim tomb, **TE56** and a Protohistoric tomb, **TE57**. It is proposed that they be protected by long term fencing.
### Table 12-17: Proposed Mitigation for the Expanded Waste Management Facility

<table>
<thead>
<tr>
<th>Proposed mitigation, Expanded Waste Management Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection of archaeological sites</td>
</tr>
<tr>
<td>TE56 &amp; TE57 (long term fencing)</td>
</tr>
<tr>
<td>- Long term fencing will be installed in order to protect the site.</td>
</tr>
<tr>
<td>- A one-track policy will be established to limit vehicle rutting.</td>
</tr>
<tr>
<td>- The CHMP and CFP will be implemented.</td>
</tr>
</tbody>
</table>

### 12.5.3.8 Facility Expansion Area

A number of sites in the Mine site will not be subject to direct construction impacts, but are located in the vicinity of working areas and roads. It is proposed that these sites be protected by long term fencing, in order to prevent any interference, vehicle tracking or other potential damage as the Mine population increases and the construction works expand.

Sites that would be given long term protection comprise Neolithic occupation sites TE25, TE32 and TE47, Protohistoric tombs TE07, TE08, TE09, TE10, TE11, TE12, TE13, TE14, TE15, TE16, TE17 and TE18 and Muslim tomb TE63.

### Table 12-18: Proposed Mitigation Facility Expansion Area

<table>
<thead>
<tr>
<th>Proposed mitigation, Facility Expansion Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Protection of archaeological sites</td>
</tr>
<tr>
<td>2. TE07, TE08, TE09, TE10, TE11, TE12, TE13, TE14, TE15, TE16, TE17, TE18, TE25, TE32, TE47; TE63 (long term fencing)</td>
</tr>
<tr>
<td>- Long term fencing will be installed in order to protect the sites.</td>
</tr>
<tr>
<td>- A one-track policy will be established to limit vehicle rutting.</td>
</tr>
<tr>
<td>- The CHMP and CFP will be implemented.</td>
</tr>
</tbody>
</table>

### 12.5.3.9 Cultural Heritage Management during the Construction Phase

**Discovery of a previously unknown site/accidental discovery**

A Chance Find Procedure (CFP), which identifies 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. CFP will form part of the CHMP, which itself will be integrated into the Mine’s Corporate Responsibility Management Systems.

No culturally significant archaeological or historical sites, remains or objects (including graves) accidentally discovered during prospection, groundworks, excavation or construction shall be disturbed until properly investigated.

**Sites threatened by vehicle damage**

All known sites within the overall assessment area of the Mine site are vulnerable to vehicle damage, in particular the surface scatters on the Neolithic dune-top occupation sites and the
tombs. Damage may involve crushing of artefacts, rutting, soil displacement and increased erosion.

- In order to avoid indirect impacts due to an increase in Mine site population and activities, vulnerable sites should be flagged (temporary flagging).
- Where reasonably 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, walking or driving on them or other interference.

- The extent and impact of interference will be limited through integration of cultural heritage issues into worker inductions, a worker information campaign, the enforcement of a Mine site worker environmental code of conduct, and the strict application of CFP, 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 CHMP and CFP will be implemented.
- Depending on the timetable and design of further expansion, sites that are judged to be particularly vulnerable will either be surrounded with long term mesh fence enclosures or will be recorded prior to or in the course of Mine development.

12.5.4 Mitigation during operational phase

It is reasonably foreseeable that additional chance finds could occur and these have been assessed as part of this EIA; although globally, the effect on such remains can only be assessed as variable at this stage, it is likely that they will be of the same character as the known remains.

- Stray finds would generally be assessed as being of negligible or low value
- Isolated Protohistoric tombs would be assessed as medium value
- Groups of Protohistoric tombs, Neolithic occupation sites and Muslim tombs would be assessed as high value

The CFP, the CHMP and measures to control looting and vehicle damage will continue to be applied during the operational phase.

The Expanded Open Pit and the Waste Rock Dump will continue to be developed during the operational phase. As noted above, it is possible that the proposed waste rock dump may not reach some of the sites close to the Mine site boundary, distant from the open pit mine. It is also possible that the more remote sites may only be impacted in the next 8 to 15 years. The mitigation outlined in the construction section will be continued. Sites will first be protected by fencing, and if a direct impact cannot be avoided, permits will be obtained and archaeological excavations or relocation will be undertaken well in advance of the construction and expansion of the Mine site components.
12.5.5 Mitigation during closure phase

It is not anticipated that Mine closure would result in any additional impacts. CFP, the CHMP and measures to control looting and vehicle damage will continue to be applied during the active closure phase.

12.5.6 Monitoring

The TMLSA Environmental Department shall regularly undertake audits and inspections, which will be set out in the CHMP and CFP in accordance with the Corporate Responsibility Management System management schedule. Audit and inspection checklists shall be amended as appropriate to include checks on construction works, correct application of the Chance Find Procedure, adequate protection of existing sites and appropriate recording and removal of sites that cannot be reasonably avoided. In the event that such monitoring identifies incidents involving loss or damage to cultural heritage, this shall be notified to the Ministry of Culture or the IMRS and senior TMLSA management. Records of audit / inspection findings and any follow-up shall be retained.

12.6 Cumulative Impacts

Both the historic landscape and individual archaeological monuments are already affected by existing development in terms of visual and noise intrusion, and air quality (dust). The proposed developments will create an industrial landscape with man-made topography, further diminishing the ability to understand previous historic land use and the significance of the past landscape.

This impact is cumulative, as the Mine area has already been transformed by previous and ongoing stages of development.

The long term protective fencing of archaeological sites will also have a cumulative visual impact.

With mitigation, the significance of the overall predicted cumulative impact on cultural heritage is assessed as large adverse and the impact is assessed as significant over the long-term, as it involves the severe transformation of the setting or context of an archaeological monument or significant loss of key components in monument groups.

12.7 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 (2012).

In overview, mitigation will be specific to the type and significance of archaeological remains:

- Where reasonably feasible, Project components will be designed to avoid impacts on Muslim tombs. These will be surrounded by protective fencing, with an access gate and an information panel. Where relocation may be required, TMLSA will enter into consultation with the Ministry of Petroleum Energy and Mines (MPEM), Ministry of the Environment and Sustainable Development (MESD), Ministry of Culture and Ministry of Islamic Affairs as appropriate.

- Where reasonably feasible, Project components will avoid known archaeological remains, such as Neolithic dune-top occupation areas and Protohistoric tombs. Where the sites are not directly impacted by Project components, they will be surrounded by long term fencing for their protection. Where the construction of the Project would result in the removal of
archaeological sites, these sites will be mitigated by archaeological recording: they will be subject to programmed, professional archaeological excavations well in advance of any construction works. Archaeological works, including fencing and excavation, will be undertaken by archaeological experts permitted and supervised by the Ministry of Culture.

- Stray finds (any finds discovered during construction works) will be dealt with by the Chance Finds Procedure, which forms part of the Cultural Heritage Management Plan, part of the Mine Environmental Management System (EMS).

Overall, with mitigation, the significance of the predicted impact on cultural heritage is assessed as large adverse, as the impact is permanent and irreversible, and the development would result in the complete removal of archaeological sites, the transformation of the setting or context of archaeological monuments, and the significant loss of key components in monument groups.

Although the development would have an adverse impact on archaeological remains, they would be preserved by record, through a high-calibre programme of archaeological investigation and protection. This mitigation programme is assessed to reduce the impact from very large adverse to large adverse. The mitigated 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 and international scientific knowledge base, and the Project will contribute to local and expatriate workers training and the development and enforcement of CHMP and CFP.

The Project has the potential to make a significant contribution to national research, 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.

12.7.1 Construction

Archaeological mitigation will adopt a two-pronged approach, involving the development and implementation of an integrated programme for the protection and investigation of archaeological remains at the Mine.

During the construction phase, mitigation will involve the protection of the specified selection of sites through the installation of long term enclosure fences. There will be worker training on cultural heritage management, and a worker education campaign regarding antiquities theft. A CHMP will be developed and CFP will be updated and implemented in consultation with the Ministry of Culture. 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 Ministry of Culture.

For sites which cannot be avoided by design or preserved in situ, a major programme of archaeological investigation will be implemented. The scientific and institutional research dividend from a series of major archaeological excavations will, to some extent, help to off-set the damage to the archaeological resource.

Residual archaeological and cultural heritage impacts during construction are assessed to be adverse, long-term and of high significance. This is because the development would result in the complete removal of archaeological sites, the severe transformation of the setting or context of archaeological monuments, and the significant loss of key components in monument groups. Although development would lead to the complete removal or transformation of
archaeological deposits, it would not lead to complete loss of research knowledge as a programme of archaeological investigation would be undertaken, which is judged to reduce the impact from very large adverse to large adverse. In addition, the design has been adapted to avoid archaeological sites wherever reasonably feasible. The impact is assessed as significant over the long-term, as archaeological remains are a finite and irreplaceable resource.

12.7.2 Operation

During the operational phase, mitigation will involve ongoing worker training on cultural heritage management, and worker education regarding illegal looting. The archaeological investigation and protection programme initiated prior to the construction programme would continue as the expanded open pit and waste rock dump continue to develop. The impacts of these elements are assessed under the construction stage, as full details of the schedule and timescale of expansion works during the operational stage have not yet been prepared and may be subject to change. A CHMP and CFP will be implemented in consultation with the Ministry of Culture. Vehicles will continue to adhere to controlled routes identified by signage. The condition of archaeological sites and protection fencing will be monitored as part of the site environmental monitoring programme and any changes reported to the Ministry of Culture.

Residual archaeological and cultural heritage impacts during operation are assessed to be neutral to slight adverse, long-term and of negligible to low significance. Effects would entail the removal of a minor part of an archaeological site (but sites would retain a significant integrity and research potential); or minor further changes to the setting of archaeological monuments; or minor removal of elements that form part of a wider surviving research resource. Some areas may undergo little physical impact or change, observable further change in setting or context and or impact from changes in use, amenity or access. Future revisions, if any, will be addressed via the CHMP and negotiated with appropriate Ministries.

12.7.3 Closure activities

During the closure phase, mitigation will involve ongoing worker training on cultural heritage management, and worker education regarding illegal looting. The CHMP and CFP will be implemented in consultation with the Ministry of Culture. Vehicles will continue to adhere to controlled routes identified by signage. The condition of archaeological sites will be monitored as part of the site environmental monitoring programme and any changes reported to the Ministry of Culture.

Residual impacts on archaeological and cultural heritage sites post-closure are assessed to be neutral to slight adverse, long-term and of negligible to low significance. Potential effects following mitigation would include minor further changes to the setting of archaeological monuments; or minor removal of elements that form part of a wider surviving research resource. Some areas may undergo no physical impact or change, no observable further change in setting or context and no impact from changes in use, amenity or access.

12.8 Summary

A summary of the potential impacts of the proposed Phase 2 following the implementation of mitigation measures with respect to cultural heritage are presented in Table 12-19.
Table 12-19: Summary of Potential Residual Impacts – Archaeology and Cultural Heritage

<table>
<thead>
<tr>
<th>Location</th>
<th>Nature of Impacts</th>
<th>Mitigation Measure</th>
<th>Project Phase</th>
<th>Nature</th>
<th>Duration</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction &amp;</td>
<td>Construction &amp; operation impacting on Neolithic dune-top occupation sites, Protohistoric and Muslim tombs. Particularly:</td>
<td>Avoid by design where reasonably feasible</td>
<td>CO D</td>
<td>Adverse</td>
<td>Long term</td>
<td>High</td>
</tr>
<tr>
<td>operation impacting</td>
<td>- Waste Rock Dump (south east)</td>
<td>Protect sites by long term fencing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>on Neolithic dune-</td>
<td>- Expanded Open Pit</td>
<td>Investigate sites by research-led scientific excavation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>top occupation</td>
<td>- Heap Leach Facility</td>
<td>Implement Chance Finds Procedures</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sites, Protohistoric and Muslim tombs. Particularly:</td>
<td>- Accommodation Camp</td>
<td>Implement CHMP &amp; monitoring</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- TSF 3/ Heap Leach Expansion Area</td>
<td>Relocate Muslim tombs where necessary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Expanded Waste Management Facility</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ancillary works,</td>
<td>Ancillary works, utilities and roads impacting on Neolithic dune-top settlement sites, Protohistoric &amp; Muslim tombs.</td>
<td>Avoid by design Protect sites by long term fencing Implement CFP</td>
<td>CO</td>
<td>Adverse</td>
<td>Long term</td>
<td>Negligible to Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Loss of archaeological remains</td>
<td>Workers information campaign and environmental workers training Vulnerable sites either to be fenced or to be excavated prior to or, if appropriate, alongside Mine development Implement Chance Finds Procedures Implement Cultural Resource Management Plan &amp; monitoring Controlled routes (one track policy), signage</td>
<td>CO D</td>
<td>Adverse</td>
<td>Long term</td>
<td>Negligible to Low</td>
</tr>
</tbody>
</table>

1Following implementation of proposed Mitigation Measures
2Project Phase: C = Construction, O = Operation, D = Decommissioning and Closure
3Duration 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

This Section presents the methodology and baseline conditions used to assess the potential impacts on the character and visual amenity of the Mine site resulting from Phase 2 development. 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.

13.1 Methodology

As referred to in Section 2, this assessment takes into consideration international guidance and applicable Kinross standards. There is no specific Mauritanian guidance on landscape and visual assessment.

In the absence of national guidelines, the format and content of this assessment is based upon guidance from the Countryside Agency (CA) / Scottish Natural Heritage (SNH) and the Landscape Institute (LI) and Institute of Environmental Management and Assessment (IEMA) given in:

- Guidelines for Landscape and Visual Impact Assessment (GLVIA), Second Edition (IEMA/LI, 2002); and

These publications form the standard reference for undertaking landscape character and visual assessment in accordance with European standards but are applicable to projects elsewhere due to the fact that they are not landscape/context specific. The guidance presents a methodology/process which is applicable irrespective of the landscape context – on that basis it was considered that it was applicable to the Mauritanian context.

In this assessment and in the GLVIA, a clear distinction is made between landscape and visual impacts as follows:

- Landscape impacts: Relate to the impacts of the proposed Projects construction and operation, upon the physical characteristics or components of that landscape. Together, these form the character of that landscape (such as, landform, vegetation, and buildings); and
- Visual impacts: Relate to the changes arising from development to individual ‘receptors’ views of that landscape (such as, local residents or passing motorists).

The GLVIA recommend a two-stage approach to landscape and visual assessment comprising an initial desktop review of published information, including designations, followed by a site visit. The Landscape and Visual Impact Assessment (LVIA) assessment for Phase 2 was undertaken, in accordance with this guidance, using the following methodology:

- Desktop review of satellite imagery, topography, site layouts and photographs of the Mine site;
- Desktop research relating to landscape designations in Mauritania in the vicinity of the Mine site;
- Members of the EIA team undertook a number of site visits and recorded views from representative locations;
• Identification of categories of potential visual receptors; and
• Use of photographs to represent the views obtained by the different groups of receptors and to identify the potential impacts of Phase 2.

13.2 Baseline Conditions

13.2.1 Landscape in Mauritania

Mauritania is recognised as having four ecological zones: the Saharan Zone, the Sahelian Zone, the Senegal River Valley, and the Coastal Zone. Although the zones are markedly different from one another in terms of landscape character, no natural features clearly delineate the boundaries between them. Sand, varying in color and composition, covers 40 percent of the surface of the country forming dunes that appear in all zones except the Senegal River Valley. Fixed sand dunes are composed of course, fawn-coloured sand, while shifting (mobile) dunes consist of fine, reddish-coloured sands that can be carried by the wind. Plateaus are generally covered with heavier blue, gray, and black sands that form a crusty surface over layers of soft, loose sand.

The ecological zones also provide the basis for national scale landscape character analysis. The Mine site lies within the Saharan zone which makes up the northern two-thirds of the country. It is recognised that the Saharan zone varies considerably in nature as described above.

13.2.1.1 Mine Context and Description

A comparison of the existing Mine site components with those proposed in Phase 2 is shown in Figure 3-3. The existing Mine facility covers an area of approximately 12,300 ha and includes a series of open pits of approximately 7 km X 1.8 km.

The Phase 2 of the Project will be undertaken within the Mine site, in the context of the existing mining operation, which currently influences landscape character through change in landform, lighting and infrastructure. The Mine is located in a remote location with no formal settlements or industries in the vicinity.

Desktop research of Mauritanian planning websites indicated that the Mine does not lie within an area of protected landscape or landscape designated in relation to landscape value/quality. The key characteristics of the landscape within and surrounding the Mine are;

• A national-scale landscape, which occupies approximately 75% of Mauritania;
• It forms part of the wider Sahara and sub-Saharan desert landscape;
• Isolated, sand dominated landscape of undulating topography;
• Limited land use and vegetation cover, but sufficient in some areas for sporadic grazing;
• Inhabitation largely confined to scattered nomadic/semi-nomadic settlements (that may only be used intermittently) and the accommodation for workers based at the Mine; and
• Mining activities, which are a locally significant element of the landscape but of a scale which is dwarfed by the overall landscape context.
13.2.1.2 Landscape Value & Quality

The landscape surrounding the Mine is open desert typical of the wider Mauritanian context and, in terms of landscape character, effectively a southern section of the larger Sahara desert. The landscape context is illustrated in Photographs 13-1 and Photograph 13-7.

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. A similar landscape is present throughout 75% of Mauritania and it is therefore not considered to be a scarce resource, irreplaceable or valuable as a result of uniqueness.

The landscape context of the Project area is therefore considered to be of low quality and value within the national context of Mauritania.

13.2.1.3 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.

For the purpose of this assessment four potential categories of landscape sensitivity have been identified; high, moderate, low or negligible.

The Mine landscape is considered to be of low sensitivity to the proposed Phase 2 development as:

- The landscape context includes an established similar mining use;
- There would be no significant loss of characteristic landscape elements; and
- The Mine is remote and surrounded by a similar landscape which is common throughout Mauritania.

13.2.1.4 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 2, the landscape currently includes operations over the majority of the Mine site. On that basis the landscape is assessed as having a high capacity to accommodate the proposed Phase 2 development.

13.2.2 Visual

The GLVIA (IEMA/LI 2002) note that 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.
Visual impacts result from changes 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 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 or adverse. The magnitude of a visual impact in this assessment may be described as high, moderate, low or negligible. Professional judgement is inherent in determining the category of impact. The sensitivity of a receptor and the level of impact upon it can be combined to assess the significance of the resultant effects.

Two viewpoint types were selected to represent the typical range of views of the Mine, which are summarised below:

- Intermittently inhabited buildings/locations occupied by nomadic/semi-nomadic local people; and
- Tracks within the desert used primarily by nomadic/semi-nomadic local people and Mine or other vehicles (e.g. water tankers).

Existing screening from locations in the wider landscape is largely derived from the landform of the sand dunes and rocky ridgelines. Views of the Mine are obtained in close proximity from a small number of isolated locations (see Table 13-1).

**Table 13-1: Visual Sensitivity**

<table>
<thead>
<tr>
<th>Receptor Groups</th>
<th>Sensitivity</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>From settlement locations used by local inhabitants on a permanent and/or temporary basis</td>
<td>Low</td>
<td>The existing Mine is a prominent element of the view in an otherwise undeveloped landscape but the receptors are not static and are often of a temporary duration</td>
</tr>
<tr>
<td>From locations close to the perimeter fence accessed on foot, camel or by vehicle</td>
<td>Low</td>
<td>The existing Mine complex is a prominent element of the view in an otherwise undeveloped desert landscape</td>
</tr>
</tbody>
</table>

**13.3 Potential Impacts**

Landscape and visual impacts resulting from Phase 2 Project components will arise from the scale, height and appearance of the components and the extent to which they will contrast with and introduce new elements into the landscape. In particular this relates to the permanent elements, which will remain after closure of the Mine, but also includes consideration of temporary infrastructure, such as:

- The Mine facilities’ footprint will increase from approximately 2,000 ha to 12,300 ha;
- A proposed open pit of approximately 10-13 km long, 2 km wide and 700 m deep;
- A mill and Carbon-in-Leach (CIL) process plant, comprising a primary crushing and stockpile module. Maximum height of the covered stockpile above grade is approximately 45 m. Height of the primary crusher control room is approximately 15 m above grade;
• Dump leach facilities which will comprise a dump leach pad and ponds and will have a footprint area of approximately 140 ha and a final dump leach pad height of approximately 100 m;

• Heap leach facilities will comprise a crushing facility, a heap leach pad and ponds and will have a footprint area of approximately 550 ha and a final dump leach pad height of approximately 100 m;

• Four waste rock dumps. The waste rock dumps will have a final height of approximately 100 m. Existing rock dumps occupy an area of approximately 250 ha and will be expanded to approximately 3,600 ha, increasing their surface area by a factor of 14.

• Tailing Storage Facilities (TSF 3), which will comprise three cells and cover an area of approximately 8 km² and will be a maximum height of approximately 40 m;

• The six power plant emission stacks will be approximately 35 m and 70 m high; and

• Numerous ancillary facilities comprising offices, workshops, warehouses, storage areas, fuelling stations, fuel farms, accommodation camp, training campus, medical clinic, waste management facilities, water treatment facilities (such as raw water storage ponds, reverse osmosis plants, and drainage and storm water management), internal electrical transmission system and roads.

13.3.1 Construction and Operation

Phase 2 Project components are located on-site within the Mine site. Due to the nature of Phase 2 activities, landscape and visual impacts during construction and operation phases will be similar and thus the construction and operation phases are assessed together.

13.3.1.1 Landscape

Phase 2 Project components may 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 2 Project components will be in the same context and similar in nature to those currently experienced within the Mine site; however they will increase the scale and footprint of the Mine and associated activities within the perimeter fence.

Landscape impacts applicable to the Phase 2 development include:

• Loss of some original, characteristic, landscape elements of value as a result of the development;

• Introduction of significant large scale landscape elements, such as the expanded open pit, dump leach facility, heap leach facility, TSF and waste rock dumps which will remain as a permanent element of the landscape; and

• Increase in the scale of development on-site both in area (footprint) and height of the new infrastructures by the extent indicated in Section 13.3.

The GLVIA indicates 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 use of the scheme having an impact on the character of the area; and

• Whether the impact is permanent or temporary. The proposed development would give rise to direct effects on landscape character, arising from the impacts identified above and is considered to be of moderate magnitude.

13.3.1.2 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. Visual effects arising from the development, excluding any 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 would be potential for visual impact arising from temporary use of cranes/machinery, vehicle movements etc. which add to intrusion within a view; and

• Visual impact arising from the height, scale and nature of the development elements and the degree to which this would change the nature of the view.

The perimeter fence, although open mesh, acts to restrict views by preventing access in close proximity to the Mine site and therefore reduces the magnitude of visual impacts.

The extent to which Phase 2 will give rise to additional visual impacts, beyond those currently experienced as a result of the existing Mine activity (the baseline) is considered in Table 13-2 in relation to the representative viewpoint categories. The impacts are described for each viewpoint category during the construction and operation.

<table>
<thead>
<tr>
<th>Viewpoint/Receptor</th>
<th>Impact</th>
<th>Magnitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>From settlement locations used by local inhabitants on a permanent and/or temporary basis</td>
<td>Increased infrastructure would be viewed prominently and is of a greater scale than the existing but would not change the overall nature of the view or add significantly to visual impact</td>
<td>Low</td>
</tr>
<tr>
<td>From locations close to the perimeter fence accessed on foot, camel or by vehicle</td>
<td>The increased infrastructure and landscape modifications would be viewed prominently and would increase visual impact, but would not change the overall nature of the view in comparison with the baseline</td>
<td>Low</td>
</tr>
</tbody>
</table>

13.3.2 Closure

13.3.2.1 Landscape

Post closure impacts on landscape character would be derived from large scale permanent change in the landform and landscape character as certain components will remain and become a permanent feature of the landscape. However given the landscape context this is considered to be of low magnitude.
13.3.2.2 Visual

The extent to which Phase 2 will give rise to visual impacts post closure is considered in Table 13-3 in relation to the representative viewpoints.

**Table 13-3: Potential Visual Impacts Post Closure**

<table>
<thead>
<tr>
<th>Viewpoint/Receptor</th>
<th>Impact</th>
<th>Magnitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>From settlement locations used by local inhabitants on a permanent and/or temporary basis</td>
<td>Impact will be reduced by removal of the infrastructure allowing areas of Phase 2 to revert to desert. The TSF, waste rock dumps, open pit, dump leach facility, and heap leach facility will remain as a large scale engineered landforms giving rise to visual impact and obstruction of views</td>
<td>Low</td>
</tr>
<tr>
<td>From locations close to the perimeter fence accessed on foot, camel or by vehicle</td>
<td>As above</td>
<td>Low</td>
</tr>
</tbody>
</table>

13.4 Mitigation Measures

The nature of Phase 2 Project components and the location of the Mine in a remote desert location are such that the scope for mitigation of landscape or visual impacts is limited. The expanded open pit, dump leach facility, heap leach facility, TSF and sub-economic rock will remain as permanent elements of the landscape.

However, at specific stages of the development the following measures will provide some mitigation of landscape and visual impacts.

13.4.1 Construction & Operation

The following measures will be incorporated into the development proposals during construction and operation.

- The perimeter fence provides a defined limit to the Mine site and prevents access to the Mine site from external locations by nomads or other users of the desert not connected with the Mine, consequently reducing the extent of available views in close proximity through prevention of access; and
- The edge of the open pit will be bounded by a 3 m high bund which will reduce visibility into the excavated feature.

13.4.2 Closure

The following measures have been incorporated into the development proposals following closure:

- On completion of operation, the Mine infrastructure and ancillary facilities such as the process plant, power plant, accommodation camp, offices and warehouses will be decommissioned and removed from the Mine site; and
- Certain facilities, such as the TSF, will be capped, others, such as the waste rock dumps, will be minimally re-graded and passive re-vegetation will be undertaken on-site.
13.5 Cumulative Impacts

The baseline landscape and visual context includes the existing Mine and Phase 1 Project components. Phase 2 will add to the impacts currently experienced and will increase the scale of development.

However, given the baseline situation the magnitude and significance of the additional impacts on both landscape character and visual impact would be low.

13.6 Evaluation of Mitigated Impacts

13.6.1 Landscape

13.6.1.1 Construction and Operation

The change to landscape character during construction and operation is assessed to be adverse, short and medium term and of moderate/low significance because:

- The baseline landscape context includes similar land uses and development within the Mine site;
- The Phase 2 Project components will increase the influence and scale of the Mine site in terms of infrastructure, landform changes and footprint as set out in Section 13.3; and
- Introduction of new infrastructure/built features, not currently present, will increase industrialisation of the Mine site.

13.6.1.2 Closure

The change to landscape character post closure is assessed to be adverse, long term and of moderate/low significance because:

- On completion of mining, the built elements such as the process plant, power plant and accommodation camp will be removed and the Mine site will rehabilitated to a land use compatible with surrounding land uses through a combination of minimal re-grading of some features and passive re-vegetation; and
- Permanent landform change will result as the final condition of the expanded open pit, dump leach facility, heap leach facility, TSF and waste rock dumps will not be fully consistent with local natural landforms.

13.6.2 Visual

13.6.2.1 Construction and Operation

The change to visual amenity during construction and operation is assessed to be adverse, short and long term and of low significance for permanent and temporary settlements and people in the desert because:

- Views of the Mine will include similar elements to those currently experienced by receptors;
- The scale of the development in terms of infrastructure, landform changes and footprint will increase visual impact but numbers of receptors are extremely limited; and
• Visibility of the Mine will increase due to the eventual height of the waste rock dumps, dump leach facilities and heap leach facilities but, from a distance, these will be of sufficient scale to feature as a new stand alone landform creating visual intrusion in the natural landscape.

13.6.2.2 Closure

The change to visual amenity post closure is assessed to be of low magnitude and of low to negligible significance because;

• The industrialisation of the view will be reduced on removal of Mine infrastructure and ancillary facilities;
• The new landforms formed as a consequence of mining will permanently affect views but, given the context, there will be a negligible number of receptors; and
• For most receptors, impacts on visual amenity will be of temporary duration due to the transitory nature of the view experienced principally by local inhabitants and people moving through the desert.

13.7 Summary

A summary of the potential impacts of the proposed Phase 2 following the implementation of mitigation measures with respect to landscape and visual are presented in Table 13-4.

Table 13-4: Summary of Potential Residual Impacts1 – Landscape and Visual

<table>
<thead>
<tr>
<th>Location</th>
<th>Nature of Impacts</th>
<th>Mitigation Measure</th>
<th>Project Phase²</th>
<th>Nature</th>
<th>Duration³</th>
<th>Significance³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change of landscape</td>
<td></td>
<td>Use of screening, such as berms, to prevent sight of facility</td>
<td>C O</td>
<td>Adverse</td>
<td>Medium term</td>
<td>Moderate/Low</td>
</tr>
<tr>
<td>Mine site</td>
<td>Removal of facilities, where possible, Passive re-vegetation</td>
<td>D</td>
<td>Adverse</td>
<td>Long term</td>
<td>Moderate/Low</td>
<td></td>
</tr>
<tr>
<td>Visual impact of facilities on local inhabitants</td>
<td>Use of screening, such as berms, to prevent sight of facility</td>
<td>C O</td>
<td>Adverse</td>
<td>Medium term</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Removal of facilities where possible and passive re-vegetation</td>
<td>D</td>
<td>Adverse</td>
<td>Long term</td>
<td>Low</td>
<td></td>
</tr>
</tbody>
</table>

¹Following implementation of proposed Mitigation Measures
²Project Phase: C = Construction, O = Operation, D = Closure
³Duration 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.

4 The Mine will not be occupied by workers post-closure.
14 Traffic and Transport

This Section presents the methodology and baseline conditions used to assess the potential impacts on traffic resulting from Phase 2. In addition, mitigation measures which avoid, reduce, remediate or compensate potential impacts are proposed and the residual impacts (impacts after mitigation measures implemented) assessed.

The transportation route for both the constructions and operation of Phase 2 of the Project will utilise existing roads and highways.

14.1 Methodology

In order to understand the existing traffic situation with respect to the Mine, a site visit was carried out between 3 and 10 November 2011. During the site visit a number of areas of interest were visited including Nouakchott, the Mine and Nouâdhibou. In addition, the main highway between Nouakchott, the Mine and Nouâdhibou was travelled to observe traffic volumes and behaviour.

A series of one-hour manual traffic counts were undertaken during the November 2011 site visit at the following junctions:
- N2 highway/Mine Access Road;
- Gamel Abdul Nasser Avenue/N2 Junction (Nouakchott); and
- Gamel Abdul Nasser Avenue/Port Access Road Junction (Nouakchott).

Further information regarding the traffic counts is provided later in this chapter.

In order to ascertain information regarding the existing traffic conditions and Port usage in Mauritania, meetings were held with the following personnel:
- Nouâdhibou Port, Technical Director and the Regional Director of the Société de Transit Aérien et Maritime;
- Nouakchott Port, Technical Manager; and
- Ministry of Transport for Mauritania.

Site specific information contained in this Section of the report was gathered during the site visit unless otherwise stated.

14.2 Baseline Conditions

The Mine site is located approximately 60 km east of the N2 highway and is accessed from the N2 highway via a 60 km two-lane un-surfaced access road.

At present, the majority of materials and equipment required by the Mine are delivered to Nouakchott Port, and transported by road to the Mine via the N2 highway. Fuel consignments and other minor deliveries are transported by road using the N2 highway from Nouâdhibou Port. Vehicles from both Ports turn from the N2 highway onto the Mine access road to gain access to the Mine.

14.2.1 Highways

The N2 highway is a surfaced road which connects Nouakchott to Nouâdhibou. The route is well signposted along its route, with attention drawn to the speed limit (which varies between
40 km/hr and 100 km/hr), the condition of the road, safety hazards (i.e. bends in the road and blind summits) and any inclines/declines.

The N2 highway starts in Nouakchott city centre at the signalised Gamal Abdul Nasser Avenue Junction. After an initial single carriageway section within the city centre, the N2 highway provides a dual carriageway with a central reservation from the Rue de l’Ambassade du Senegal roundabout to approximately 50 km outside of Nouakchott. The central reservation is at grade with no raised kerb and within the city limits it accommodates street lighting columns. Photograph 14-1 provides examples of the dual carriageway section of the N2 highway within Nouakchott.

Approximately 50 km north of Nouakchott, the N2 highway dual carriageway merges to provide a single lane in each direction which continues along its length to Nouâdhibou. In addition to the standard carriageway width, there is approximately 2 m of hard packed verge on either side of the carriageway, as shown Photograph 14-2, which allows for vehicles to pull over without impeding the flow of traffic along the highway.

The N2 highway is maintained along its length and it is clear that maintenance is ongoing, although during the November 2011 site visit some sections were observed where the surface has become sub-standard and requires repair or upgrade. The proximity of large sand dunes to the road results in some sand accumulation onto the road, particularly after heavy wind events. When this occurs, the road is cleared of sand and pushed back away from the highway; however as the dunes are constantly moving, this is an ongoing road maintenance routine.

In general, junctions along the single carriageway are informal and operate as priority junctions with priority given to vehicles on the N2 highway. The majority of roads which connect with the N2 highway are un-surfaced, and many are unbound tracks which have developed with use over time.

Within Nouakchott and Nouâdhibou, the major roads are all surfaced although minor access roads remain un-surfaced. Major junctions within the cities are controlled by either roundabout or signalised interchanges; however there are also a number of informal priority junctions within the city centres providing access to residential areas.

The Mine access road was previously a track which linked nomadic/semi-nomadic residents to the N2 highway and was predominantly used to deliver water to drop off points in the area. Following commissioning of the Mine, the track was upgraded to an unsealed access road which is regularly maintained. As noted above, this is to be hard surfaced following the completion of the proposed expansion works.

Currently the un-surfaced access road is predominantly used by Mine vehicles and, also, water delivery vehicles which supply water to local semi-nomadic/nomadic people. Within the Mine site, a network of internal unsealed roads exists for Mine traffic only. These roads are speed restricted and regularly maintained.

14.2.2 Ports

Nouakchott Port is located in the south west of Nouakchott. The Port area accommodates two Ports, a new deepwater Port to the south and the older Port to the north. The two Ports are accessed by surfaced roads from the city centre. Information gained during a visit to Nouakchott Port in November 2011 indicated that on average the Port accommodates between 1,700 to 1,800 containers per week, equivalent to three to four ships per week, and an additional one to two vessels per week for non-containerised cargo. Operational workers at the
Port suggested that the Port generates a total of between 100 to 150 lorries per day. In addition to the average number of vehicles generated by the Port activities, special deliveries for specific firms (i.e. to meet construction requirements etc) may result in an additional 50 lorry movements per day for a short period.

Nouâdhibou Port is located in the south of Nouâdhibou peninsula, and is accessed directly from the N2 highway via a priority junction. During a meeting with the Port’s Technical Director and the Regional Director of Société de Transit Aérien et Maritime in November 2011, information regarding the official 2009 annual tonnage movements for the Port was shared. The information provided suggests that a total of 843,412 tonnes of materials was exported during the 12 month period, and a total of 2,135,657 tonnes of materials was imported during the same period. Assuming that each lorry from the Port carries approximately 25 tonnes per load (as advised by the Technical Director) and operation of the Port for 365 days/a; this equates to 92 export lorries accessing the Port and 234 import lorries egressing the Port per day.

14.2.3 Movement of Mine Workers

In January 2012, the combined Project construction and operation workforce at the Mine was approximately 3,300 workers (of which approximately 80% were Mauritanian). Both local and expatriate workers are accommodated at the Mine site.

National workers work on a rotation of two weeks on/one week off and are transported to and from the Mine on pre-coordinated bus transfer. Bussing national workers to and from the Mine site minimises the impact of worker transfer on the local highway network. Currently, there are three to four bus trips per day to transport workers to the Mine.

Expatriates workers work on an approximate rotation of six weeks on/three weeks off and are accommodated on-site during their ‘on’ shifts. Transfer of expatriate workers to Nouakchott airport for onward travel home is carried out by aircraft operated by a contracted service provider.

14.2.4 Baseline Traffic Data

In order to gain an understanding of the existing level of off-site vehicular traffic generated by the Mine on an average day, a meeting was held with the Mine’s Logistics Manager during the November 2011 site visit. This meeting indicated that the following off-site movements are generated by the Mine on an average day:

<table>
<thead>
<tr>
<th>Table 14-1: Existing Off-site Vehicles Movements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of Movement</strong></td>
</tr>
<tr>
<td>Personnel</td>
</tr>
<tr>
<td>Fuel</td>
</tr>
<tr>
<td>Equipment &amp; Materials</td>
</tr>
<tr>
<td>Equipment &amp; Materials</td>
</tr>
</tbody>
</table>

It is accepted that, in general, the volumes of traffic experienced within Mauritania are not significant. Consultation with the Mauritanian Ministry of Transport has indicated that, at present, baseline traffic data for the aforementioned areas is not available.
In the absence of more comprehensive baseline information, in order to gain a better understanding of the existing flow of traffic, a limited series of one-hour manual counts were undertaken during the November 2011 site visit. Traffic counts were undertaken at the following junctions:

- N2 highway/ Mine Access Road;
- Gamel Abdul Nasser Avenue/N2 Junction (Nouakchott); and
- Gamel Abdul Nasser Avenue/Port Access Road Junction (Nouakchott).

No traffic counts were undertaken in Nouâdhibou during the site visit as the results, particularly in relation to lorry movements in Nouakchott, may have been distorted by the public holiday weekend within Mauritania. However, information gained from other sources during our site visit indicated that there are no existing congestion issues due to vehicles entering or exiting the Port site; this indicates that the existing highway capacity in the area of the Port is sufficient.

The results of the traffic counts are summarised in Figures 14-1 to 14-5.

### 14.2.5 N2 Highway/Mine Access Road Junction

This point is located at the junction of the un-surfaced access road to the Mine and the N2 highway (Photograph 14-3). The junction operates as a priority junction with priority given to vehicles on the N2 highway.

To ensure a good representation of the level of traffic at this junction, two sets of one-hour traffic data were collected, the first commencing at 15:50 hrs on Friday 4 November 2011, and the second commencing at 10:00 hrs on Saturday 5 November 2011. It should be noted that both days fell over the weekend in Mauritania; however the Mine is operational seven days a week and therefore the level of traffic generated by the Mine is not affected by the time of week. Furthermore, due to the Mauritanian public holiday on the 6 and 7 November, it is believed that the level of incidental traffic on the N2 highway during the traffic counts may have been greater than ordinarily observed due to an increased volume of people travelling to celebrate the holidays. The results of the two traffic counts are summarised in Figure 14-1.

The sample traffic counts indicate that the volume of the traffic travelling on the N2 highway at the junction with the Mine access road is minimal, with a maximum of 37 vehicles observed travelling in a single direction (south bound). The level of inbound traffic generated by the Mine remains constant over both hours collected, with not more than a single vehicle turning into the access road from the N2 highway in an hour.

Outbound vehicles from the Mine site were observed to be greater in volume during the afternoon count period with a total of 14 vehicles exiting the Mine site, five of which were Heavy Goods Vehicles (HGVs). In contrast only three vehicles, all of which were HGVs were observed during the morning count on the following day.

### 14.2.6 Gamel Abdul Nasser Avenue/N2 Highway Junction (Nouakchott)

This junction is located within the centre of Nouakchott to the west of the city and is indicated in the Figure 14-2.
The junction is a fully signalised junction with four arms. This is one of the more important junctions in Nouakchott as it connects the main highways providing access to the north and south of the city, the N2 and N1 highways.

The level of resources available during the site visit did not allow for a full count of traffic at this junction; accordingly, those movements which may be impacted upon by the proposed Phase 2 works were prioritised and data was collected on the following arms:

- Gamel Abdul Nasser Avenue western approach arm (vehicles approaching from the Port);
- All vehicles approaching the Gamel Abdul Nasser Avenue western arm.

The results from the traffic survey, undertaken on the 9 November 2011 at 16:15 hrs, are summarised in Figure 14-3.

Over the observed hour a total of 462 vehicles approached the junction Gamel Abdul Nasser Avenue from the west. Of these only six, or 1.3% of the total, were HGVs. A similar volume of vehicles (486 vehicles) approached this arm from the other four arms of the junction, with a total of 8 HGVs or 1.6%. The volume of HGVs observed on these arms is minimal, especially given the location of the junction in relation to the main Port facilities.

64% of the total traffic approaching the junction from the Port area continues straight on towards the centre of Nouakchott and the eastern part of the city centre. Furthermore 69% of vehicles travelling towards the Port area from this junction also approach from Gamel Abdul Nasser Avenue (eastern arm).

Given the central location of this junction, the volume of traffic observed is not significant. It is also noted that all traffic was accommodated within the capacity of the junction with no significant queuing observed. The volume of traffic built up on each arm of the junction during the relevant ‘red phase’ within the traffic signal staging was cleared in a single ‘green phase’ with no residual queuing.

**14.2.7 Gamel Abdul Nasser Avenue / Port Access Road Junction (Nouakchott)**

This junction is a simple ‘T’ priority junction, giving priority to the east-west movement on the Gamel Abdul Nasser Avenue (Figure 14-4).

All arms of the junction were surveyed for one hour on Wednesday 9 November 2011 starting at 15:00 hrs. The results of the counts are summarised in Figure 14-5.

The distribution of traffic over the three arms of this junction is very even, with 30% and 37% observed on the western and eastern arms of Gamel Adbel Nasser Avenue respectively, and 33% on the Port Access Road.

3% of all traffic approaching the junction is HGV traffic, the majority of which is either travelling to or from the Port. All HGV vehicles approaching the junction from the Port Access Road turn right towards Nouakchott centre, and 77% of all HGVs approaching the junction from Nouakchott turn towards the Port.

No significant queuing was observed at the junction during the site count, and the traffic demand was accommodated within the available capacity of the junction.

**14.3 Potential Impacts**

This Section outlines the potential traffic related impacts during construction, operation and closure of Phase 2 of the Project.
It should be noted that this assessment only refers to trips external to the Mine site, and does not assess any trips which occur within the Mine site.

In addition to the phase specific impacts, there are a number of elements which are pertinent throughout the Project life and these are discussed below.

The N2 highway crosses open land between Nouakchott and Nouâdhibou. Sand dunes form an integral part of the landscape at a number of points along both the N2 highway and the Mine access road. Sand dunes are active formations which travel and migrate across the landscape, and which can therefore impact upon the functional operation of the highways. Currently sand dunes are monitored and, as and when required; sand accumulations are removed from the road by a suitable vehicle and pushed away from the highway. This is an ongoing maintenance routine and has the potential to impact upon vehicles accessing the Mine site.

Similarly, ephemeral flooding has the potential to impact on the ability of vehicles to access the Mine site and heavy rainfall/flood events will need to be monitored throughout the Project. Flooding is rare in Mauritania, but does occur during the infrequent rainfall events and can impact on the condition and operation of the N2 highway.

14.3.1 Construction

14.3.1.1 Freight Transport

There will be an increase in vehicle movements to and from the Mine site during the construction of Phase 2 for the delivery of labour, equipment and materials. It is intended that all construction equipment and materials will be transported from Nouâdhibou Port to the Mine site along the N2 highway and access road.

It should be noted that there will be a gradual increase (approximately 10-15%) in operational traffic volumes with respect to the level of vehicles generated by the existing Mine operations during the proposed construction period. It is not anticipated that this increase will be a material change from the baseline situation.

With the exception of fuel deliveries which will continue to be transported from Nouâdhibou Port, all routine operational traffic (e.g. deliveries of reagents, consumables and spare parts for maintenance activities) will continue to travel primarily from Nouakchott Port.

During the construction period, the Nouâdhibou Port will act as the primary delivery point for all construction goods, although some incidentals (up to 25% of construction traffic) may pass through Nouakchott Port. It should be noted that the volumes of traffic anticipated to travel from Nouakchott Port will not have any material impact on the existing highway network.

At present, full details of the volume of cargo to be imported to facilitate the Phase 2 are not available. The estimates for the requirement of vehicle movements from the Nouâdhibou Port are calculated on the basis of the worst case scenario, which is the maximum available capacity for Mine activities at the Port. It is understood that the Port currently has capacity to accommodate 1,000 t/day on behalf of the Mine, which based on the assumption that vehicle capacity from the Port is 25 t/vehicle this equates to 40 vehicles per day\textsuperscript{14}.

Freight activities during construction will be subcontracted to a specialist freight firm (the contractor) that will be responsible for the movement of construction equipment. The

\textsuperscript{14} 40 vehicles per day will result in 80 movements per day (40 vehicles entering and then exiting the site)
contractor will develop a set of Convoy and Safety Procedures which will be reviewed and approved by TMLSA’s, prior to the commencement of any construction works.

All large construction related vehicles will move in convoy from Nouâdhibou to the Mine site. There are two types of convoy, Standard Convoy & Over-dimensional (OD) Convoy. OD vehicle convoys will take up both carriageways of the N2 highway and travel slowly (48 kmph).

During construction there is a minor risk of an increase in accidents at the junction of the access road and the Nouakchott – Nouâdhibou N2 highway, as well as along the access road or within the Mine site.

14.3.1.2 Worker Transport

It is assumed that the local workers will be bussed to and from the Mine site at the start/end of their two week work rota as per existing arrangements. Table14-2 presents the number of bus trips predicted to occur during the proposed construction period.

| Table14-2: Estimated Bus Trip’s Generated by Local Construction Workers |
|--------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Construction Bus Trips | 4 | 9 | 13 | 13 | 0 |

The existing level of bus trips is between three and four per day. The proposed construction requirements will increase that to a maximum of 13 trips per day in January 2014, i.e. a total of 9 additional bus movements per day to accommodate the additional local workers.

No changes are anticipated in the way that expatriate workers are transferred between Nouakchott and the Mine.

14.3.1.3 Combined Impacts

The increase in vehicle movements along the N2 highway from Nouâdhibou Port and access road to the Mine site will also result in increased:

- Dust levels caused by vehicles passing over sand which may have blown across the road (see Section 7);
- Noise levels caused by vehicles passing, braking and horns (see Section 8);
- Risk of traffic accidents involving local residents and livestock (see Section 11); and
- Emission of greenhouse gases for vehicle fuel (see Section 16).

The transportation route for the construction period of Phase 2 of the Project will utilise existing roads and highways. As such as there are no new land requirements. This coupled with the low increased usage of the road means that the impact on water, soils and land use, archaeology and cultural heritage, biodiversity, landscape, visual, and waste are negligible. The transportation route is therefore scoped out of these sections and is not considered further in this EIA report.

14.3.2 Operation

Once the construction phase is complete, there will be an increase in vehicle movement over the baseline levels associated with the larger workforce and increase in equipment and materials required to support the expand Mine operations.
14.3.2.1 Freight Transport

It is anticipated that the number of vehicles required to transport materials from Nouakchott Port to the Mine will increase from the current estimate of approximately 16 vehicles per day to a peak of approximately 38 trucks per day in 2015/2016 for the expanded operations. This number is expected to drop to 30 trucks per day for operations in 2016 and moving forward. It should be noted that these numbers represent a ‘snap shot’ figure and the actual number of vehicles may fluctuate around this number on a day to day basis subject to actual requirements.

Section 11 of this Report discusses the potential social impacts related to the increased movement of mining materials along the N2 highway to accommodate the higher production levels associated with Phase 2. The discussion in this section includes reference to the increased accident risk, planning and approval with the Mauritania road authorities and emergency response.

At the peak of operational trip generation (2015/2016) the increase in vehicles used to transport materials to the Mine will be 20 over the current level of generation. This level of additional vehicles is not considered to be significant and can be accommodated on the existing road network. When the level of truck movements falls to 30 per day, this will represent an increase of 12 over the current level, a minimal increase over the existing level of trips, and can therefore be accommodated on the existing road network.

14.3.2.2 Fuel Transport

Fuel storage, dispensing and transport will be handled by a third party supplier (TOTAL) as is currently the case. Oil transportation will continue to be by tanker trucks from Nouâdhibou Port, although the number of tanker trips will increase to cover the additional fuel requirements to accommodate the Phase 2 power plant.

The number of tanker trips hauling oil-based fuels following the completion of Phase 2 is 42 per day. This will equate to 42 inbound and 42 outbound movements per day from and to Nouâdhibou Port respectively.

This represents an increase of approximately 37 vehicles per day, over the existing five trips per day. The transport of fuel tankers will take place over a 24 hour work day, and the additional requirement will result in an average of 1.75 tankers per hour. This level of tanker movements is not significant and can be accommodated on the existing road network. However, in the event that the Mine could make a switch to natural gas as the primary fuel for power generation, the requirement for oil-based fuels – and therefore tanker deliveries – would be substantially reduced.

14.3.2.3 Worker Transport

It is anticipated that the number of operations workers will increase as outlined in Section 3.2.9 and will peak in 2016. Following this peak, the number of workers will decline yearly until the termination of operations and the closure of the Mine.

Local workers will work on a rotation pattern and will be bussed to and from the Mine site on pre-coordinated bus transfers. Bussing local workers to and from Mine site minimises the impact of worker transfer on the local highway network. The forecast level of operational workers suggests that the level of bus trips per day will increase to a maximum of approximately 18 in 2016, declining yearly after this peak.
The bussing of workers on a coordinated timetable limits any potential impact on the surrounding highway due to the arrival and departure of workers, by ensuring that workers are transported in groups rather than a large number of individual movements.

Expatriates workers will continue to work on a rotational basis (which might vary over time) and will be accommodated in Mine site accommodation camp as per the existing situation. The majority of expatriate workers will continue to be transferred to Nouakchott airport by the Mine’s aircraft for transfer home by international airlines. Should the Mine’s aircraft be unavailable; workers will be grouped and transferred to Nouakchott by road, via the N2 highway. Therefore, the impact on the local highway network by the transfer of expatriate workers is not considered significant.

14.3.2.4 Combined Impacts

The increase in vehicle movements along the N2 highway, from Nouakchott Port, and access road to the Mine site will also result in increased:

- Dust levels caused by vehicles passing over sand which may have blown across the road (see Section 7);
- Noise levels caused by vehicles passing, braking and horns (see Section 8);
- Risk of traffic accidents involving local residents and livestock (see Section 11); and
- Emission of greenhouse gases for vehicle fuel (see Section 16).

As with the construction period, the operational period of the Project will utilise existing roads and highways. As such as there are no new land requirements. This coupled with the low increased usage of the road means that the impact on water, soils and land use, archaeology and cultural heritage, biodiversity, landscape, visual and waste are negligible. The transportation route is therefore scoped out of these sections and is not considered further in this EIA report.

14.3.3 Closure

Upon closure of the mining activities, the movement of materials, fuels and workers will cease, therefore the level of traffic generated by the Mine will also cease.

The level of traffic generated by any demobilisation of the Mine site (i.e. removal of equipment) is not currently available, however it is anticipated that the potential level of traffic generation will be less than the figures anticipated for construction and operation.

14.4 Mitigation Measures

A series of mitigation measures will be employed to minimise the impact of Phase 2 on the traffic conditions in the surrounding area.

A number of the proposed measures will be relevant to all proposed components of Phase 2 and are summarised below. Where specific mitigation measures are applicable to a specific element only (i.e. construction) these are discussed under the relevant heading.

Current best practice will be extended to include Phase 2 activities. Where relevant, contractors will undergo driver training to reduce the risk of accidents along the access road and plant will only be operated by specially trained drivers. Delivery drivers will be given instructions on entering and leaving the Mine site and will be required to stay on the access road (See Sections, 10, 11 and 12).
All roads within the Mine site and along the access road will be clearly marked and sign posted to ensure that vehicles only operate on designated roads / tracks. In addition, speed limits are set for the access road and within the Mine site.

As discussed in this section, the impact of the movement of workers to and from the Mine site will continue to be mitigated against by the bussing of local workers on prearranged transport, and the transport of expatriate workers by air to Nouakchott airport.

14.4.1 Construction

The current assumption regarding the level of vehicle movements generated from Nouâdhibou Port to the Mine site by the proposed construction requirements is based on the understanding that the maximum capacity available at the Port for Mine activities is 1,000 t per day, or 40 HGVs per day. This volume of additional movements from the Port to the Mine site is not significant and can be accommodated on the existing road network. Therefore it is not anticipated that any specific mitigation measures are required with respect to the increase in traffic volumes due to construction.

In order to mitigate any impacts related to the damage that may be caused to the N2 highway from Nouâdhibou Port to the Mine site by the projected increase in construction traffic and/or the number of oversize vehicles, a Construction Traffic Management Plan will be developed and implemented by the contractor prior to the commencement works. The Plan will identify the maintenance requirements and also any amendments required to accommodate the movement of oversized vehicles from the Port to the Mine. The plan will aim to maintain the N2 highway during the Phase 2 construction period to a similar condition as exists in the current situation.

During construction, freight activities will be subcontracted to a specialist freight firm that will be responsible for the movement of construction equipment. The contractor will develop a set of Convoy, Journey and Safety Procedures which will be reviewed and approved by TMLSA prior to the commencement of any construction works.

All large construction related vehicles will move in convoy from Nouâdhibou to the Mine site and will be managed by the contractor. There are two types of convoy, Standard Convoy & OD Convoy; both will be subject to the approved procedures to ensure minimal impact on the existing traffic flows and infrastructure. OD vehicle convoys will take up both carriageways of the N2 highway and travel slowly (48 km/h), and so that other traffic will need to be subject to warning and control measures. This will involve the construction of a series of bypasses (passing points) along the highway to enable traffic to pass the convoy by using the area to the side of the carriageway. The Freight Forwarding team will prepare a detailed plan (as an integral part of the Convoy Procedures) setting out the proposed locations for the bypasses along the length of the N2 highway between Nouâdhibou and the Mine site. It is currently anticipated that the bypasses will be located at approximately every 15 km, but the exact location will be subject to consideration of existing security checkpoints and constraints of the physical environment. Construction will probably involve simple grading and the laying of a gravel base.

The above procedures will mitigate against any potential impacts related to the movement of construction materials and equipment including reduction in the risk of accidents during road transport operations and the development of suitable emergency response.
14.4.2 Operation

All existing operational practices will be extended to cover the Phase 2 activities, to include the management of deliveries to the Mine and driver procedures in order to minimise the impact of the operational traffic on the existing traffic and highways infrastructure.

14.4.3 Closure

The closure of mining activities on the Mine site will remove the trip generation potential of the area, and will therefore reduce the impact on the surrounding traffic and highways.

The demobilisation of the Mine site should be programmed to ensure that the volume of traffic generated by any removal of equipment and materials from the Mine site does not exceed the traffic generation for the operational phase. This will ensure that there are no additional traffic related impacts associated with this phase.

14.5 Cumulative Impacts

There will be some cumulative impacts associated with Phase 2 as the current operation of the Mine will continue whilst the construction of Phase 2 is carried out. This is particularly apparent when the transport of workers and movement of equipment and materials is considered. These elements are discussed below.

14.5.1 Worker Transport

The programme for the Phase 2 construction works will proceed whilst the operation of the existing Mine activities continues, meaning that there will be a cumulative impact on the level of workers on-site.

The peak number of local construction workers will be in 2014 and early 2015 (approximately 2,500 workers). The number of local operation workers forecast for the same period is estimated at approximately 3,300. This results in total of 5,800 local workers.

Using the existing ratio of bus trips per workers this would result in a maximum of approximately 13 bus trips per day during this year period. Following this peak, the number of bus trips will decline to the termination of Mine operations when these trips will cease.

This is approximately 14 to 15 bus trips per day greater than the existing three to four bus trips per day for the transportation of workers.

It should be noted that there may be additional vehicle movements from Nouakchott airport to the Mine for the transport of expatriate workers should transfer by plane not be possible. However, this number is not expected to be significant and will only be required when transport by plan is not possible due to capacity or mechanical issues.

14.5.2 Equipment, Materials and Fuel Transport

It has been assumed that the maximum capacity available at the Port for Mine activities will result in a maximum of 40 HGVs per day\(^1\). This volume of additional movements from the Port to the Mine site is not significant and can be accommodated on the existing road network.

It should be noted that the operation of the existing Mine activities will continue during the construction and therefore the existing movements generated will be additional to the

---

\(^1\) 40 vehicles per day will result in 80 movements per day (40 vehicles entering and then exiting the site)
construction vehicles. The exact volumes of traffic will be reviewed in the Construction Traffic Management Plan.

### 14.5.3 Combined Trip Generation

In order to assess the cumulative impact of Phase 2, Table 14-3 summarises the volume of traffic generated during the peak period of Phase 2 in comparison to the existing volume of vehicles generated by the Mine.

#### Table 14-3: Phase 2 Peak Vehicle Generation

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Phase 2 Peak</th>
<th>Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vehicles/Day</td>
<td>Vehicles/Day</td>
<td>Vehicles/Day</td>
</tr>
<tr>
<td>Personnel</td>
<td>3-4</td>
<td>18</td>
<td>14-15</td>
</tr>
<tr>
<td>Fuel</td>
<td>5-6</td>
<td>42*</td>
<td>36-37</td>
</tr>
<tr>
<td>Equipment &amp; Materials</td>
<td>18</td>
<td>38*</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>26-28</td>
<td>98</td>
<td>70-72</td>
</tr>
</tbody>
</table>

* Operation of Phase 2 only, construction volumes unavailable. Construction freight will be delivered from Nouâdhibou.

It should be noted that the above assessment assumes that the peak in personnel, fuel and equipment and material transport demand will occur in the same period. It may however be the case that the peak vehicle generation occurs during a different period, therefore lowering the total movements.

### 14.6 Evaluation of Mitigated Impacts

Table 14-3 indicates that, based on the information available at the time of writing, the maximum number of vehicles generated by the Mine during Phase 2 (assuming all peak vehicle generating elements occur at the same time) will be 108 vehicles per day. This represents an increase of approximately 84 vehicles per day over the existing situation for a one year period.

As set out earlier in this Section, the level of vehicle traffic currently generated by Mine activities is minimal, and therefore the volume of traffic using the Mine access road is negligible. Any increase in traffic on this road would therefore appear to be a statistically large increase; this would however mask the actual increase and may exacerbate any potential impacts. The Mine access road provides sufficient capacity to accommodate the volumes of traffic identified for the construction phase. Following the completion of the construction works, it is planned that the access road will be hard surfaced to provide a single lane in each direction to the Mine from the N2 highway and will provide sufficient capacity to accommodate the volumes of traffic identified in Table 14-3 for the peak vehicle generation within Phase 2 based on the information available at the time of writing.

Information recorded during a site visit in November 2011 indicates that the N2 highway generally carries a low volume of traffic in the area close to the Mine access road. It is

---

16 Vehiciles per day. Each vehicle will result in two movements per day (one vehicle entering and then exiting the site)
therefore concluded that the volume of traffic outlined in this Report can be accommodated on the N2 highway.

Due to the increase in vehicle traffic on the access road and along the N2 highway during construction and operation of Phase 2 there is an associated impact on the potential level of road traffic accidents on the N2 highway, the Mine access road and at the junction of the access road and the N2 highway.

14.6.1 Construction

It has therefore been assumed that the maximum level of vehicle movements generated from Nouâdhibou Port to the Mine site is 40 HGVs per day \(^\text{17}\) based on our current understanding of the maximum capacity available at the Port for Mine activities. This volume of additional movements from the Port to the Mine site is not significant and can be accommodated on the existing road network. It should be noted that some incidental deliveries will be delivered from Nouakchott Port during construction, although the level of this demand is not confirmed it is anticipated that it will not be greater than 25% of the total construction traffic.

During the construction of Phase 2, the operation of the Mine will continue and therefore any construction vehicles will be additional to the existing Mine related traffic.

It is proposed that the majority of construction equipment and materials will be transported from Nouâdhibou Port via convoy along the N2 highway. All convoy’s will be managed by agreed procedures to minimise the impact on the existing traffic flows, however the bypass areas will be located approximately every 15 km which will mean that some traffic will have to wait for the convoy to pass. The management of the bypass areas will limit the wait time for traffic travelling towards the convoy to a maximum of 30 minutes.

With the exception of the existing fuel deliveries and minor materials, all operational materials and equipment are delivered from Nouakchott Port. Therefore there will be limited interaction with the construction and operational deliveries.

Residual traffic impacts during construction are therefore considered to be adverse, medium term and of low significance.

14.6.2 Operation

Operational traffic for Phase 2 will follow the same profile as the existing Mine operations, with fuel deliveries from Nouâdhibou and the majority of materials from Nouakchott.

The increase in fuel requirements will result in an increase of 36 to 37 vehicles per day from Nouâdhibou in the operational period. Assuming a 12 hour work day, this equates to one additional vehicle per hour, which is not considered to be significant given the low volume of flows on the N2 highway towards Nouâdhibou.

During the peak operational phase, an increase of approximately 20 vehicles per day, or 1.6 vehicles per hour (assuming a 12 hour day) will be generated for the transport of materials. This volume of traffic is not considered to be significant given the existing level of traffic on the N2 highway. In addition to the N2 highway, this traffic will travel through Nouakchott using the junctions assessed earlier in this Section. It is not considered that the level of additional traffic forecast for the operational element of Phase 2 will have an adverse impact on the existing traffic and infrastructure on the proposed route.

\(^{17}\) 40 vehicles per day will result in 80 movements per day (40 vehicles entering and then exiting the site)
Residual traffic impacts during operation are therefore considered to be adverse, medium term and of low to moderate significance.

14.6.3 Closure

The closure of mining activities on the Mine site will remove the trip generation potential of the area, and will therefore reduce the impact on the surrounding traffic and highways.

Residual traffic impacts during operation are therefore considered to be short term and negligible significance.

14.7 Summary

A summary of the potential residual impacts of the proposed Phase 2 with respect to traffic is presented in Table 14-4.

**Table 14-4: Summary of Potential Residual Impacts1 – Traffic**

<table>
<thead>
<tr>
<th>Location</th>
<th>Source of Impact</th>
<th>Mitigation Measure</th>
<th>Project Phase2</th>
<th>Nature3</th>
<th>Duration3</th>
<th>Significance3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access road</td>
<td>Increased traffic</td>
<td>The enforcement of driver training and speed limits along all roads. Also ensure</td>
<td>C O</td>
<td>Adverse</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Traffic accidents</td>
<td>that all roads are clearly sign posted.</td>
<td></td>
<td></td>
<td>term</td>
<td></td>
</tr>
<tr>
<td>N2 highway</td>
<td>Increased traffic</td>
<td>The enforcement of driver training and speed limits along all roads. Also ensure</td>
<td>C O</td>
<td>Adverse</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Traffic accidents</td>
<td>that all roads are clearly sign posted.</td>
<td></td>
<td></td>
<td>term</td>
<td>Low / Moderate</td>
</tr>
<tr>
<td></td>
<td>Delay to traffic</td>
<td>Effective operation of the convoys from Nouâdhibou</td>
<td>C</td>
<td>Adverse</td>
<td>Short</td>
<td>Low</td>
</tr>
<tr>
<td>Nouâdhibou Port</td>
<td>Increased Traffic</td>
<td>The enforcement of driver training and speed limits along all roads. Also ensure</td>
<td>C</td>
<td>Adverse</td>
<td>Short</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>that all roads are clearly sign posted.</td>
<td></td>
<td></td>
<td>term</td>
<td></td>
</tr>
<tr>
<td>Nouakchott Port</td>
<td>Increased Traffic</td>
<td>The enforcement of driver training and speed limits along all roads. Also ensure</td>
<td>O</td>
<td>Adverse</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>that all roads are clearly sign posted.</td>
<td></td>
<td></td>
<td>Term</td>
<td></td>
</tr>
</tbody>
</table>

1 Following implementation of proposed Mitigation Measures
2 Project Phase: C = Construction, O = Operation, D = Decommissioning and 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.

---

Phase 2 Environmental Impact Assessment

March 2012

277
15 Waste Management

This Section presents the methodology and baseline conditions used to assess the potential impacts on waste management resulting from Phase 2. 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.

This waste management section addresses non-mining wastes generated during the construction, operation and closure of the Phase 2 activities. It does not address the management of Mine sub-economic rock and tailings, which are detailed in the Project description (see Section 3) and are addressed separately in the relevant Sections of this Environmental Impact Assessment (EIA) Report. The types of non-mining waste that are anticipated to be generated are described in Section 15.3 below.

15.1 Methodology

15.1.1 Legislation and Guidelines

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

15.1.1.1 Mauritanian legislation

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. It defines urban waste, which includes household waste, industrial waste on national land and hazardous waste coming from abroad (Articles 60, 64 and 67).

The Environmental Code prohibits the depositing, discharge and dumping of solid, liquid or gaseous waste or residues that are potentially polluting. It prohibits the storage and abandonment of waste in unsuitable sites. It holds responsible any individual who holds such wastes under conditions that are liable to cause harm to human health and to the environment.

Additional provisions are included in this law with regard to the responsibility for the management of other types of waste. Relying on technologies and processes for waste recycling is strongly encouraged under this Code.

The Ministry of the Interior is responsible for solid waste management activities undertaken by municipal authorities, whilst the Delegated Ministry of the Environment and Sustainable Development, Department of Pollution and Environmental Emergencies, is responsible for promoting and supporting local policies for sustainable waste management and for controlling waste treatment operations.

15.1.1.2 IFC requirements

The relevant International Finance Corporation (IFC) Environmental Health and Safety (EHS) Guidelines include:

- EHS Guidelines for Mining
- EHS Guidelines for Waste Management Facilities; and
- General EHS Guidelines: Environmental – Waste Management
The EHS Guidelines for Mining set out the following recommendations with regard to non-hazardous and hazardous wastes:

15.1.1.3 General Non-Hazardous Waste

"Recommended practices for the management of household and non-process related industrial waste include the following:

- Non-hazardous solid waste should be collected for disposal at an approved sanitary landfill;
- External landfills should be audited to ensure appropriate waste management practices. When such a facility is not available within a feasible distance, the Mine should establish and operate its own with appropriate regulatory permits and scientifically defensible studies that can demonstrate that the disposal of the hazardous waste will not impact human health and the environment;
- Non-hazardous solid waste should not be disposed of together with sub-economic rock or overburden except under exceptional circumstances to be fully documented in the environmental and social assessment of the project."

15.1.1.4 Hazardous Waste

"Recommended practices for the management of hazardous waste include the following:

- Hazardous waste, including waste oils and chemicals, spent packaging materials and containers, should be managed as described in the General EHS Guidelines;
- Hazardous waste should be handled by specialised providers (in accordance with regulatory permits) of hazardous waste management facilities specifically designed and operated for this purpose. When such services are unavailable within a feasible distance of the mine, the mine should establish and operate its own waste facility with the necessary permits;
- Combustion of waste oils should preferably be undertaken as a supplementary fuel in power generation facilities and in accordance with emissions guidelines applicable to combustion sources (see the General EHS Guidelines and the EHS Guidelines for Thermal Power)."

The types of waste arisings have been estimated based on the Phase 2 Project descriptions and the Design Basis for Waste Management Facilities (Hatch, 2011b). The mitigation measures have been identified based on the draft Waste Management Plan (WMP) for the Project.

The residual impacts are then assessed based on the suitability of the proposed mitigation measures to adequately manage the anticipated waste arisings in a manner consistent with national regulations and international best practice as defined in the IFC EHS Guidelines for Mining and the General EHS Guidelines.
15.2 Baseline Conditions

15.2.1 Current Waste Management

15.2.1.1 Management

This Section briefly describes the current procedures and facilities for managing waste at the Mine. Waste management activities at the Mine are operated in accordance with the WMP which forms part of the overall Corporate Responsibility Management System for the Mine.

The existing facility on the Mine site includes a waste compound to accommodate solid wastes produced on-site. The compound is located south of the accommodation camp and east of the process plant (Figure 3-1).

This facility will continue to remain in use after the construction of the new WMF primarily for accepting domestic wastes.

Waste collected on-site is segregated 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 from operation or maintenance and which possess one of the six characteristics (corrosive, reactive, explosive, toxic, inflammable or biologically infectious).

Once the waste is segregated it is transferred to the current Waste Management Facility (WMF); which includes two incinerators and a landfill area comprising four cells used principally for the disposal of non-combustible dry non-hazardous waste.

The current incinerator capacity on-site comprises two diesel fired top loading units (INCINER8 A2600 units with a chamber capacity of 1,200 kg of waste) which are used to dispose of combustible and putrescible waste. The incinerator is operated on a batch (i.e. non-continuous) basis, and ash from the incinerator and non-combustible wastes are placed in the landfill on-site.

Redundant plant and equipment is stored in a laydown yard on the northern edge of warehouse/workshop facilities location.

The accommodation camp and office complex are provided with wheeled bins for temporary storage of waste prior to incineration or landfill.

15.2.1.2 Waste Types and Arisings

Non-mining waste is predominantly managed on-site. Currently, there are no off-site waste disposal facilities in Mauritania that are suitable for receiving non-mining waste produced on-site (with the exception of TOTAL facilities for receiving recyclable hydrocarbons).

- Scrap metals: Scrap metal (largely comprising redundant plant and equipment) is currently stored on-site pending re-sale;
- Laboratory waste: Laboratory waste arises from the on-site laboratory and comprises contaminated cupels, crucibles and glass containers together with small quantities of
reagents (e.g. acids) and packaging. All laboratory waste is currently stored on-site at a dedicated location within the existing WMF.

- 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 and/or landfilled;

- Kitchen waste: Kitchen waste arises from the accommodation camp and comprises food and packaging waste. It is currently disposed of by on-site incineration (or open pit burning);

- Waste water sludge: Sludge arises from septic tanks used to treat domestic waste water and is disposed of on land in the vicinity of the Mine site;

- Waste oils and lubricants: All used waste oil and solvents are directed to a dedicated waste oil storage tank at a 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;

- Used Tires: currently stored on-site; and

- Healthcare waste: Healthcare waste is generated from the on-site medical clinic and includes hazardous healthcare waste such as sharps and pathological/infectious waste (materials contaminated with bodily fluids or potential pathogens). It is currently disposed of in a lined cell within the waste compound.

15.2.1.3 New Waste Management Facilities (Phase 1b and Phase 2)

A new WMF was permitted under Phase 1b Eland will comprise the following individual components:

- Covered sorting area with concrete bays to ensure correct waste segregation and store segregated waste awaiting re-sale, compactors to reduce the volume of used packaging materials, weighing station and workers facilities;

- Two nominal 9 t/day capacity continuous loading batch incinerators designed to comply with IFC air emissions standard. Only one 9 t/day incinerator will be operated at one time;

- Non-hazardous waste sanitary landfill with a capacity of approximately 40,000 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);

- Hazardous waste storage facility with separate bays for used batteries, electronics, chemicals/contaminated packaging etc.;

- The current WMF is being replaced as part of Phase 1b of the Project, and the new WMF is described below; however its 2 incinerators will continue to be used concurrently with the additional P2 incinerator.

Additional facilities will be added to the new WMF facility as part of the Phase 2 development. These include:

- One 5 t/day capacity continuous loading batch incinerator designed to comply with IFC air emissions standards;

- Two laydown areas: one for large “re-sellable” materials for resale (50 m X 50 m), and one for metal equipment and metal waste from the maintenance shop (50 m X 100 m).
• Additional storage area for bulk items area for items such as used tyres; and
• A 30m x 30m open burning area will be contained by 2m high concrete walls on three sides. The area will be used to burn any non toxic waste, which has not been classified salvageable during the sort this is to include but limited to rinsed cyanide boxes, wooden pallets and building materials.

A separate purpose designed small incinerator will be installed at the clinic for the disposal of medical waste.

15.3 Potential Impacts

15.3.1 Construction

Waste generated during construction will predominantly comprise inert materials such as excavated spoil and surplus inert construction materials. Small quantities of non-inert construction waste such as plasterboard, coatings, timber and plastic will also be generated.

In addition, there will be quantities of hazardous waste, predominantly arising from the operation and maintenance of construction plant. This waste will include waste oil and batteries.

In the absence of mitigation, i.e. introduction of the Phase 2 inputs to the waste management facility, the solid waste impacts during construction are assessed to be adverse, short-term and moderate.

15.3.2 Operation

Categories of waste generated during operation will include:

15.3.2.1 Non-hazardous waste

• Wet waste, e.g. kitchen waste, cooking oils, sewage sludges;
• Dry waste, comprising:
  • Metal based, e.g. drinks cans, scrap metal and worn parts;
  • Rubber based, e.g. hoses, conveyors, tires and geomembrane scrap;
  • Wood based, e.g. pallets and furnishings;
  • Plastic based, e.g. plastic bottles, plastic pipe work;
  • Paper based, e.g. waste paper;
  • Inert Materials, e.g. glass bottles and construction debris; and
  • Incinerator ash.

15.3.2.2 Hazardous waste

• Liquid hazardous waste – e.g. waste oil, solvents and some laboratory wastes;
• Dry hazardous waste – e.g. oily sludge’s and rags, batteries, oil filters and drums, gas bottles, laboratory wastes, hydraulic hoses etc.;
Table 15-1 below describes the main types of waste that will be generated by Phase 2 Project activities during the operation phase.

**Table 15-1: Waste Arisings – Operation Phase**

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Waste Types</th>
</tr>
</thead>
</table>
| **CIL process plant** | Empty reagent containers used for transport and storage and transport of:  
- Lime  
- Anti-scalant  
- Copper sulphate  
- Sodium cyanide  
- Sulphur  
- Sodium hydroxide  
- Hydrochloric acid  
- Activated carbon  
- Sodium metabisulphate  
- Flocculant |
| **Phase 2 power plant** | Used lubricant oil, transformer oil and waste oil from oil/water separators  
Office waste from operator facilities |
| **Power distribution systems** | Minimal quantities of oils and other consumables used for maintenance |
| **Ancillary facilities** (such as: offices, workshops, warehouses, storage areas, fuelling facilities, laboratory) | Office wastes (including paper and putrescibles)  
Maintenance wastes (including waste oils, batteries and scrap tires)  
Packaging wastes (including wood, plastics and metal containers) from de-stuffing of incoming containers – majority of packaging waste generated at point-of-use in CIL process building.  
Laboratory wastes - slags, lead cupels, neutralised spent acids and chemical packaging.  
Incinerator ash (potentially contaminated) |
| **Accommodation camp** | Domestic and kitchen waste from camp inhabitants (up to 10,000 inhabitants during peak occupancy, 3,000 inhabitants during routine operation)  
2.1 L x 10,000  
= 21,000 L/day @ 1 kg/L  
= 21.2 t/day (peak)  
2.1L x 3,000  
= 6,300 L/day @ 1 kg/L  
= 6.3 t/day (routine operation) |
| **Medical clinic** | Healthcare waste from clinic |
| **Drainage and stormwater management system** | Sediment and sludges from periodic system cleaning |
| **Internal roads, explosive storage, and raw water storage pond** | None anticipated |

In the absence of mitigation, the impacts of solid waste generated during operation are assessed to be adverse, medium-term and high.
15.3.3 Closure

At closure, waste arisings will comprise demolition waste including a mixture of recyclables (e.g. metal), inert (e.g. rubble) and non-inert (e.g. plasterboard, timber). The majority of this waste will either be recyclable or inert, with some other materials requiring disposal such as piping used for chemical supply in process plants. This assumes that all waste generated during operation (including those temporarily stockpiled) will be dealt with in an appropriate manner prior to cessation of operations.

In the absence of mitigation, the impacts of solid waste generated during and after closure are assessed to be adverse, long-term and moderate.

15.4 Mitigation Measures

15.4.1 General Approach

The general approach to mitigating solid waste management impacts will be the preparation and implementation of the Project and Mine WMP. The Project WMP will include guidance on:

- Waste minimisation/prevention;
- Identification and segregation of waste materials at source;
- Recycling/reuse of suitable materials; and
- Appropriate treatment and disposal of specific waste streams.

All wastes will be strictly managed in accordance with applicable local regulations and will be consistent with the waste characteristics.

15.4.1.1 Non-Hazardous Wastes

Combustible non-hazardous waste will be managed using the on-site incinerators; non-combustible non-hazardous waste will be disposed of in the on-site landfill.

The contractor responsible for the WMF will monitor and report various operational parameters including the types and quantity of wastes entering the landfill and incinerator feedstock.

The TMLSA Environmental Department will undertake appropriate performance audits of the incinerators and periodic checks for odours (olfactory), dust emissions (visual) and abusive waste disposal activities (such as, windblown litter, debris or ash outside waste facility). As appropriate, periodic analyses of ashes and residues and emissions shall be commissioned to verify compliance with adopted standards including those specified by the IFC EHS Guidelines for WMF.

Both the landfill and the new incinerators will require operational procedures to ensure the correct management of waste. These procedures will include:

- Landfill: Waste segregation and handling; identification and segregation of potentially unsuitable wastes; installation of any lining systems or other site engineering works; covering of incinerator ash; and emergency preparedness and response; and
- Incinerator: Quality and quantity of feedstock and ashes; operating efficiency; and emissions from the process.

The landfill will be designed, constructed and operated as an engineered sanitary landfill in accordance with international best practice and relevant IFC Performance Standards. This will
include an impermeable lining system as a precautionary measure should there be any formation of leachate and landfill gas.

15.4.1.2 Hazardous Waste

Hazardous waste will be stored in a secure dedicated location at the new WMF and will be designed so as to prevent co-mingling or contact between incompatible wastes. Waste will be stored in suitable closed containers which are capable of preventing accidental releases to soil, air or water, and appropriate secondary containment will be provided for any liquid wastes stored in volumes greater than 220 litres. 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 five 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 hazardous waste transport, brokerage, treatment and or disposal service providers). In the unlikely event that no suitable solutions have been identified during this time-frame, then the hazardous waste storage facility will be increased in size in order to provide sufficient capacity until such time as suitable solutions have been identified.

Hazardous waste collection, transport and management will be carried out solely by workers who have been appropriately trained, and access to hazardous waste storage areas will be limited to these trained workers. The location of the hazardous waste storage areas 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 hazardous waste materials and made available to any workers managing these materials; all such wastes / waste containers will be clearly labelled to identify the contents. An emergency spill response plan will be prepared and implemented for the waste facility.

Comprehensive records will be compiled and retained; these will detail the quantities and types of hazardous waste that are generated, as well as the type and duration of storage.

15.4.1.3 Waste Oils

Waste oil and solvents will continue to be stored in a dedicated waste oil storage facility operated by TOTAL (or alternative contractor) and collected for off-site disposal at a suitable facility, as described for the current arrangements in Section 15.2 above.

15.4.1.4 Recycling/Reuse of Materials

Waste which is potentially suitable for recycling or re-use will be collected separately and will be stored within the WMF until such time appropriate off-site receivers can be identified.

15.4.2 Construction

During construction, mitigation measures for construction waste (comprising surplus materials and packaging) will be collected at the point of generation and returned to the WMF for management. Combustible material will be incinerated, non-combustible/inert material placed in the landfill and any hazardous waste (e.g. batteries or waste oil) temporarily stored in the hazardous waste storage area.
Excess spoil from site formation works will be re-used as part of site earthworks or in bunds/berms.

### 15.4.3 Operation

The specific mitigation measures that will be adopted to ensure responsible management of the wastes arising from operation of Phase 2 of the Project are shown in Table 15-2 below.

**Table 15-2: Operation Phase Mitigation Measures**

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Waste Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIL process plant</td>
<td>Empty reagent containers used for storage and transport</td>
</tr>
<tr>
<td></td>
<td>Reagent containers (except sodium cyanide) compacted prior to on-site landfilling.</td>
</tr>
<tr>
<td></td>
<td>Sodium cyanide containers to be washed then burnt in a dedicated open burning site in accordance with ICMC</td>
</tr>
<tr>
<td>Phase 2 power plant</td>
<td>Used lubricant oil, transformer oil and waste oil from oil/water separators</td>
</tr>
<tr>
<td></td>
<td>Any waste oils, fuels, oily sludges and solvents to be stored in the hazardous liquids facility operated by TOTAL and removed for appropriate off-site disposal</td>
</tr>
<tr>
<td></td>
<td>Office waste from operator facilities</td>
</tr>
<tr>
<td></td>
<td>Dispose of combustible waste by on-site incineration</td>
</tr>
<tr>
<td>Power distribution systems</td>
<td>Minimal quantities of oils and other consumables used for maintenance</td>
</tr>
<tr>
<td></td>
<td>Waste oils, fuels, oily sludges and solvents to be stored in the hazardous liquids facility operated by TOTAL and removed for appropriate off-site disposal</td>
</tr>
<tr>
<td>Ancillary facilities (such as: offices, workshops, warehouses, storage areas, fuelling facilities, laboratory)</td>
<td>Office wastes (including paper and putrescibles).</td>
</tr>
<tr>
<td></td>
<td>Dispose of combustible waste by on-site incineration</td>
</tr>
<tr>
<td></td>
<td>Dispose of non-combustible non-hazardous waste by on-site landfill</td>
</tr>
<tr>
<td>Maintenance wastes (including scrap tyres, waste oils and batteries)</td>
<td>Any waste oils, fuels, oily sludges and solvents to be stored in the hazardous liquids facility operated by TOTAL and removed for appropriate off-site disposal</td>
</tr>
<tr>
<td></td>
<td>Other hazardous wastes to be stored in waste management facility awaiting suitable off-site disposal route</td>
</tr>
<tr>
<td></td>
<td>Non-hazardous combustible wastes (e.g. oily rags) to be incinerated on-site</td>
</tr>
<tr>
<td></td>
<td>Scrap tyres to be stored on-site awaiting determination of suitable disposal route</td>
</tr>
<tr>
<td>Packaging wastes (including wood, plastics and metal containers)</td>
<td>Dispose of non-combustible non-hazardous waste by on-site incineration</td>
</tr>
<tr>
<td>Laboratory waste</td>
<td>Hazardous wastes to be stored in waste management facility awaiting suitable off-site disposal route</td>
</tr>
<tr>
<td>Incinerator ashes</td>
<td>Lined landfill area</td>
</tr>
<tr>
<td>Accommodation Camp</td>
<td>Domestic and kitchen waste from camp inhabitants</td>
</tr>
<tr>
<td></td>
<td>Dispose of combustible waste by on-site incineration</td>
</tr>
</tbody>
</table>
### Project Component | Waste Types | Mitigation Measures
---|---|---
Medical Clinic | Healthcare waste from clinic | Healthcare waste will be incinerated in a dedicated incinerator at the clinic
Drainage and stormwater management system | Sediment and sludges from periodic system cleaning | Re-use as part of earthworks or in bunds/berms
 | Waste oil from oil/water separators | Waste oils, fuels, oily sludges and solvents to be stored in the hazardous liquids facility operated by TOTAL and removed for appropriate off-site disposal.

#### 15.4.4 Closure

The specific mitigation measures that will be adopted to ensure responsible management of the wastes arising from closure of Phase 2 of the Project are shown in Table 15-3 below. This assumes that all waste generated during operation (including those temporarily stockpiled) will be dealt with in an appropriate manner prior to cessation of operations.

**Table 15-3: Closure Phase Mitigation Measures**

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Waste Types</th>
<th>Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIL process plant</td>
<td>Demolition waste</td>
<td>Combustible material to be incinerated, metals to be recycled, non-combustible / inert material placed in landfill</td>
</tr>
<tr>
<td>Phase 2 power plant and power distribution systems</td>
<td>Demolition waste</td>
<td>Combustible material to be incinerated, metals to be recycled, non-combustible / inert material placed in landfill</td>
</tr>
<tr>
<td>Ancillary facilities (such as: offices, workshops, warehouses, storage areas, fuelling facilities, accommodation camp, medical clinics, waste management facilities and water treatment facilities)</td>
<td>Demolition waste</td>
<td>Combustible material to be incinerated, metals to be recycled, non-combustible / inert material placed in landfill</td>
</tr>
</tbody>
</table>

#### 15.5 Cumulative Impacts

Cumulative impacts may occur to the extent that both Project construction activities will overlap with existing operations.

Cumulative impacts have been addressed by ensuring that the WMF, to be constructed under Phase 1 and Phase 2, has been designed to accommodate all of the wastes that will be produced during construction, operation and closure of the Project and ensure their safe storage and disposal.

#### 15.6 Evaluation of Mitigated Impacts

Given the design of the new WMF the mitigation requirements for Phase 2 are modest and primarily restricted to the need to ensure application of the separate Project and Mine WMP – i.e. a disciplined approach to waste segregation.
15.6.1 Construction

The impacts during construction relate to the management of general construction wastes (such as site office waste, plastics, cables etc), excess excavated spoil, and hazardous wastes from activities such as vehicle maintenance and use of solvents and paints.

The Project WMP will 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. However, the hazardous waste facility is being designed to accommodate up to five years accumulation of hazardous wastes to allow time to identify the required solutions.

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

15.6.2 Operation

A dedicated WMF comprising three incinerators, a landfill site and non-hazardous and hazardous associated storage facilities will be constructed as part of the Phase 1 and Phase 2 works and will be designed to adequately manage wastes generated during all phases of the Project, including waste generated by the increase in mining rate at the site. Additional capacity will be available from the retention of the existing WMF (which includes two incinerators), and a clinical waste incinerator will be provided to manage healthcare wastes.

The Mine WMP will include adequate measures for management of all wastes generated during the operational phase of the Phase 2 activities, 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 storage is being designed to accommodate up to five years accumulation of hazardous wastes to allow time to identify the required solutions.

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 five years, or if such solutions require trans-boundary shipments. If necessary, additional storage capacity can be provided until such time as a suitable off-site disposal facility has been identified.

Residual waste impacts during operation are assessed to be adverse, medium term and of low/moderate significance, provided suitable disposal facilities for hazardous waste are identified.

15.6.3 Closure

Demolition and removal of the facilities will be carried out in accordance with the Mine Rehabilitation and Closure Plan (RCP), which will include adequate measures for management of all wastes generated during the closure of the Phase 2 activities. The impacts during close relate mainly to the management of inert demolition wastes, which will be mainly either land filled or recycled.

Residual waste impacts post-closure are assessed to be adverse, long term and of low/moderate significance.
15.7 Summary

A summary of the potential impacts of the proposed Phase 2 following the implementation of mitigation measures with respect to waste management are presented in Table 15-4.

**Table 15-4: Summary of potential residual impacts1 – Waste Management**

<table>
<thead>
<tr>
<th>Location</th>
<th>Nature of Impacts</th>
<th>Mitigation Measure</th>
<th>Project Phase</th>
<th>Nature³</th>
<th>Duration³</th>
<th>Significance³</th>
</tr>
</thead>
<tbody>
<tr>
<td>All construction activities</td>
<td>Construction waste comprising surplus materials and packaging and hazardous waste from vehicle maintenance and use of solvents etc</td>
<td>Ensure waste is collected at the point of generation and returned to waste compound for management. Combustible material to be incinerated. Non-combustible/inert material placed in landfill. Hazardous waste stored pending identification of suitable disposal route</td>
<td>C</td>
<td>Adverse</td>
<td>Short term</td>
<td>Low</td>
</tr>
<tr>
<td>Accommodation Camp - Operations</td>
<td>Domestic and kitchen waste from camp inhabitants</td>
<td>Dispose of combustible waste by on-site incineration.</td>
<td>O</td>
<td>Adverse</td>
<td>Medium term</td>
<td>Moderate</td>
</tr>
<tr>
<td>CIL Process Plant</td>
<td>Empty reagent containers used for storage and transport.</td>
<td>Reagent containers (except sodium cyanide) compacted prior to on-site landfilling. Sodium cyanide containers to be washed then burnt. (Plastic liners will be washed and buried in landfill, boxes burnt)</td>
<td>O</td>
<td>Adverse</td>
<td>Medium term</td>
<td>Moderate</td>
</tr>
<tr>
<td>Medical clinic</td>
<td>Healthcare waste from clinic</td>
<td>Dispose of by combustion in dedicated clinical waste incinerator.</td>
<td>O</td>
<td>Adverse</td>
<td>Medium term</td>
<td>Moderate</td>
</tr>
<tr>
<td>Laboratory</td>
<td>Laboratory waste</td>
<td>Hazardous wastes to be stored in waste management facility awaiting suitable off-site disposal route.</td>
<td>O</td>
<td>Adverse</td>
<td>Medium term</td>
<td>Low</td>
</tr>
<tr>
<td>On-Site Non Process Buildings</td>
<td>Used lubricant oil, transformer oil and waste oil from oil/water separators;</td>
<td>Waste oils, fuels, oily sludges and solvents to be stored in the hazardous liquids facility operated by TOTAL and removed</td>
<td>O</td>
<td>Adverse</td>
<td>Medium term</td>
<td>Moderate</td>
</tr>
<tr>
<td>Location</td>
<td>Nature of Impacts</td>
<td>Mitigation Measure</td>
<td>Project Phase</td>
<td>Nature</td>
<td>Duration</td>
<td>Significance</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------</td>
<td>---------------</td>
<td>--------</td>
<td>----------</td>
<td>--------------</td>
</tr>
<tr>
<td>other maintenance waste (e.g. batteries, scrap tires)</td>
<td>for appropriate off-site disposal Other hazardous wastes to be stored in waste management facility awaiting suitable off-site disposal route Non-hazardous combustible wastes (e.g. oily rags) to be incinerated on-site. Scrap tires to be stored on-site.</td>
<td></td>
<td></td>
<td>O</td>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Office wastes (including paper and putrescibles)</td>
<td>Dispose of combustible waste by on-site incineration.</td>
<td></td>
<td>O</td>
<td>Adverse</td>
<td>Medium term</td>
<td>Low</td>
</tr>
<tr>
<td>Drainage and Stormwater Management System</td>
<td>Sediment and sludges from periodic system cleaning</td>
<td>Re-use as part of earthworks or in bunds/berms, or dispose of to landfill in case of contamination</td>
<td>O</td>
<td>Adverse</td>
<td>Medium term</td>
<td>Low</td>
</tr>
<tr>
<td>All demolition activities</td>
<td>Demolition waste</td>
<td>Combustible material to be incinerated, metals to be recycled, non-combustible/inert material placed in landfill</td>
<td>D</td>
<td>Adverse</td>
<td>Short term</td>
<td>Low</td>
</tr>
</tbody>
</table>

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

This Section presents the methodology and baseline conditions used to assess the potential impacts on climate change resulting from greenhouse gas (GHG) emissions in Phase 2. 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.

This Section also presents the estimated direct GHG emissions from Mine operations that have been calculated in line with IFC guidelines.

16.1 Background

16.1.1 Mauritania

In 2005, Mauritania’s GHG emissions were reported by the World Resources Institute as 8.9 MtCO₂e, equivalent to 0.02% of total global emissions (World Resource Institute, 2010)\textsuperscript{18}. This is based on data for carbon dioxide, methane, nitrous oxide, perfluorocarbon, hydrofluorocarbon, and sulphur hexafluoride emissions, including fuel use, bunker fuel emissions and land use change.

In 2008 GHG emissions per capita for Mauritania were 0.6 tCO₂/person, ranking the country 165th out of 214 countries, equivalent to emissions from Nigeria, the Federated States of Micronesia, Djibouti and Cape Verde (US Department of Energy 2008)\textsuperscript{19}.

While Mauritania ratified the Kyoto Protocol in 2005, there are currently no legal requirements to calculate, report or reduce GHG emissions.

16.1.2 Kinross/Tasiast Mauritanie Limited SA (TMLSA)

Kinross measures and voluntarily publishes information on the carbon footprint from its operations through its commitment to the Carbon Disclosure Project (CDP) and through their biennial Corporate Reporting\textsuperscript{20}. The CDP is a database of primary corporate climate change information in which over 3,000 organisations disclose their GHG emissions. The goal of the CDP is to accelerate unified action on climate change by encouraging companies to measure and disclose GHG emissions and making this data available for use by a wide audience including institutional investors.

In 2011 Kinross scored 73 in the CDP Carbon Disclosure Leadership Index; the carbon performance score recognises companies that are taking positive measures on climate change mitigation. Kinross achieved the highest score within their sector, demonstrating that they understand and are addressing the risks and opportunities associated with climate change. Kinross have integrated climate change into their business strategy.

16.2 Methodology

Following a detailed review of the principal methodologies for estimating cumulative GHG emissions, including the International Finance Corporation’s (IFC) Carbon Emissions Estimation Tool (CEET) (IFC, 2011)\textsuperscript{21}, and the World Resource Institutes GHG Protocol, it was

\textsuperscript{18} World Resources Institute ‘Climate Analysis Indicators Tool’ (CAIT); available from http://cait.wri.org/ (registration required)

\textsuperscript{19} US DoE Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory - http://cdiac.ornl.gov/trends/emis/top2008.cap


\textsuperscript{21} CEET is available from the IFC web site: http://www.ifc.org/ifcext/climatebusiness.nsf/Content/ClimateBusinessHome
decided to align the measurement of the Project’s GHG emissions with the IFC CEET guidance as far as reasonably practical. The IFC CEET tool is based on the International Panel on Climate Change (IPCC) methodology for greenhouse gas emissions reporting.

An indication of the Mine’s operational carbon footprint can be obtained by multiplying the estimated annual direct consumption of fuels and other major GHG producing materials at the Mine by a conversion factor to calculate its emissions, expressed as tonnes of CO2 equivalent22 (tCO2e).

### 16.2.1 Scope of footprint

The revised (2012) IFC Performance Standard 3 (PS3): ‘Resource Efficiency and Pollution Prevention’, outlines IFC requirements for the project-level monitoring and reporting of GHG emissions for projects that are expected to or currently produce more than 25,000 t/a of CO2 equivalent. PS 3 states that direct emissions from facilities owned or controlled within the Project’s physical boundary as well as indirect emissions associated with the off-site production of energy used by the Project should be quantified annually in accordance with an internationally recognised standard.

In accordance with the IFC requirements the following GHG emissions sources have therefore been provisionally scoped out of this footprint calculation (but may be re-introduced in future GHG report):

- **Construction emissions**: GHG emissions from construction including land clearance, erection of infrastructure, building materials and fuel use for vehicles and plant not associated with core processes of the Mine have been excluded as these are ‘optional’ under the IFC CEET methodology;

- **Other potential direct GHG emissions from Mine operations**: Fugitive emissions data from other on-site sources such as refrigerants, sulphur hexafluoride (SF6) and hydrofluorocarbons (HFCs) are estimated to be less than 1% and therefore scoped out for materiality;

- **Indirect emissions associated with the off-site use of vehicles and office space in Mauritania**: Not applicable for the Project;

- **Geothermal emissions**: Not applicable to the Project; and

- **Specific process emissions**: No IFC conversion factor for refining gold.

In addition to the exclusions justified by the IFC’s methodology, emissions from light vehicle and aircraft transportation, blasting materials and waste management and have also been excluded:

- **Light vehicles, aircraft and blasting materials**: emissions from light vehicles, aircraft flying in and out of the Mine and from the utilisation of blasting materials are each estimated to be less than 1% of the overall total footprint (base case scenario) and therefore provisionally scoped out for materiality.

- **Waste Management Facility (WMF) and landfill emissions**: Waste produced at the Mine site will be sorted at source where possible. Waste will be stored, reused, recycled, incinerated or land filled depending upon its nature. Only inert wastes will be deposited in landfill, with putrescible wastes being incinerated, consequently there will

---

22 The CO2 equivalent (CO2e) is 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.
only be negligible amounts of methane from the landfill. Power for the incinerator will be supplied from a generator until the WMF is connected to the permanent power distribution network. Emissions associated with provision of energy to the incinerators will therefore already be accounted for.

Phase 3 GHG emissions associated with increased supply of water to meet demand for the expanded operations will be included in the Phase 3 EIA report and are not assessed in this report. The water demand is expected to be met through development of a sea water supply system which will be powered by HFO generators at the sea water abstraction site or powerline.

16.2.2 Boundary for the Phase 2 footprint

Construction of the main power plant, scheduled under the Phase 2, is due to be completed and commissioned in 2015. Therefore 2016 was chosen as the reporting year to reflect the fully operational power plant.

Processing, power and mine plan alternatives are currently being assessed as part of the Project planning process. For the purposes of the EIA, the Project components and footprint selected are those which result in a conservative approach to impact assessment. As such, the GHG assessment has been carried out on two potential power plants and various types of fuel. Phase 2 Project components and their specific capacities will be refined as part of the final feasibility and detailed design process.

16.2.3 Existing Mine Operations and Phase 1 expansion

As the Mine is operational, it already emits GHG emissions from a number of direct sources including, inter alia:

- Fuel consumption from both the existing and the additional new power plant (permitted in Phase 1b) including Heavy Fuel Oil (HFO) and diesel;
- Fuels consumed by combustion processes including, mobile generators and other fuel combustion sources such as the borefield and other remote generators; and
- Fuel consumption from mining and construction vehicles and mobile machinery including diesel, gasoline, Liquefied Petroleum Gas (LPG) etc.

HFO is used by the three 2.7 MW generators in the existing power plant. Diesel is used to fuel twelve 1 MW generators plus the range of vehicles and assorted mining equipment, including mobile generators at the Mine. Phase 1b of the Project included a new interim power plant comprising six 5 MW HFO generators.

Power to supply the Mine’s water requirements is supplied by a diesel generator located at the existing borefield and a small mobile unit at the new intermediary pumping station. Phase 1b of the Project also included a new generator for the expanded borefield operations.

16.3 Sources of Impact from Phase 2

The emissions sources to be included from Phase 2 can be summarised as follows:

- Fuel consumption from the existing and Phase 1 power plant in their back-up role following commissioning of the Phase 2 power plant;
- Fuel consumption by the Phase 2 power plant; and
• Vehicles and mobile / stationery plant fuel use to include the consumption of diesel, gasoline, LPG, etc., from additional on-site production vehicles and machinery use.

16.3.1 Power Plant

There is no national power supply currently available in Mauritania that will meet the estimated Project power demand. The Project power demand is directly affected by the mining plan, size of the CIL mill and size of the crushed heap leach components for Phase 2. The Project power demand is undergoing further study and will be refined with the final feasibility and detailed engineering processes. If off-site power generation and power transmission becomes available in Mauritania and ample power load capacity is economically available, TMLSA will consider utilising this power for on-site activities.

Based upon the power demand ranges currently envisioned for the Project, two on-site power plant options have been selected for EIA analysis; a 120 MWe HFO reciprocating power plant and a multi-fuel 140-160 MWe gas turbine combined cycle power plant (CCPP) with Gas Turbine Generators (GTG).

The CCPP option will consist of 4 multi-fuel GTGs that will produce the total electrical power needed for the Mine site. Three of the generators will run as a single cycle for approximately six months after construction in 2015 while the fourth will act as back up. For the purposes of calculating power plant GHG emissions, it has been assumed that, in addition to full operation of the other three generators, the backup GTG will run for 500 hours per annum - the maximum hours permitted. From late 2015 a steam turbine generator will be operated and the plant will run as a combined cycle. Thereafter the existing power plants (including Phase 1a(ii) and Phase 1b) power plants will be utilised for contingency back-up.

The reciprocating engine power plant option is based upon seven 17.1 MWe units. GHG emissions estimates have been based on HFO fuel containing 2% or less sulphur and that the reciprocating engines will meet IFC guidance for other emission constituents.

16.3.2 Production vehicles and Mobile Equipment

Emissions from the consumption of diesel by production vehicles and mobile plant equipment have been included in the Phase 2 footprint. Data have been provided by TMLSA and are shown in Table 16-1. As discussed in 16.2.1, emissions from the use of light vehicles and other workers transportation have been excluded from the Phase 2 calculation as this is deemed likely to be negligible when compared to the overall footprint.

Table 16-1: Annual Fuel Use of On-site Production Vehicles

<table>
<thead>
<tr>
<th>Emissions Source</th>
<th>Fuel type</th>
<th>Fuel use (litres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trucks</td>
<td>Diesel</td>
<td>41,974,478</td>
</tr>
<tr>
<td>Excavators</td>
<td>Diesel</td>
<td>14,707,823</td>
</tr>
<tr>
<td>Auxiliary</td>
<td>Diesel</td>
<td>10,253,305</td>
</tr>
<tr>
<td>Workshop</td>
<td>Diesel</td>
<td>2,600</td>
</tr>
<tr>
<td>ROM rehandle</td>
<td>Diesel</td>
<td>431,694</td>
</tr>
</tbody>
</table>
16.4 Results

The following tables summarise the GHG emission sources and total emissions from both the Phase 1 expansion and the proposed Phase 2 activities. They outline the estimated changes in emissions sources and associated emissions from the Mine as it continues to be developed.

16.4.1 Phase 1 GHG Emissions

Table 16-2 below uses annualised 2010 monthly fuel consumption data provided by TMLSA as the basis for calculating Phase 1 GHG emissions. Activities during Phase 1 relate to the expansion of support infrastructure and some preliminary upgrades including increased borefield water extraction and new warehousing and office space. There is also an initial increase in Mine equipment and the rate of mining. Key sources of GHG emissions arising from Phase 1 expansion come from additional vehicles movements and mobile generators as well as the main site power plant running on HFO.

<table>
<thead>
<tr>
<th>Emission Source</th>
<th>Fuel Type</th>
<th>Fuel use (litres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drilling</td>
<td>Diesel</td>
<td>10,941,282</td>
</tr>
</tbody>
</table>

The emissions footprint submitted in the Phase 1b EIA report was calculated using standard emissions factors supplied by Kinross and totalled 82,393 tCO₂e. For consistency with the Phase 2 report emissions for Phase 1 have been recalculated in Table 16-2 using IFC emissions factors. Using the IFC emission factors has resulted in a reduction in estimated Phase 1 emissions of 49 tCO₂e.

16.4.2 Phase 2 GHG Emissions

Table 16-3 to Table 16-7 set out estimated GHG emissions associated with Phase 2 Mine operations for the reporting year of 2016. For each scenario the GHG emissions are estimated based upon fuel consumption figures calculated by the design engineer, Hatch 2011.

For the CCPP option power will initially be generated using diesel fuel (Table 16-3). In order to maintain optionality during operations, alternative fuels may be used to generate electrical power. The assessment recognises that alternative fuels may be used for power generation and therefore, in addition to diesel fuel, GHG emissions and associated impacts of using three alternative fuels (Heavy Fuel Oil, Light Crude Oil, and Natural Gas) has been assessed, see Table 16-4 to Table 16-6. For the reciprocating engine option the assessment has been undertaken based on the use of HFO.
Power plant emissions have been calculated by multiplying the estimated quantities of each fuel by the appropriate IFC emissions factors. The Phase 2 power plant will run constantly throughout the year – i.e. 24 hours/day, 7 days/week.

The Phase 1 power plant is to be used as back-up to the main plant. Emissions have therefore been calculated assuming the plant will only be running for a maximum twenty days per annum. Emissions from the consumption of HFO in the back-up power plant and from production vehicles remain constant for each scenario with fuel use for the main power plant being the only variable dependent on fuel type and use.

**Table 16-3: Phase 2 Emissions (CCPP - Diesel fuel scenario)**

<table>
<thead>
<tr>
<th>Emission Source</th>
<th>Fuel type</th>
<th>Fuel Consumption (units per annum)</th>
<th>tCO₂ emissions per Annum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 2 Power plant (Combined cycle)</td>
<td>Diesel</td>
<td>216,543 tonnes</td>
<td>690,005</td>
</tr>
<tr>
<td>Fuel consumption from the existing &amp; Phase 1b power plant</td>
<td>HFO</td>
<td>696,986 litres</td>
<td>2,014</td>
</tr>
<tr>
<td>Production vehicles/machinery</td>
<td>Diesel</td>
<td>78,311,182 litres</td>
<td>215,025</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>907,044</strong></td>
</tr>
</tbody>
</table>

**Table 16-4: Phase 2 Emissions (CCPP - HFO fuel scenario)**

<table>
<thead>
<tr>
<th>Emission Source</th>
<th>Fuel type</th>
<th>Fuel Consumption (units per annum)</th>
<th>tCO₂ emissions per Annum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 2 Power plant (Combined cycle)</td>
<td>HFO</td>
<td>222,320 tonnes</td>
<td>695,217</td>
</tr>
<tr>
<td>Fuel consumption from the existing &amp; Phase 1b power plant</td>
<td>HFO</td>
<td>696,986 litres</td>
<td>2,014</td>
</tr>
<tr>
<td>Production vehicles / machinery</td>
<td>Diesel</td>
<td>78,311,182 litres</td>
<td>215,025</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>912,256</strong></td>
</tr>
</tbody>
</table>

**Table 16-5: Phase 2 Emissions (CCPP - LCO fuel scenario)**

<table>
<thead>
<tr>
<th>Emission Source</th>
<th>Fuel type</th>
<th>Fuel Consumption (units per annum)</th>
<th>tCO₂ emissions per Annum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 2 Power plant (Combined cycle)</td>
<td>LCO</td>
<td>225,091 tonnes</td>
<td>697,949</td>
</tr>
<tr>
<td>Fuel consumption from the existing &amp; Phase 1b power plant</td>
<td>HFO</td>
<td>696,986 litres</td>
<td>2,014</td>
</tr>
<tr>
<td>Production vehicles / machinery</td>
<td>Diesel</td>
<td>78,311,182 litres</td>
<td>215,025</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>914,988</strong></td>
</tr>
</tbody>
</table>
Table 16-6: Phase 2 Emissions (CCPP - natural gas fuel scenario)

<table>
<thead>
<tr>
<th>Emission Source</th>
<th>Fuel type</th>
<th>Fuel Consumption (units per annum)</th>
<th>tCO₂e emissions per Annum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 2 Power plant (Combined cycle)</td>
<td>Natural gas</td>
<td>182,948 tonnes</td>
<td>492,677</td>
</tr>
<tr>
<td>Fuel consumption from the existing &amp; Phase 1b power plant</td>
<td>HFO</td>
<td>696,986 litres</td>
<td>2,014</td>
</tr>
<tr>
<td>Production vehicles / machinery</td>
<td>Diesel</td>
<td>78,311,182 litres</td>
<td>215,025</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>709,716</strong></td>
</tr>
</tbody>
</table>

Table 16-7: Phase 2 Emissions (Reciprocating engine power plant HFO fuel scenario)

<table>
<thead>
<tr>
<th>Emission Source</th>
<th>Fuel type</th>
<th>Fuel Consumption (units per annum)</th>
<th>tCO₂e emissions per Annum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 2 Power plant (Reciprocating Engine)</td>
<td>HFO</td>
<td>163,802 tonnes</td>
<td>512,227</td>
</tr>
<tr>
<td>Fuel consumption from the existing &amp; Phase 1b power plant</td>
<td>HFO</td>
<td>696,986 litres</td>
<td>2,014</td>
</tr>
<tr>
<td>Production vehicles / machinery</td>
<td>Diesel</td>
<td>78,311,182 litres</td>
<td>215,025</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>729,266</strong></td>
</tr>
</tbody>
</table>

From the above tables, it can be seen that the primary sources of GHG emissions are the proposed Phase 2 power plant, designed to meet most of the Mine’s energy requirements, and from diesel consumption by Mine production vehicles and mobile equipment. Emissions from the back-up power plant are minimal in comparison.

The Table 16-8, presents total estimated CO₂e emissions for Phase 1 and each of the Phase 2 scenarios. Also detailed is the estimated percentage increase in emissions between Phase 1 and each of the Phase 2 scenarios.

Table 16-8: CO₂e Emissions Summary by Scenario

<table>
<thead>
<tr>
<th>Project Phase</th>
<th>Estimated emissions tCO₂e per annum</th>
<th>% increase over Phase 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>82,342</td>
<td>n/a</td>
</tr>
<tr>
<td>Phase 2 HFO CCPP Scenario</td>
<td>912,256</td>
<td>1,008</td>
</tr>
<tr>
<td>Phase 2 LCO CCPP Scenario</td>
<td>914,987</td>
<td>1,110</td>
</tr>
<tr>
<td>Phase 2 Diesel CCPP Scenario</td>
<td>907,044</td>
<td>1,002</td>
</tr>
<tr>
<td>Phase 2 Natural Gas CCPP Scenario</td>
<td>709,716</td>
<td>762</td>
</tr>
<tr>
<td>Phase 2 HFO Reciprocating Engine Scenario</td>
<td>729,266</td>
<td>785</td>
</tr>
</tbody>
</table>
The resulting Phase 2 calculations reflect the change in emissions from the baseline/Phase 1 through to Phase 2 as the Mine expands. The Phase 2 Project expansion is large: mining and milling increase by a factor of five and thus power requirements increase significantly resulting in an increase in GHG emissions. The processes utilised in gold mining use substantial amounts of fuel which in turn emits significant quantities of GHGs when combusted.

It should be noted that the Phase 2 CCPP design incorporates a 60 MWE Steam Turbine Generator (STG) that will recover waste heat. This example of best practice technology is anticipated to save a considerable amount of emissions depending upon the type of fuel. A conservative estimate of the embedded STG mitigation for this power plant is equivalent to a reduction of total GHGs by 30% or more for each specific fuel type; however, as they are difficult to predict accurately, they are not included in these preliminary footprint calculations.

Of the four Phase 2 CCPP scenarios detailed, utilising natural gas would result in approximately 22% (using an average of emissions for other fuel types) less GHG emissions than the other fuel options. Natural gas burns more cleanly than other hydrocarbon fuels and produces less CO$_2$e per unit of fuel combusted; less gas is required to achieve the equivalent thermal output. However, Diesel (the base case option) will result in slightly lower emissions than using the other liquid fuels.

As expected the reciprocating engine power plant option, specified to meet the lower end of estimated Mine power requirements, emits less GHG than the majority of CCPP options. However, due to the high carbon conversion factor associated with HFO, emission still remain higher than the natural gas CCPP option.

16.5 Mitigation Measures

As discussed in Section 16.1.2, to align with their corporate climate change commitments and external annual reporting to the Carbon Disclosure Project, Kinross currently collate and monitor direct fuel use associated with the Mine. Kinross and TMLSA will continue to report direct GHG emissions, assess GHG risks and seek reasonably feasible opportunities to minimise GHG emissions across the Mine.

To allow a better understanding of the emissions, and facilitate improved energy management (and therefore GHG emissions) in the future, a number of further emissions monitoring and management measures will be considered for implementation as appropriate, including:

- **Monitoring and reporting of operational parameters (data):** Collation and quality analysis of fuel quantity data, ozone depleting substances, energy production and process efficiency, continuous emissions monitoring system for certain constituents and comparison against design standards including applicable IFC emissions parameters (i.e. General EHS Guidelines for both ambient air and emissions);

- **Provision of energy balance and energy efficiency reviews:** Using the findings to optimise operational procedures so as to achieve and maintain optimum energy utilisation throughout the Mine; and

- **Adherence to an energy use plan and conservation measures:** Typical measures that TMLSA may consider are:
  - Use of LED lighting;
  - Variable Frequency Drive controls;
- Reducing idling time on compressors;
- Eliminating leaks on compressed air systems; and
- Regular maintenance and servicing.

### 16.6 Evaluation of Mitigated Impacts

It is not practicable to accurately specify the energy saving potential (and hence GHG reductions) associated with the adoption of the mitigation measures described in Section 16.5 above. However establishing a robust GHG emissions measurement and reporting process aligned with international standards will allow TMLSA to understand the impact of the Mine year on year. These outputs can then be used as a basis for identifying further opportunities for the control and reduction of GHG emissions.

As stated in section 16.4.2 using Natural Gas as fuel for the primary power plant would result in an approximately reduction in GHGs of 22% compared to the other fuel options and therefore represents the most significant opportunity for GHG reduction. GHG emissions will reduce substantially towards the end of the Mine’s operational life and post closure will be a fraction of the operational footprint.

### 16.7 Summary

The successful outcome of Phase 2 of the Project will be a large increase in mining activities, which in turn will require a major increase in energy demand. It is the associated emissions from the burning of fossil fuels to supply this energy for both vehicles and infrastructure which will contribute most to carbon footprint of the Mine.

Table 16-9 below summarises the key impacts from increased Mine operations and provides an overview of mitigation measures to be adopted by TMLSA. As Mine operations expand with the implementation of Phase 2, sustained monitoring and periodic reporting of GHG emissions will continue.

Moving forward, TMLSA will develop its GHG reporting based upon actual as opposed to estimated data and, if appropriate, emissions from those operational activities provisionally excluded in the above calculations on the grounds of materiality. The Mine will also respond to the evolving GHG reporting requirements of the Carbon Disclosure Project as well those of Lenders. Suitable, economically justified opportunities for reducing emissions will be implemented as and when identified during the life of the Mine.

#### Table 16-9: Summary of Potential Residual Impacts 1 – Climate Change

<table>
<thead>
<tr>
<th>Location</th>
<th>Nature of Impacts</th>
<th>Mitigation Measure</th>
<th>Project Phase</th>
<th>Nature³</th>
<th>Duration³</th>
<th>Significance³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power plant</td>
<td>GHG emissions</td>
<td>Use of low carbon fuel/regular plant maintenance to ensure efficient operation</td>
<td>O</td>
<td>Adverse</td>
<td>Medium term</td>
<td>Moderate</td>
</tr>
<tr>
<td>Vehicles and Mobile Equipment</td>
<td>GHG emissions</td>
<td>Fuel efficient vehicles / minimise on-site travel / educate vehicle users</td>
<td>O</td>
<td>Adverse</td>
<td>Medium term</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

¹Following implementation of proposed Mitigation Measures

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

³Duration 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.
17 Analysis of Alternatives

In accordance with the Mauritanian requirements for the preparation of an EIA described in Section 2, as well as international best practice for impact assessments, this Section examines the various alternatives considered as part of the Project.

Alternatives examined include the zero “no development” option. In addition, Project alternatives and various alternatives for Phase 2 components were assessed based on a number of factors including technology, location, economics, environmental and social impact.

17.1 The Zero Option

The zero option has been discounted as it does not deliver substantial value improvement for stakeholders that is achieved through the proposed Project. The Project enables better efficiencies, lower unit costs, increased employment opportunities, infrastructure development and a greater contribution to the national economy and local communities as compared to the zero option.

The Project will allow the existing operations to expand and for the Mine to continue with an increased workforce for approximately 16 years. It will also substantially improve the efficiency and productivity of the Mine. 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.

17.2 Project Components - Phase 2

The Mine is currently in operation and so the existing overall approach to mining including processing of ore and management of sub-economic rock and tailings are considered to be the best options for the type of deposit and conditions at the Mine. Phase 2 forms part of the overall Project for which consideration of alternative mining, processing and waste management methods have been assessed with a view to possible improvements to the existing proven approach in order to determine the base case (preferred Project option), which is presented in Section 3 of this Report and is the basis of the Environmental Impact Assessment (EIA). The assessment also included a consideration of power supply options, mine fleet, ancillary facilities and transportation of construction and operations materials to the Mine site.

In examining alternatives and selecting the base case, factors considered include; existing operating and processing techniques, programme/timeframes, cost/economic efficiencies, environmental/social impacts, in-country resources/capacity and national/international guidelines and internationally accepted best practice.

Extensive consultation between Kinross/Tasiast Mauritanie Limited SA (TMLSA), the Project engineers and the independent consultants undertaking the EIA has been undertaken throughout the development of the Project to ensure that suitable alternatives for the Project’s development have been identified, assessed and selected.

17.2.1 Location

It is preferable from economic, environmental and social grounds to minimise the Project footprint. The location of the Phase 2 components have all therefore been located within the existing Mine site footprint, see Figure 3-3, and alternative locations outside the fence have
been discounted. This is therefore considered to be a ‘brownfield’ Project, with the location of the deposits and existing infrastructure already determined.

17.2.2 Mining

The current surface mining method will continue to be the most suitable approach for gold exploitation at the Mine. The already established mining method of truck, shovel and excavator will therefore continue to be used to Mine ore bearing and sub-economic rock from the open pit.

The internal mine scoping study for the Project assessed industry methods for open pit mining and precious metal recovery to determine the optimal approach for economic extraction of gold from the Tasiast deposit. The assessment confirmed that open pit mining using truck and shovel equipment was the optimal method for mining. The mining method has therefore been defined by extensive economical modelling, consideration of gold pricing, ore recovery efficiencies, and geotechnical/hydrogeological parameters. Taking those factors into account, mining using underground techniques has been discounted as this method is unsuitable, at this time, for this deposit and would not be economically viable.

17.2.3 Processing

Currently, Carbon-in-Leach (CIL) and dump leach processes are utilised to treat fresh and low grade oxide respectively at the Mine.

As part of the internal mine scoping study, metallurgical tests were undertaken to investigate the optimal processing techniques for the various ore material types (such as; fresh, low grade and unoxidised ore). Metallurgical work completed indicated that in order to optimise economic gold recovery from the Tasiast deposit the following processing techniques have been considered in the base case:

- The continued use of milling and CIL processing are optimal for fresh and high grade non-oxidised ore;
- The continued use dump leach processing is optimal for low grade ores; and
- The introduction of heap leach processing to the Mine is likely the optimal processing technique for the recovery of low grade non-oxidized ore.

Heap leaching, an alternate to the existing processing techniques is defined in Section 3. The introduction of this additional processing technique would enable additional gold recovery from ore that was not previously amenable to CIL and dump leaching.

Processing techniques such as BIOX treatment of ore (using of bacteria that promote oxidation reactions in an aqueous environment) and ore roasting (oxidation of sulphur and organic carbon at high temperatures using air and/or oxygen) are not necessary to treat the ore at the Mine, as standard cyanide leaching are possible. These alternate processes have therefore been discounted.

The results of the internal mine scoping study, metallurgical testing and the Mine’s adoption of the ICMC Cyanide Code’s requirements for the design of the process have formed the basis for the design and specification for the CIL process plant, dump leach and heap leach facilities.
17.2.4 Rock Dumps and Tailings

Mine waste falls into two categories; sub-economic material (waste rock) generated from surface mining the ore and tailings from the CIL process plant.

17.2.4.1 Sub-Economic Rock

Sub-economic material, which cannot be economically processed, is currently disposed of by depositing on waste rock dumps. As is current practice, sub-economic material generated by the Mine’s expanded operations will continue to be disposed of in this way.

Alternative locations for the proposed dumps within the Mine site have been considered as the existing dumps will not have sufficient capacity. Economically, the new dumps need to be in close proximity to the open pits to minimise haulage distances, which in turn reduces other potential related impacts, such as dust emissions. Environmentally, siting of the waste dumps has also been governed by information obtained during the baseline studies of this and previous EIA studies. To the extent reasonably feasible, waste dumps have been located to avoid impacting environmental and cultural resources on the Mine site.

17.2.4.2 Tailings

Tailings from the CIL process are currently disposed of via Tailings Storage Facility 2 (TSF 2). Due to the substantial expansion of operations and continued use of the existing CIL processing plant, it is necessary to develop additional TSF capacity to safely dispose of process waste.

Alternative TSF designs have been considered; these have however been discounted and the selected design aims to meet international industry best practice, including the requirements of the Cyanide Code (e.g. the introduction of a cyanide destruction process).

In addition, a number of alternative locations within the Mine site were considered for tailings storage; consideration has included topography, distance, locating within the perimeter fence and avoidance, where reasonably feasible, of areas of archaeological importance.

17.2.5 Power

Available power supplies within Mauritania are insufficient to meet the demands of the Project. There are currently no viable options involving the procurement of electricity from third party energy suppliers. Consequently, Tasiast Mauritanie Limited (TMLSA) is dependent upon developing its own power generation facilities.

To supply the immediate operational power requirements for the Project, it is proposed to construct a new power plant within Mine site that will produce the total electrical power needs for the expanded Mine operations. The existing and Phase 1 Heavy Fuel Oil (HFO) power plants are currently permitted for a total of approximately 50 MWe of power. Those power plants will cease to be used for operations and will be used as back-up power plants in emergency or repair situations, once the Phase 2 power plant is operational.

Based upon the power demand ranges currently envisioned for the project, two power plants have been selected for EIA analysis; a 120 MWe HFO reciprocating power plant and a multi-fuel 140-160 MWe gas turbine combined cycle power plant. Fuel specifications and air emissions limits have been based on IFC guidance related to power plant size and power generation equipment.
Alternative options to the above power plant and its location include:

- On-site power generation using various reciprocating engine configurations fuelled by HFO or LNG;
- On-site power generation using STGs fuelled by coal;
- On-site power generation using CCPP fuelled by LNG re-gasification;
- Development of a new off-site power in Nouâdhibou using STGs fuelled by coal;
- Development of new off-site power in Nouâdhibou using CCPP fuelled by HFO or LNG re-gasification; and
- Development of a new off-site power plant at Nouakchott fuelled by HFO or natural gas.

All off-site options necessitate the construction of electrical transmission and distribution infrastructure between the potential power plant location and the Mine.

The options involving LNG have been discounted due to uncertainty in short and long term LNG fuel prices. The options involving coal were discounted due to environmental concerns. Off-site power plant development has also been discounted because current estimates (at the time of developing this EIA) of the time frame to construct an off-site power plant and electrical transmission line may not meet the Project timeline requirements, due to uncertainties in potential off-site power plant and electrical transmission line locations and to reduce initial Project execution risk.

The preferred option of CCPP or reciprocating engine technology at the Mine site has been selected for development in order to meet Project construction and implementation timeframes. Air quality models have been developed and greenhouse gas emissions calculated for each of the technologies and fuel types, (see Section 7 and Section 16 respectively). The definitive combination of technologies and fuels will be finalised in the Project’s detailed design process.

Although the CCPP option has been selected for development in Phase 2, alternative optimisation options may be considered later in the Project’s evolution in order to further reduce emissions and increase economic efficiencies. If off-site power generation and power transmission becomes available in Mauritania and ample power load capacity is economically available, TMLSA will consider utilising this power for on-site activities.

### 17.2.6 Ancillary Facilities

The internal mine scoping study has outlined the scale of the expanded operations and, from this, the requirements for expanded ancillary facilities to support the operations have been developed. Ancillary facilities required are similar to those currently in operation at the Mine – however on a larger scale (e.g. expanded maintenance workshops, mineral laboratory, warehousing and accommodation camp).

Alternative locations for development of ancillary facilities outside of the existing Mine site perimeter fence were discounted to avoid any additional land requirement for the expanded Mine options.

Within the Mine site, alternatives have considered their development at various locations; however, wherever practicable, certain process/maintenance/storage facilities are being located adjacent to existing facilities to maximise efficiency of use and minimise additional impacts, whilst others like the accommodation camp are being located away from the main operational areas.
17.2.7 Transportation

The transportation of equipment and materials to the Mine site from ports of entry, Nouakchott and Nouâdhibou, considered the alternatives of rail and road.

17.2.7.1 Railway

This alternative considered the development of a rail alignment that would link the Mine to the existing Société Nationale Industrielle et Minière (SNIM) railway line which runs along the north of the country between Nouâdhibou and Zouérate.

Preliminary consideration indicated that the railway may be economically competitive compared to road transportation. However, timescales for construction and implementation of the railway did not meet the Project construction timeframes and therefore the railway alternative has been discounted for the Project construction schedule and initial operations.

The alternative to transporting equipment and material by railway for long term operations may be further reviewed later during the Project's operation.

17.2.7.2 Road

This alternative considers that all equipment and materials will be transported to the Mine site in trucks via the existing paved national highway, the N2 highway, connecting Nouakchott and Nouâdhibou. This option meets immediate schedules and flexibility for construction and initial operational needs, enables the continued use of the existing road system and allows greater flexibility for equipment and materials to be transported from multiple origins.

Current arrangements for the transport of reagents and other operational consumables via Nouakchott will be maintained; however, construction materials including new plant and machinery will be primarily imported via Nouâdhibou and delivered to the Mine from there. The latter was selected as the most practical and efficient means of reducing impacts on roads and local inhabitants arising from transporting larger quantities of materials and abnormal, large loads and the associated costs of any road infrastructure changes to accommodate those loads.
18 Environmental Management

18.1 Introduction

This Section presents the provisional outline Environmental Management Plan (EMP) for Phase 2 of the Project. It lists potential environmental and social impacts and proposed mitigation measures, and provides the framework for implementing and monitoring those measures.

The Mine’s original 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) and is complemented by the subsequent EMP developed for the West Branch Development EIA (Scott Wilson, 2010a). The EMP is being updated with the recommendations from the Phase 1b EIA (URS Scott Wilson, 2011c).

This EMP has been developed as a potential stand-alone section of the Environmental Impact Assessment (EIA) so that it can be developed and incorporated as appropriate into the TMLSA Environmental Management Systems.

Following Mauritanian Government approval, the EMP for Phase 2 of the Project will be integrated with the existing EMP and become subject to TMLSA policies, standards and procedures. This will be phased according to construction timescales and operational practices, and take into account any design modifications, local conditions and relevant overarching Kinross principles, policy framework and management standards.

With operations and projects in different countries, Kinross has developed and implemented a Company-wide management system, which is modelled on ISO 14001, OHSAS 18001 and other internationally accepted standards. This management system provides the foundation of policies and guidance to protect the environment and worker health and safety, and to drive continuous improvement for all Kinross operations through the definition of globally applicable targets and performance standards that Kinross operations worldwide are expected to meet.

The Kinross Corporate Responsibility Strategy also requires that TMLSA develops a site-specific approach to the management of its socio-economic impacts and stakeholder engagement. Accordingly, the Mine is developing a Site Responsibility Plan (SRP) which includes the following elements:

- Engagement: Ongoing dialogue with stakeholders, maintained in a spirit of transparency and honesty;
- Evaluation: Analysis of engagement feedback, community aspirations and resources, Project impacts, systematic analysis of socio-economic data and other information to inform TMLSA project designs and community development strategies;
- Action: Strategic initiatives based on the results of engaged evaluation of stakeholder interests and concerns, designed to consolidate sustainable benefits within the communities where TMLSA operate and generate project support;
- Monitoring: Regular, quantitative and qualitative measurement of the effectiveness of TMLSA corporate responsibility initiatives, to inform further engagement, evaluation and action.
This consistent approach across the Kinross Group requires TMLSA to fully implement the requirements of its companywide management system. This integration process is on-going and will involve assimilation of previous EMPs and environmental management system documentation prepared for the Mine. This EIA refers to the various Environmental and Social Management Plans anticipated by the Project’s Feasibility Study. These management plans are listed in 18.3.1 but may be subject to changes as they are integrated into the Tasiast site specific management system.

Performance against the EMP and the embedded mitigation as defined in Sections 6-17 shall be subject to routine internal auditing and regular reporting to the regulatory authorities and other stakeholders (see Section 20).

Table 18-1 presents a framework action plan for integration of the Phase 2 into the Environmental Management System/ Environmental Management Plan (EMS/EMP) Revision.

**Table 18-1: Action Plan for Integration of Phase 2 Environmental Management Plan into the EMS/EMP for the Mine**

<table>
<thead>
<tr>
<th>Item</th>
<th>Actions Required</th>
<th>Responsibility</th>
<th>Provisional timescale from Phase 2 EIA Approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Review existing EMP, integrate Kinross corporate policies and update with Phase 2 items</td>
<td>Environment / H&amp;S / Community Relations Department</td>
<td>3-6 months</td>
</tr>
<tr>
<td>2</td>
<td>Review EMS in view of updated EMP</td>
<td>Environment /H&amp;S / Community Relations Department</td>
<td>6-9 months</td>
</tr>
<tr>
<td>3</td>
<td>Review EMP/EMS Implementation budget &amp; resources</td>
<td>Environment /H&amp;S / Community Relations Department</td>
<td>6-9 months</td>
</tr>
<tr>
<td>4</td>
<td>Inform department heads of updated EMP highlighting key issues and agree implementation strategy and timescale</td>
<td>Environment Department</td>
<td>6-12 months</td>
</tr>
<tr>
<td>5</td>
<td>Training for HSE/environment technicians and other identified site staff as necessary</td>
<td>Environment / H&amp;S Department</td>
<td>6-12 months</td>
</tr>
<tr>
<td>6</td>
<td>Review of contractors’ HSE procedures and performance in view of updated EMP.</td>
<td>Environment / H&amp;S Department</td>
<td>6-12 months</td>
</tr>
<tr>
<td>7</td>
<td>Allocation of additional resources e.g. spill kits, storage bunds, waste management facilities</td>
<td>Environment Department</td>
<td>9-12 months</td>
</tr>
<tr>
<td>8</td>
<td>Expand current monitoring programme to include Phase 2 and instigate additional monitoring where specified in the EMP.</td>
<td>Environment Department</td>
<td>12-18 months</td>
</tr>
<tr>
<td>9</td>
<td>Inform site staff and local community of key aspects of Phase 2 development</td>
<td>Environment / Community Relations Department</td>
<td>12-18 months</td>
</tr>
</tbody>
</table>
18.2 Environmental and Social Management Programme

18.2.1 Overall Approach

TMLSA is committed to managing the impacts of its operations at the Mine, in conformance with Kinross policy and recognised international best practice (for example the IFC standards). In order to achieve this, TMLSA have implemented an environmental and social management programme (ESMP) for the Mine as detailed in Section 6 of the existing EMP and subsequent amendments, e.g. West Branch and Phase 1 Mine expansion. The Mine’s ESMP has been designed so that it can be reviewed and updated on a systematic basis in line with overarching corporate policies.

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 ESMP have been documented on a component basis in order to assist future audits and the evaluation of the existing EMP.

Figure 18-1 shows the principles of continual improvement which underpin the Mine’s environmental and social management programme.

![Figure 18-1: Environmental and social management process](image)

In order to assist with easy understanding of the Phase 2 components in the context of the EMP, Table 18-2 identifies the relevant sections of the existing EMP that correspond to the Phase 2 Project components. The table also identifies departmental responsibility for implementing key components of the EMP. Where required, TMLSA will impose environmental management and supervision on contractors used to construct and/or operate Project components of this phase.
### Table 18-2: Summary of Phase 2 Project Components in Relation to the Existing Tasiast EMP

<table>
<thead>
<tr>
<th>Phase 2 Project Component</th>
<th>Existing EMP Reference</th>
<th>Department Responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expanded open pit</td>
<td>Open Pits and Ore Transfer (OP)</td>
<td>Mining</td>
</tr>
<tr>
<td>Waste rock dumps</td>
<td>Waste Rock Dumps (WRD)</td>
<td>Mining</td>
</tr>
<tr>
<td>CIL process plant and mill</td>
<td>ROM Pad and Processing Facilities (PF)</td>
<td>Processing</td>
</tr>
<tr>
<td>Tailings storage facility (TSF 3)</td>
<td>Tailings (TSF)</td>
<td>Processing</td>
</tr>
<tr>
<td>Dump leach facility</td>
<td>ROM Pad and Processing Facilities (PF)</td>
<td>Processing</td>
</tr>
<tr>
<td>Heap leach facility</td>
<td>ROM Pad and Processing Facilities (PF)</td>
<td>Processing</td>
</tr>
<tr>
<td>Power plant</td>
<td>Energy (ENG)</td>
<td>Maintenance</td>
</tr>
<tr>
<td>Power distribution systems</td>
<td>Energy (ENG)</td>
<td>Maintenance</td>
</tr>
<tr>
<td>Raw water storage pond</td>
<td>ROM Pad and Processing Facilities (PF)</td>
<td>Processing</td>
</tr>
<tr>
<td>Office buildings</td>
<td>Environmental Management System (EMS)</td>
<td>Administration</td>
</tr>
<tr>
<td>Fuelling stations</td>
<td>Energy (ENG)</td>
<td>Maintenance</td>
</tr>
<tr>
<td>Workshops</td>
<td>Workshops (WS)</td>
<td>Maintenance</td>
</tr>
<tr>
<td>Storage</td>
<td>Materials Handling and Storage (MHS)</td>
<td>Logistics</td>
</tr>
<tr>
<td>Training &amp; development campus</td>
<td>Training (T)</td>
<td>Training Department</td>
</tr>
<tr>
<td>Drainage / Stormwater management system expansion</td>
<td>Water Supply (WA)</td>
<td>Maintenance</td>
</tr>
<tr>
<td>Accommodation camp</td>
<td>Environmental Management System (EMS)</td>
<td>Contractors (CIS)</td>
</tr>
<tr>
<td>Internal access roads</td>
<td>Transport Management (TM)</td>
<td>Logistics / Maintenance</td>
</tr>
<tr>
<td>Haul roads</td>
<td>Open Pits and Ore Transfer (OP)</td>
<td>Mining / Maintenance</td>
</tr>
<tr>
<td>Additional incinerator and waste storage areas</td>
<td>Waste Management (WM)</td>
<td>Maintenance</td>
</tr>
<tr>
<td>Stakeholder engagement</td>
<td>Social Programme (SP); Public Consultation and Development Plan (PCDP)</td>
<td>Community Relations</td>
</tr>
</tbody>
</table>

#### 18.2.2 Roles and Responsibilities

Operational responsibility at the Mine rests with the General Manager of TMLSA. 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 key support roles in EMP implementation. The roles and responsibilities of all departments in relation to the EMP for Phase 2 of the Project are shown in Table 18-2.
18.2.2.1 Tasiast Environment Department

The Mine has an Environment Department, with an Environmental Manager and a team of supporting specialist staff. The Mine’s Environmental Manager and supporting team will have direct responsibility for ensuring that environmental good 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;
- On-site accountability for the implementation of the integrated EMP (with relevant parts delegated to Contractors as appropriate);
- Site inspections and auditing of both Mine and contractor responsibilities;
- Environmental monitoring data management and reporting; and
- Support for reporting to the relevant authorities, Kinross Corporate and stakeholders.

18.2.2.2 Tasiast Community Relations Department

The Mine has a Community Relations Department based in the Nouakchott Office which comprises a Community Relations Specialist and a team of supporting specialist staff. The Community Relations Department collaborates 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. The team works closely with the Government Relations Department, also based in Nouakchott, which has responsibility for external communication with the various Ministries, authorities and agencies.

18.2.2.3 Tasiast Health and Safety Department

The Health and Safety (H&S) 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. The H&S Department comprises an H&S Manager and dedicated H&S staff.

18.2.2.4 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 contractors and contractor management. Where this is the case, contractors will assume responsibility for complying with the Mine’s environmental, health and safety requirements. Contractor performance will be monitored to ensure suitable 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 possible negative impacts on the environment by considering potential pollution risks, managing waste and resource consumption, and protecting the local environment.

Kinross will be responsible for issuing contract documents, which will include relevant clauses or conditions relating to environmental protection, as well as employment and health and safety, as per IFC Performance Standards 2 and 3. Principal contractors (national and international) 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, TMLSA shall impose the site rules or other environmental procedures as appropriate.

18.2.3 Commitment Registers

The foundation of the Environmental and Social Programmes is a ‘Commitment Register’ which details how the impacts of the Project will be mitigated, and who has responsibility for this mitigation in order to meet the Mine’s environmental and social management objectives. The Environmental Commitment Register is presented in Table 18-3 and is based on the impacts identified in Sections 6-16 (excluding section 11 – Social Commitments) along with the relevant mitigation requirements. Impacts have been grouped by technical subject area as follows:

• WA – Water (Section 6);  
• AQ – Air Quality (Section 7);  
• NV – Noise and Vibration (Section 8);  
• SL – Soils and Land Use (Section 9);  
• E – Ecology (Section 10);  
• AH – Archaeology and Cultural Heritage (Section 12);  
• LV – Landscape and Visual (Section 13);  
• T – Traffic (Section 14);  
• W – Waste (Section 15); and  
• CC – Climate Change (Section 16).

The Social Commitment Register is presented in Table 18-4 and is based on the impacts identified in Section 11.

18.2.4 Cyanide Code

TMLSA recognises the need to maintain and, where necessary, establish robust standards in the management of the increased quantities of process reagents needed to achieve the Mine’s expansion program’s production targets. To this end, TMLSA is developing a Cyanide Management Plan for the Mine’s expanded facilities and aims to achieve certification against
the International Cyanide Management Institute’s (ICMI) specification for cyanide management in gold mining operations.

The International Cyanide Management Code For The Manufacture, Transport and Use of Cyanide In The Production of Gold (also known as ICMC or the Code, and hereafter referred to as the Cyanide Code) is a voluntary industry program for the gold mining industry to promote responsible management of cyanide used in gold mining, enhance the protection of human health and reduce the potential for environmental impacts. Companies seeking accreditation must have their operations audited by an independent third party to demonstrate their compliance with the Cyanide Code. This auditing process for cyanide management will include, if required, the operations of contracted suppliers e.g. warehousing and transport services.

Achieving Cyanide Code certification requires an extended management program that includes incorporation of suitable and sufficient safeguards into the design of the process plant and associated infrastructure, plant commissioning tests, staff training, stakeholder communication and the development of robust procedures to prevent or respond to emergency situations.

The design of the new processing facilities (CIL process plant, heap and dump leach facilities) and associated process equipment was conducted with adherence to Cyanide Code requirements. Designs are being verified for Cyanide Code fitness-for-purpose accordingly.

Key safety features of the Cyanide Code include:

- Application of internationally recognised specifications for key installations such as tanks, pipe work, secondary containment, alarm systems and cyanide destruction units in slurry circuits;
- Certification of correct manufacture / installation / upkeep of key installations and equipment (chain of evidence for eventual Cyanide Code compliance);
- Staff training, personal protective equipment (PPE) and permit-to-work/lock-out-tag-out maintenance controls;
- Emergency response plans and equipment; and
- Routine cyanide audits and inspection/maintenance activities and analysis of water balance.
<table>
<thead>
<tr>
<th>Ref No.</th>
<th>Issue</th>
<th>Impact</th>
<th>Location</th>
<th>Phase</th>
<th>Nature of Impact</th>
<th>Duration</th>
<th>Significance</th>
<th>Management Objective</th>
<th>Mitigation / Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>WA1</td>
<td>Surface Water</td>
<td>Change in surface water runoff &amp; quality</td>
<td>Mine site</td>
<td>C O D</td>
<td>Adverse</td>
<td>Long term</td>
<td>Low</td>
<td>Safely convey storm water out of the Mine site and containment of any potentially contaminated water</td>
<td>• Project design • Storm water management • Monitoring • Emergency response</td>
</tr>
<tr>
<td>WA2</td>
<td>Groundwater</td>
<td>Change in groundwater quantity &amp; quality</td>
<td>Mine site</td>
<td>C O D</td>
<td>Adverse</td>
<td>Long term</td>
<td>Low</td>
<td>Avoid adverse impact on regional aquifers through mining activity</td>
<td>• Project design to contain liquids &amp; comply with ICMC. • Regular monitoring of groundwater levels &amp; water quality</td>
</tr>
<tr>
<td>AQ1</td>
<td>Air Quality</td>
<td>Dust generation from construction and mining activities</td>
<td>C O</td>
<td>Adverse</td>
<td>Short – Medium Term</td>
<td>Negligible</td>
<td></td>
<td>Reduce dust levels originating from facilities &amp; operations where practicable</td>
<td>• Best practicable means Control Techniques • Site Management Practices</td>
</tr>
<tr>
<td>Ref No.</td>
<td>Issue</td>
<td>Impact</td>
<td>Location</td>
<td>Phase</td>
<td>Nature of Impact</td>
<td>Duration</td>
<td>Significance</td>
<td>Management Objective</td>
<td>Mitigation / Monitoring</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
<td>------------------------------------------------------------------------</td>
<td>------------------</td>
<td>-------</td>
<td>------------------</td>
<td>----------------</td>
<td>------------------</td>
<td>----------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| AQ2     | Air Quality | Airborne emissions from power plant, waste management plant and traffic | Mine site        | C O   | Adverse          | Medium Term    | –Moderate / Low  | • Minimise particulate emissions  
• Efficient use of power supply                                                      | • Scheduling  
• Control Techniques  
• Site Management Practices                                                      |
| AQ3     | Air Quality | Cyanide emissions from CIL plant and dump leach facility               | Mine site        | O     | Adverse          | Medium Term    | Negligible       | Minimise cyanide emissions                                                            | • Control Techniques  
• Site Management Practices                                                                                             |
| NV1     | Noise & Vibration | Noise and Vibration from construction and operational activities e.g. use of heavy plant, blasting, fixed plant. | Mine site & off-site roads | C O D | Adverse          | Short – Medium Term | Low / Negligible | • Minimise excessive noise and vibration levels  
• Where possible avoid excessive noise and vibration near office and accommodation areas at peak use times  
• Hearing protection                                                        | • Best Practicable Means, e.g. compliance with national/international noise standards shut down of plant when not in use, use of noise attenuating materials & acoustic shielding where appropriate  
• Refuelling protocols  
• Use of correct storage facilities for potentially hazardous materials/chemicals  
• Emergency                                                                                                                  |
| SL1     | Soils & Land Use | Soil disturbance, erosion & contamination                              | Mine site        | C O D | Adverse          | Short – Medium Term | Low / Negligible | • Limit soil disturbance & erosion;  
• Reduce risk of soil contamination                                                  | • Refuelling protocols  
• Use of correct storage facilities for potentially hazardous materials/chemicals  
• Emergency                                                                  |
<table>
<thead>
<tr>
<th>Ref No.</th>
<th>Issue</th>
<th>Impact</th>
<th>Location</th>
<th>Phase</th>
<th>Nature of Impact</th>
<th>Duration</th>
<th>Significance</th>
<th>Management Objective</th>
<th>Mitigation / Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>SL2</td>
<td>Soils &amp; Land Use</td>
<td>Restoration of soil &amp; land</td>
<td>Mine site</td>
<td>D</td>
<td>Neutral</td>
<td>Long term</td>
<td>Low / Negligible</td>
<td>Implement Mine Rehabilitation and Closure Plan</td>
<td>Response Plan &lt;br&gt; • Manage disturbance &lt;br&gt; • Close / secure borrow pits as soon as practicable &lt;br&gt; • Use designated roads &amp; tracks within Mine site &lt;br&gt; • Dust management &lt;br&gt; • Passive re-vegetation</td>
</tr>
<tr>
<td>E1</td>
<td>Ecology</td>
<td>Clearance of vegetation (including protected tree species) &amp; loss of habitat</td>
<td>Mine site</td>
<td>C O</td>
<td>Adverse</td>
<td>Medium term</td>
<td>Low</td>
<td>Minimise the loss of habitat &amp; vegetation &lt;br&gt; Mitigation for loss of protected trees</td>
<td>Implementation of mitigation program to be agreed with appropriate ministries</td>
</tr>
<tr>
<td>E2</td>
<td>Ecology</td>
<td>Disturbance &amp; displacement of wildlife</td>
<td>Mine site</td>
<td>C O D</td>
<td>Adverse</td>
<td>Short / Medium term</td>
<td>Low</td>
<td>Minimise disturbance to wildlife</td>
<td>Vehicle movements in accordance with Mine guidelines (e.g. controls on off-roading) &amp; speed limits.</td>
</tr>
<tr>
<td>E3</td>
<td>Ecology</td>
<td>Wildlife (bird) mortality as a result of cyanide poisoning from mining process water bodies.</td>
<td>Mine site</td>
<td>O</td>
<td>Adverse</td>
<td>Short / Medium term</td>
<td>Low</td>
<td>Reduce the risk of wildlife coming into contact with Mine water bodies</td>
<td>Treatment of tailings to ICMC standards &lt;br&gt; Wildlife monitoring at</td>
</tr>
<tr>
<td>Ref No.</td>
<td>Issue</td>
<td>Impact</td>
<td>Location</td>
<td>Phase</td>
<td>Nature of Impact</td>
<td>Duration</td>
<td>Significance</td>
<td>Management Objective</td>
<td>Mitigation / Monitoring</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------------</td>
<td>--------------------------------</td>
<td>----------------</td>
<td>-------</td>
<td>------------------</td>
<td>----------</td>
<td>--------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E4</td>
<td>Ecology</td>
<td>Invasive / alien species</td>
<td>Mine site</td>
<td>COD</td>
<td>Adverse</td>
<td>Medium</td>
<td>Low</td>
<td>Minimise presence of invasive / alien species</td>
<td>• Survey for presence &amp; remove as appropriate ● No non-native plant stock to be brought onto site.</td>
</tr>
<tr>
<td>AH1</td>
<td>Archaeology &amp; Cultural Heritage</td>
<td>Construction and operation activities impacting on Neolithic dune-top settlement sites, Protohistoric &amp; Muslim tombs.</td>
<td>Mine site</td>
<td>COD</td>
<td>Adverse</td>
<td>Long</td>
<td>High</td>
<td>Avoid impacts to known archaeological sites</td>
<td>• Avoid by design where reasonably feasible ● Protect sites by long term fencing ● Investigate sites by research-led scientific excavation ● Implement Chance Finds Procedures ● Implement Cultural Resource Management Plan &amp; monitoring</td>
</tr>
<tr>
<td>Ref No.</td>
<td>Issue</td>
<td>Impact</td>
<td>Location</td>
<td>Phase</td>
<td>Nature of Impact</td>
<td>Duration</td>
<td>Significance</td>
<td>Management Objective</td>
<td>Mitigation / Monitoring</td>
</tr>
<tr>
<td>---------</td>
<td>-------</td>
<td>--------</td>
<td>----------</td>
<td>-------</td>
<td>------------------</td>
<td>---------------</td>
<td>--------------</td>
<td>----------------------</td>
<td>--------------------------</td>
</tr>
</tbody>
</table>
| AH2     | Archaeology & Cultural Heritage | Loss of archaeological remains, e.g. by:  
  - Looting/degradation of surface scatters & tombs caused by persons on Mine site  
  - Damage to sites caused by vehicle tracking | Mine site | COD | Adverse | Long term | Low / Negligible | Avoid of known archaeological sites |  
  - Staff information campaign & environmental staff training  
  - Vulnerable sites either to be fenced or to be excavated prior to or, if appropriate, alongside Mine development  
  - Implement Chance Finds Procedures.  
  - Implement Cultural Heritage Management Plan & monitoring  
  - Controlled routes (one track policy), signage |
| LV1     | Landscape & Visual | Change in landscape through addition of new Mine site infrastructure | Mine site | COD | Adverse | Medium / Long term | Moderate - Low | Not applicable |  
  - Use of screening, such as a low berm around the open pit, to minimise sight of low height facility  
  - Removal of Facilities |
<table>
<thead>
<tr>
<th>Ref No.</th>
<th>Issue</th>
<th>Impact</th>
<th>Location</th>
<th>Phase</th>
<th>Nature of Impact</th>
<th>Duration</th>
<th>Significance</th>
<th>Management Objective</th>
<th>Mitigation / Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>LV2</td>
<td>Landscape &amp; Visual</td>
<td>Visual impact of additional Mine site infrastructure on local population</td>
<td>Mine site</td>
<td>C O D</td>
<td>Adverse</td>
<td>Medium / Long term</td>
<td>Low</td>
<td>Not applicable</td>
<td>• Removal of Facilities at Closure, where possible and passive re-vegetation</td>
</tr>
</tbody>
</table>
| T1     | Traffic | Increased traffic, traffic delays and increased risk of traffic accidents | Mine site, N2 Highway, Nouâdhibou Port and Nouakchott Port              | C O   | Adverse          | Short – Medium Term | Low - Moderate | Optimise traffic levels | • Enforcement of driver safety training  
• Ensure that all Mine roads are clearly sign posted and speed limits are enforced.  
• Accident reporting procedure and analysis to assist preventative measures on Mine site  
• Monitoring and evaluation of complaints from local community |
<p>| W1     | Waste  | Construction / Demolition waste including hazardous                    | All construction / Demolition                                            | C D   | Adverse          | Short term     | Low           | Minimise waste generation &amp; manage waste as per Waste | • Minimise waste generation as far as |</p>
<table>
<thead>
<tr>
<th>Ref No.</th>
<th>Issue</th>
<th>Impact</th>
<th>Location</th>
<th>Phase</th>
<th>Nature of Impact</th>
<th>Duration</th>
<th>Significance</th>
<th>Management Objective</th>
<th>Mitigation / Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>W2</td>
<td>Waste</td>
<td>Domestic &amp; kitchen waste from accommodation camp; and Office waste from operator facilities, including hazardous and non-</td>
<td>Accommodation camp; Office Buildings</td>
<td>O</td>
<td>Adverse</td>
<td>Low - Moderate</td>
<td>Minimise waste generation &amp; manage waste as per Waste Management Plan</td>
<td>Practical. • Ensure waste is collected &amp; sorted at source &amp; sent to waste compound for management (unless deemed appropriate to leave in situ e.g. demolition rubble) • Combustible material to be incinerated • Non-combustible / inert material placed in landfill (Recycle materials where possible) • Hazardous waste stored pending identification of suitable disposal route</td>
<td></td>
</tr>
<tr>
<td>Ref No.</td>
<td>Issue</td>
<td>Impact</td>
<td>Location</td>
<td>Phase</td>
<td>Nature of Impact</td>
<td>Duration</td>
<td>Significance</td>
<td>Management Objective</td>
<td>Mitigation / Monitoring</td>
</tr>
<tr>
<td>--------</td>
<td>------------</td>
<td>-------------------------</td>
<td>---------------------------</td>
<td>-------</td>
<td>------------------</td>
<td>----------</td>
<td>--------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>W3</td>
<td>Waste</td>
<td>hazardous wastes</td>
<td>CIL Process Plant</td>
<td>O</td>
<td>Adverse</td>
<td>Medium</td>
<td>Moderate</td>
<td>Minimise waste generation &amp; manage waste as per Waste Management Plan</td>
<td>• Hazardous wastes to be stored or treated as appropriate in waste management facility</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Reagent containers (except sodium cyanide) to be rinsed if appropriate or necessary, and then compacted prior to on-site landfilling</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Sodium cyanide containers to be washed then burnt (Plastic liners will be rinsed and buried in landfill, boxes burnt)</td>
</tr>
<tr>
<td>W4</td>
<td>Waste</td>
<td>Healthcare and Mineral wastes</td>
<td>Medical Clinic and Mineral Laboratory</td>
<td>O</td>
<td>Adverse</td>
<td>Medium</td>
<td>Low - Moderate</td>
<td>Minimise waste generation &amp; manage waste as per Waste Management Plan</td>
<td>• Hazardous wastes to be stored or treated as appropriate in waste management facility</td>
</tr>
<tr>
<td>W5</td>
<td>Waste</td>
<td>Hydrocarbon waste including used</td>
<td>Mine site</td>
<td>C O D</td>
<td>Adverse</td>
<td>Medium</td>
<td>Moderate</td>
<td>Minimise waste generation &amp; manage waste as per Waste Management Plan</td>
<td>• Waste oils, fuels, oily</td>
</tr>
<tr>
<td>Ref No.</td>
<td>Issue</td>
<td>Impact</td>
<td>Location</td>
<td>Phase</td>
<td>Nature of Impact</td>
<td>Duration</td>
<td>Significance</td>
<td>Management Objective</td>
<td>Mitigation / Monitoring</td>
</tr>
<tr>
<td>--------</td>
<td>------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>----------</td>
<td>-------</td>
<td>------------------</td>
<td>----------</td>
<td>--------------</td>
<td>---------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>CC1</td>
<td>Climate Change</td>
<td>Increased GHG Emissions from power plant &amp; vehicle fuel</td>
<td>Mine site</td>
<td>O</td>
<td>Adverse</td>
<td>Medium</td>
<td>Moderate</td>
<td>Minimise GHG emissions as far as practicable</td>
<td>Use of low carbon fuel as far as reasonably and economically practical</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>term</td>
<td></td>
<td>Calculate &amp; publish annual carbon footprint data</td>
<td>Regular plant</td>
</tr>
</tbody>
</table>

- Lubricant oil, transformer oil & waste oil from oil / water separators
- Sludges and solvents to be stored in the hazardous liquids facility operated by contractor and removed for appropriate disposal.
- Other hazardous wastes (e.g. batteries, electronics) to be stored in waste management facility awaiting suitable disposal route.
- Non-hazardous combustible wastes (e.g. oily rags) to be incinerated on-site.
- Scrap tires to be disposed on-site.
<table>
<thead>
<tr>
<th>Ref No.</th>
<th>Issue</th>
<th>Impact</th>
<th>Location</th>
<th>Phase</th>
<th>Nature of Impact</th>
<th>Duration</th>
<th>Significance</th>
<th>Management Objective</th>
<th>Mitigation / Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>accordance with World Resources Institute GHG Protocol</td>
<td>maintenance</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Use of fuel efficient vehicles / minimise on-site travel and educate drivers;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Monitor &amp; report operational parameters (data)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Provision of energy balance &amp; energy efficiency reviews;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Adherence to Energy Use Plan &amp; Conservation Measures</td>
</tr>
</tbody>
</table>


## Table 18-4: Social Commitments Register

<table>
<thead>
<tr>
<th>Ref No.</th>
<th>Aspect</th>
<th>Impact</th>
<th>Location</th>
<th>Phase</th>
<th>Nature of Impact</th>
<th>Duration</th>
<th>Significance</th>
<th>Management Objective</th>
<th>Mitigation / Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE1</td>
<td>Socio-Economics</td>
<td>Generation of Government revenues through payment of Mine royalties and taxes</td>
<td>Nationally</td>
<td>C O</td>
<td>Beneficial</td>
<td>Long Term</td>
<td>High</td>
<td>Maintain transparency on payments to Government</td>
<td>• No additional mitigation required</td>
</tr>
<tr>
<td>SE2</td>
<td>Socio-Economics</td>
<td>Job creation</td>
<td>Nationally</td>
<td>C O</td>
<td>Beneficial</td>
<td>Medium / Long Term</td>
<td>High</td>
<td>Community development &amp; provision of transferrable skills to Tasiast employees</td>
<td>• No additional mitigation required</td>
</tr>
<tr>
<td>SE3</td>
<td>Socio-Economics</td>
<td>Improvement of the national skills base for the mining sector</td>
<td>Nationally</td>
<td>C O</td>
<td>Beneficial</td>
<td>Long Term</td>
<td>Moderate / High</td>
<td>Provision of high quality practical training and maintain training campus graduates</td>
<td>• No additional mitigation required</td>
</tr>
<tr>
<td>SE4</td>
<td>Socio-Economics</td>
<td>Generation of business opportunities and consumer demand for Mauritanian enterprises</td>
<td>Nationally</td>
<td>C O</td>
<td>Moderately Beneficial / Beneficial</td>
<td>Medium / Long Term</td>
<td>Moderate / High</td>
<td>Maximise the use of Mauritania services where possible</td>
<td>• No additional mitigation required</td>
</tr>
<tr>
<td>SE5</td>
<td>Socio-Economics</td>
<td>Provision of service support</td>
<td>Locally</td>
<td>C O</td>
<td>Beneficial</td>
<td>Medium Term</td>
<td>High</td>
<td>Manage community expectations</td>
<td>• No additional mitigation required</td>
</tr>
<tr>
<td>SE1</td>
<td>Socio-Economics</td>
<td>Improvements in workforce wellbeing / worker satisfaction with terms and</td>
<td>Locally</td>
<td>C O</td>
<td>Beneficial</td>
<td>Short/ Medium term</td>
<td>High</td>
<td>Ensure fair treatment of contractors’ workforce</td>
<td>• Monitoring contractors’ and subcontractors’</td>
</tr>
</tbody>
</table>

Phase 2 Environmental Impact Assessment

March 2012

322
<table>
<thead>
<tr>
<th>Ref No.</th>
<th>Aspect</th>
<th>Impact</th>
<th>Location</th>
<th>Phase</th>
<th>Nature of Impact</th>
<th>Duration</th>
<th>Significance</th>
<th>Management Objective</th>
<th>Mitigation / Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>compliance with national labour laws and TMLSA HR / OHS policies, standards and procedures (including capacity building for contractors if needed).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Ensuring adequate resources to undertake labour compliance monitoring (e.g. HR staff or consultants, undertake periodic audits).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Preparation of a formal Retrenchment Plan for managing any lay-offs caused by ‘unforeseen circumstances’. This Plan should take account of the IFC’s</td>
</tr>
<tr>
<td>Ref No.</td>
<td>Aspect</td>
<td>Impact</td>
<td>Location</td>
<td>Phase</td>
<td>Nature of Impact</td>
<td>Duration</td>
<td>Significance</td>
<td>Management Objective</td>
<td>Mitigation / Monitoring</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------</td>
<td>------------------------------------------------------------------------</td>
<td>----------</td>
<td>-------</td>
<td>------------------</td>
<td>---------------</td>
<td>-------------</td>
<td>---------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>SE2</td>
<td>Socio-Economics</td>
<td>Potential for inward migration in the vicinity of the mine, and along the access road and N2 highway</td>
<td>Locally</td>
<td>C O</td>
<td>Adverse</td>
<td>Short / Medium term</td>
<td>Low</td>
<td>Manage community expectations to avoid influx of people</td>
<td>• Strict enforcement of existing mitigation - all Project workers accommodated within perimeter fence, no direct recruitment at Mine, etc.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Working with government on rural development strategies</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Engagement with local communities to ensure that water supplies and other services are sustainable and appropriate for human needs</td>
</tr>
</tbody>
</table>

Good Practice Note on Managing Retrenchment and be completed prior to the operational stage.
<table>
<thead>
<tr>
<th>Ref No.</th>
<th>Aspect</th>
<th>Impact</th>
<th>Location</th>
<th>Phase</th>
<th>Nature of Impact</th>
<th>Duration</th>
<th>Significance</th>
<th>Management Objective</th>
<th>Mitigation / Monitoring</th>
</tr>
</thead>
</table>
|        | Socio-Economics    | Increased traffic on access road and N2 highway and potential increase in accidents involving communities and/or livestock | Locally  | C O   | Adverse          | Short / Medium to Long term | Moderate / Low | Minimise disruption to existing users of N2 highway | • Notification of convoy movements, improved road signage and driver training  
• Transparent community complaints / grievance procedures  
• Community awareness training /sensitisation with regards to increased potential for accidents along the Nouakchott – Nouâdhibou N2 national highway and along the access road |
<table>
<thead>
<tr>
<th>Ref No.</th>
<th>Aspect</th>
<th>Impact</th>
<th>Location</th>
<th>Phase</th>
<th>Nature of Impact</th>
<th>Duration</th>
<th>Significance</th>
<th>Management Objective</th>
<th>Mitigation / Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE4</td>
<td>Socio-Economics</td>
<td>Loss of services support at Mine closure</td>
<td>Locally</td>
<td>D</td>
<td>Slight Adverse</td>
<td>Medium to Long term</td>
<td>Low / moderate</td>
<td>Manage community expectations</td>
<td>• Working with the government and the local communities to develop specific plans to phase in sustainable management of support services</td>
</tr>
<tr>
<td>SE5</td>
<td>Socio-Economics</td>
<td>Loss of employment at Mine closure</td>
<td>Locally</td>
<td>D</td>
<td>Adverse</td>
<td>Short / medium term</td>
<td>Low</td>
<td>Community development &amp; provision of transferrable skills to Tasiast employees</td>
<td>• Retrenchment / Rehabilitation and Closure Plan</td>
</tr>
</tbody>
</table>
18.3 Monitoring Programme

A monitoring programme has been developed for the Mine and this will be extended to include Phase 2 of the Project. The Environment Department will be responsible for overseeing and auditing environmental monitoring, with certain duties, devolved to the appropriate TMLSA department (e.g. traffic monitoring devolved to H&S / Security). The Community Relations Department is in charge of social programme monitoring.

The current environmental and social monitoring programme for the Mine is outlined in Table 18-5, although some aspects are in the process of revision and modification. 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, if necessary, on an annual basis.

Monitoring requirements are also summarised in Appendix 8, together with a summary of proposed mitigation measures, on a Project component basis.
### Table 18-5: Outline environmental and social monitoring programme incorporating existing mining operations and proposed Phase 2 developments

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Monitoring Locations</th>
<th>Parameters</th>
<th>Initial Proposed Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artificial Surface Water Discharges</td>
<td>Water treatment plant; sewage treatment plant</td>
<td>• Performance against Stormwater Management Plan and Water Use, Discharge and Conservation Management Plan.</td>
<td>Quarterly</td>
</tr>
<tr>
<td></td>
<td>All artificial surface water bodies associated with Mine operation (including raw water ponds, process ponds at dump leach facility/heap leach facility, active TSF &amp; stormwater diversion channel)</td>
<td>• Sewage effluent quality to be monitored in accordance with IFC effluent guidelines.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Storm water flows in diversion channel during / following significant rainfall events</td>
<td>• Annual water balance for Mine to be calculated</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Water quality samples to be taken in accordance with groundwater monitoring programme to monitor mining process impacts against IFC Guidelines (including major ions, metals, hydrocarbons and cyanide)</td>
<td></td>
</tr>
<tr>
<td>Groundwater Levels</td>
<td>Environmental Monitoring boreholes within the Mine site &amp; observation wells at the water supply borefield (Sondage)</td>
<td>• Annual water balance for Mine to be calculated</td>
<td>• Annually</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Salt load balance to be calculated</td>
<td>• Routinely as required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Visual checks for potential contamination (confirm by testing if necessary) and correct functioning of berms. storm drains, oil separators, etc</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Open Pit</td>
<td>Groundwater levels</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Groundwater Quality</td>
<td>Water quality of the water supply borefield (sondage) including expansion area</td>
<td>Major ions, metals, hydrocarbons</td>
<td>Quarterly</td>
</tr>
<tr>
<td></td>
<td>Mine site monitoring boreholes</td>
<td>Heavy metals (e.g. as per IFC EHS Guidelines for Surface Water in Mining), cyanide (including WAD), hydrocarbons and major cation/anion content</td>
<td>Quarterly</td>
</tr>
<tr>
<td></td>
<td>Open Pit</td>
<td>Heavy metals (e.g. as per IFC EHS Guidelines for Surface Water in Mining), cyanide (including WAD), hydrocarbons and major cation/anion content</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Aspect</td>
<td>Monitoring Locations</td>
<td>Parameters</td>
<td>Initial Proposed Frequency</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>-----------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>Acid Rock Drainage</td>
<td>Sub-economic rock, Ore Stockpiles, Tailings</td>
<td>Acid Base Analysis of sub-economic rock, stockpiles and tailings</td>
<td>As required - Determined by mining programme</td>
</tr>
<tr>
<td>Potable water supply</td>
<td>RO plant</td>
<td>WHO guidelines</td>
<td>Routine according to requirements of individual parameters</td>
</tr>
</tbody>
</table>
| Total Cyanide Concentrations          | Processing Plant, TSFs, TSF/leach facility pipelines, leach facility and solution ponds | • CN solution in process liquid – through measuring flows and concentrations throughout the process in accordance with Kinross Tasiast Design Standards / Cyanide Code requirements.  
• Hydrogen Cyanide (HCN) gas – personal detectors at leach facilities / CIL plant alarm systems as part of TMLSA Occupational Health and Safety monitoring. Against 5ppm action threshold and 10ppm evacuation threshold used. | Daily / Routine                                          |
| Air Quality                           | Representative locations around Mine site including accommodation camp, office complex, power plant. Incinerator at Waste Management Facility | • NO₂, NOx, SOx, Ozone & Acid Gases; emissions performance; fuel consumption including quality.  
• Performance against Air Emission Management Plan | Passive monitoring for NO₂, NOx, SO₂ and Acid Gases over a monthly period throughout operation using diffusion tubes; Routine monitoring of performance against Air Emission management Plan. |
|                                       | Power plant                                               | • Measurements at source to a recognised standard method, to demonstrate achievement of Emissions Limits set out in IFC Guidelines for NOx, SO₂, PM₁₀ and CO  
• Recording of fuel quality and fuel consumption to demonstrate consistency with IFC Guidelines | Combination of continuous monitoring for NOx and CO or a substitute parameter and regular (every 3 years) extractive sampling of NOx, SOx, PM₁₀ and CO to a recognised standard method to confirm performance against IFC emission Limits. |
<p>|                                       | Incinerators at Waste Management Facility                | Measurements at source to a recognised standard method, to demonstrate achievement of Emissions Limits for pollutants as set out in EU Waste Incineration Directive | Measurement at time of plant commissioning and regular monitoring thereafter of performance against Air Emission |</p>
<table>
<thead>
<tr>
<th>Aspect</th>
<th>Monitoring Locations</th>
<th>Parameters</th>
<th>Initial Proposed Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dust</td>
<td>TSFs, leach facility, Crusher, Open Pit, Haul roads and waste rock dumps</td>
<td>Visual assessment of dust concentrations</td>
<td>Daily / Routine</td>
</tr>
<tr>
<td>Noise &amp; Vibration</td>
<td>Current and proposed accommodation camps and offices</td>
<td>'Free field' noise measurements using all-weather protected microphones if/where appropriate. Performance against Construction Management Plan</td>
<td>Routine operation</td>
</tr>
<tr>
<td>Soils &amp; Land Use</td>
<td>Mine site</td>
<td>• Baseline physio-chemical parameters including heavy metals.</td>
<td>As needed e.g. if soil contamination suspected in sensitive area of Mine site</td>
</tr>
</tbody>
</table>
| Ecology                        | Artificial water bodies (Active TSFs / leach facilities)                              | • Record bird and animal incident or fatality at active TSF/ dump leach facility / heap leach facility  
• Record other relevant sightings involving birds and mammals  
• Performance against Flora, Fauna and Biodiversity Plan | Daily / Routine                                                                          |
| Archaeology & Cultural Heritage| All areas within Mine site & Borefield                                               | • Chance Finds, change in condition of known sites (e.g. any incidents resulting in loss or damage).  
• Use of procedures in Cultural Resources Management Plan | Route site inspections of known sites & periodic audits.                             |
| Traffic                        | N2 highway, Access Road and                                                            | • Traffic category & volume monitored at gatehouse  
• Complaints monitored by Community Relations Department | Routine                                                                                 |

Primary Crusher

Measurements at source for PM$_{10}$ to a recognised standard method, to confirm performance to design criteria is achieved

Measurement at time of plant commissioning and regular monitoring thereafter of performance against Air Emission management Plan

CIL plant, dump leach facility and heap leach facility

• Measurements of concentrations in non-confined workplaces in-line with requirements of ICMC

Regular monitoring of performance against Air Emission management Plan
<table>
<thead>
<tr>
<th>Aspect</th>
<th>Monitoring Locations</th>
<th>Parameters</th>
<th>Initial Proposed Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste Management</td>
<td>Mine site</td>
<td>• Volumes &amp; types of wastes entering landfill</td>
<td>Quarterly reporting of waste operations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• incinerator feedstock &amp; performance</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• odour &amp; litter checks</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Performance against Waste Management Plan</td>
<td></td>
</tr>
<tr>
<td>Climate</td>
<td>Weather Station at Mine site</td>
<td>• Rainfall, Wind Speed and Direction, humidity, Temperature, Evaporation</td>
<td>Daily / Routine monitoring via automated weather station</td>
</tr>
<tr>
<td>Climate Change</td>
<td>Power Station &amp; Fuel Farm</td>
<td>Fuel consumption including GHG fuel quality</td>
<td>Quarterly, with annual data being used to calculate carbon footprint.</td>
</tr>
<tr>
<td>Environmental and Social Management Programme</td>
<td>Tasiast Gold Mine</td>
<td>Audit of the Environmental Management Programme</td>
<td>Internally (6 months); Independently (Annually)</td>
</tr>
<tr>
<td>Socio-Economic (community perceptions, accommodation camps, employee terms &amp; conditions, occupational H&amp;S)</td>
<td>Local Community</td>
<td>• Public Consultation &amp; Grievance Mechanisms; Performance against Public Consultation and Disclosure Plan</td>
<td>Routine</td>
</tr>
<tr>
<td></td>
<td>Mine site</td>
<td>• Site Responsibility Plan, OHS Management Plan</td>
<td>Supervision by HR, H&amp;S and Community Relations team as appropriate; periodic site inspections and audits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Tasiast standards for camp accommodation; fair conditions of contract, worker consultations, disciplinary actions and grievance procedure; Provision of suitable resources including health and safety specialists, risk assessments and controls (Lock-Out, Tag-Out and Hot Works methods, PPE, training and information).</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Accidents/incidents and injuries.</td>
<td></td>
</tr>
</tbody>
</table>
18.3.1 Environmental and Social Management Plans

The environmental and social management programme will be supported by a set of tailored environmental and social management plans for specific aspects of the Project, that provide procedures, guidelines and protocols for the day to day activities during construction, operation and closure of the Mine.

Development of these plans will be an evolving process in collaboration with Kinross corporate policies and integration of the EMS and existing working practices. Where there is no equivalent in the Mine’s existing EMS, new documentation shall be prepared during the construction stage and then adapted for the operational phase.

It is anticipated that specific plans developed for the Project will include the following as identified during the FS, and are subject to alteration or modification during integration into Mine management systems:

- Air Emission Management Plan;
- 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; and
- Occupational and Safety Management Plan;
- Retrenchment Plan

As the above management plans are being developed, areas of common management may be combined into one plan. An example may be a Water Management Plan which would include the Stormwater Management Plan and the Water Use, Discharge and Conservation Management Plan.
### 18.3.2 Auditing and Reporting

Audits will be undertaken at regular intervals throughout the Project life in accordance with Kinross guidelines, and also in response to any major 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 Environment Department during construction works. Remediation of minor non-conformances e.g. small oil/chemical spills will be monitored as part of routine site inspections.

The audit process may identify further instances of actual or potential 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 department or 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 personnel as appropriate. Contractors will be required to submit regular progress reports to the Environmental Manager or their appointed designate, detailing their environmental performance.

An Annual Declaration will be produced by the Environment Department as part of the existing statutory reporting programme on environmental performance to the Ministry of Environment.

### 18.4 Emergency Response Planning

Under Mauritanian legislation and in keeping with good international practice, the EMP is required to consider emergency response planning. Emergency Response Planning covers all aspects of potential emergency situations, and is based on-site specific guidelines within the Emergency Preparedness Plan and the Spill Prevention and Response Plan. Key environmental risks that have been identified for Phase 2 will be incorporated into the Emergency Plans being developed as part of TMLSA’s management systems, and are as follows:

- **Fire risk associated with the fuelling stations, power plant, incinerator, and waste storage areas** e.g. following any leakage of fuel, lubricant oil or transformer cooling oil or ignition of vapour accumulated in tanks during maintenance or other source of ignition of flammable materials;
- **Spillage of solid cyanide or cyanide solution may occur at the new processing plant or at the dump and heap leach facilities during transfer, handling or storage (both at site and in transit along public highways and Mine access road);**
- **Accidental mixing, heating of cyanide in solution may occur at the new processing plant causing release of hydrogen cyanide gas;**
- **Accidental spills of fuels or other harmful chemical products are a particular risk at the fuelling stations, CIL process plant, TSF 3, heap leach, dump leach, and storage facilities including hazardous waste storage areas. Harmful products may be in gas, liquid or solid form with resulting in releases of harmful substances to the environment;**
Accidental explosion of Ammonium Nitrate/Fuel Oil during explosives preparation for blasting of the expanded open pit;

Pit failure, caused by unstable geotechnical conditions.

Specific emergency response procedures will be reviewed and developed by TMLSA to address material risks identified in connection with the Project. These procedures will be incorporated into the existing Emergency Preparedness / Spill Prevention and Response Plan 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;

**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);

**Incident management/coordination:** including descriptions of actions to be taken in the event of emergencies, clear lines of responsibility for actions, list of all relevant contact numbers for appropriate authorities, and identifying the location of any abatement equipment held on-site. Actions include 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, as required to be notified by the regulatory authorities.
19 Preliminary Rehabilitation and Closure

This Section outlines the objectives and strategy for rehabilitation and closure of the Phase 2 Project components, including the preliminary closure costs for these components.

The existing operations at the Mine are supported by a preliminary Rehabilitation and Closure Plan (RCP) (Scott Wilson, 2008d) as well as further commitments made in the Environmental Impact Assessment (EIA) for the West Branch Development (Scott Wilson, 2010a) and the Phase 1b EIA for the Project (URS Scott Wilson, 2011c). As part of the Project, an inclusive preliminary RCP (URS Scott Wilson, 2011i) has been developed for the rehabilitation and closure of Mine facilities associated with existing operations and Phases 1 and 2 of the Project.

19.1 Background

The preparation of a preliminary RCP prior to commencement of the Project activities is a key part of the EIA process and the Mine’s overall operations plan. By identifying the components that require decommissioning and the actions necessary to accomplish the successful closure of the Mine early in the planning stage, a clear definition of the closure process is determined.

The preliminary RCP also represents a base document that will be modified and updated as the cessation of operations approaches and detailed closure requirements are finalised in line with Mauritania regulation (notably Article 14 of Decree 2004-054). It identifies provisional end land uses for the Mine, together with estimated costs to achieve these objectives.

The Mauritanian Government (as outlined in Article 14, Decree No. 2004-054) requires a financial guarantee that will cover the costs to rehabilitate and close the Mine should Tasiast Mauritanie Limited SA (TMLSA) cease operations before the end of the planned Mine life. An indication of the costs of the proposed operational decommissioning for Phase 2 of the Project is therefore outlined in Section 19.6. This will form the basis for the establishment of a long term total financial guarantee (reclamation bond).

TMLSA will provide appropriate incremental financial assurance for the proposed activities and associated reclamation and closure liabilities.

19.2 General Rehabilitation and Closure Objectives

19.2.1 General

Mauritanian legislation (notably Article 14, Decree No. 2004-054) requires the inclusion of a preliminary RCP with an EIA in order to ensure the environmentally and physically stable and safe closure of the Mine. The closure of each Phase 2 component has been designed to accord with previous closure commitments in the preliminary RCP (Scott Wilson, 2008d), West Branch EIA (Scott Wilson, 2010a) and) and the EIA for the Phase 1b (URS Scott Wilson, 2011c).

Two years prior to the estimated end of the Project and Mine operations, TMLSA will need to prepare a detailed RCP.

Closure activities will be undertaken to enable the Mine to obtain the necessary closure certificate (environmental acquittal) from the Mauritanian Government. Closure of each component of the Mine has been designed with consideration of the strategies outlined in Section 19.4. In line with Article 14, such discharge must be obtained as a necessary and sufficient condition in order to obtain cancellation of the financial guarantee.
19.2.2 Worker and Public Health and Safety

TMLSA will undertake a risk assessment to identify potentially high-risk situations, which may occur on or off the Mine site during rehabilitation and once rehabilitation has been completed. This process will include an update of the emergency plan, including safety measures, which will detail the measures to be applied in the event of accident.

Closure works will be designed to ensure that safety of workers and minimise any risks to public safety associated with the Mine.

19.2.3 Physical Stability

Any structures that remain after 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 preliminary RCP that any structures that may be 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, drainage will be designed to remain operational. All contours across the restored/reclaimed areas will be designed to minimise erosion and promote structural and geochemical stability.

19.2.4 Chemical Stability

The consequences of potential chemical instability and leaching of chemicals into the environment from mining and processing activities with regard to applicable surface and groundwater resources should not endanger public health or safety.

If necessary, the detailed RCP will identify the need for any specialist studies, which take into account baseline conditions, may be necessary to inform the design of measures to ensure the protection of applicable water resources during and after closure.

19.2.5 Land Use

In the closed condition, the rehabilitated Mine site will be broadly compatible with the surrounding land uses, to the extent that is both practical and economical.

The acceptability of the detailed RCP will involve a review of the naturally occurring physical hazards/conditions, level of environmental impact or benefit, and expected post-operational use of the mining affected area and its compatibility with the surrounding land.

19.2.6 Self-Sustaining Ecosystem

The establishment of a self-sustaining ecosystem on mining impacted land is heavily dependent on-site conditions. In general, the aim of the rehabilitation process is to re-establish the land so that an ecosystem which is similar to that which existed before mining related disturbance can re-establish over time.

The pre-mining conditions at the Mine site are characterised by an arid, low productivity landscape with sparse and limited vegetation. The potential to salvage any significant material suitable for reuse during land clearance is limited, if any. Where practical, suitable materials will be collected and stockpiled for eventual re-use.
19.2.7 Reclamation Maintenance

It is anticipated that rehabilitated areas will need to be maintained for a few years after closure. Maintenance typically includes repairs to any damage that results from extreme weather conditions and routine upkeep of structures or facilities until management control can be transferred to the post mining land use or until a self-sustaining system is achieved.

19.2.8 Social Sustainability

The Mine should leave a positive legacy on surrounding communities, workers, businesses and any other stakeholders associated with the operations. Adverse effects on human life as a result of the Mine closure should be minimised in terms of service provision (such as medical clinic), and general environmental health and any safety hazards associated with the Mine (see Section 19.4.1).

19.3 Rehabilitation and Closure Strategy

19.3.1 General Strategy

The proposed overall strategy for the rehabilitation and closure of the Mine is outlined below:

- Decontaminate, dismantle and demolish, as far as practicable, all Mine installations, structures and infrastructure not identified for retention and hand over to another entity;
- Safe disposal of all contaminated materials removed during decontamination, dismantling and demolition activities;
- Salvage for sale and/or allocation to other operations, all equipment, mechanical and electrical plant, identified in the asset register as having a residual value or useful life;
- Removal from the Mine site as scrap (if economically viable) or dispose as solid waste of all equipment, plant and structures not deemed suitable for future refurbishment and/or re-use;
- Apply closure design options which are effective, practical and cost effective;
- Ensure the Mine site is left in a safe condition;
- Implement procedures which address the balance between affordability and long-term liabilities and responsibilities;
- Where practical, undertake phased closure of the facilities making allowance in the implementation timeframe for retention of facilities required to support the closure process and subsequent post closure monitoring activities;
- Through passive re-vegetation, restore the landscape to degree state compatible with surrounding land uses, or make suitable for an alternative use;
- Address any potential residual environmental impacts, where appropriate, resulting from the Mine activities;
- Minimise residual impacts requiring on-going monitoring post closure of the facility; and
- Leave a positive legacy on surrounding communities (as noted in 19.2.8).

It is recognised that there may be opportunities post closure to hand over facilities to other entities; these opportunities may be considered in the detailed RCP but, due to the lack of certainty, are not considered in the preliminary RCP.
The following Project components have been identified as requiring specific closure management measures in addition to those listed above:

19.3.2 Open Pit

The following closure management measures will be implemented to ensure the stability of the open pit post closure:

- Removal of all fixed plant, infrastructure and facilities from the pit;
- Blocking of pit access roads;
- Post operations, pit walls will be left in generally stable and acceptable conditions and will not require stabilization during closure;
- An approximate three metre high waste rock berm with appropriate storm water drainage will be constructed around the open pit during the operating phase to prevent public, livestock and animal access;
- Placement of warning signs on waste rock berm; and
- Water rebound/quality monitoring to enable assessment of hydro-geochemical response compared to background water quality.

19.3.3 Internal Mine and Haul Roads

The following closure measures will be implemented for road areas:

- Minimal re-grading of roads, including removal of any safety berms, to blend in with local topography.

19.3.4 Cyanide Facilities

All works relating to the decommissioning of facilities associated with cyanide storage and use will be carried out under strict control measures, in line with ICMC requirements, which will be included in the Mine’s Corporate Responsibility Management System and applicable Kinross Standards (e.g. 7.02: Life of Mine Reclamation Plan) and emergency response plans.

All liquids/sludge associated with, or produced as a result of the decommissioning works of cyanide storage and circuit installations will be disposed of in the Tailings Storage Facility (TSF) 3.

19.3.5 Carbon-in-Leach (CIL) Process Plant

The following closure measures will be implemented for buildings and their foundations:

- Decontamination / demolition / dismantling of facilities;
- Appropriate assessment of any potentially contaminated substrate and implementation, if necessary, of contaminated land remediation;
- Break up all foundation structures and coverage with approximately 0.5 m of fill;
- Breaking/ripping of any hard-standing areas and compacted ground; and
- Minor re-grading of areas to establish suitable topography.
19.3.6 Dump and Heap Leach Facilities

The following closure management measures will be implemented for the dump and heap leach pads:

- Decontamination and removal of all fixed plant and other support infrastructure from the leach facility (water management plant will be retained until rinsing is complete);
- Rinsing with coastal water to reduce cyanide level to acceptable limits (cost estimate based upon four pore volumes);
- Confirmatory analysis of dump rinse leachate;
- Minimal re-grading, where necessary, to establish safe, stable slopes; and
- Decommissioning of ponds by cutting and in-folding to pond floor HDPE liners and backfilling with clean borrow material to blend in with the local topography. Sediments to be tested prior to encapsulation within liner.

19.3.7 Waste Rock Dumps and Stockpiles

The design and operation of the waste rock dumps should ensure that minimal activities are required at closure. It is assumed that all ore stockpiles will be removed prior to Mine closure; however should any remain, the same general waste rock dump closure principals will apply.

The following aspects will be incorporated into the design of the waste rock dumps:

- Design of rock placement to minimise over-steepening of slopes;
- Potentially acid generating sub-economic rock is effectively managed, though Acid Rock Drainage (ARD) analysis to date does not indicate material concerns;
- Limited re-grading, where necessary, to establish safe slopes and controlled runoff with storm water flows routed, where possible, into pits or to existing surface water course; and
- Bare areas previously occupied by stockpiles will be ripped and, if necessary re-graded to establish an acceptable local topography.

19.3.8 Tailings Storage Facility

Detailed design of the TSF 3 will include an element of planning for closure and final design of closure specific aspects will be undertaken towards the end of the Mines operational life, or the operational life of each TSF cell. TSF closure management measures may include:

- Design of TSF outer slopes and final cap gradient, to ensure that they are resistant to erosion and natural runoff of storm water is acceptable;
- Minimal regarding of outer ring dyke slopes;
- All delivery and return pipes, and pumps and associated infrastructure (including power supplies) will be removed;
- Final TSF drain down will be managed via passive evaporation with an evaporation pond constructed at time of site closure;
- All water in the TSF will be managed in accordance with the Fluid Management Plan;
• The TSF surface will be capped with at least 0.6 m of sub-economic rock fill. Tipped material will be pushed out into the spaces between the access roads and finally graded to achieve the necessary design profile;
• TSF 3 will be utilised throughout operations and until final closure; and
• Potentially acid generating tailings are effectively managed, though ARD analysis to date does not indicate material concerns.

19.3.9 Ancillary Facilities
The closure of accommodation units, offices, warehouses, workshops, yards and other open areas will be managed as follows:
• Dismantling and demolition of ancillary facilities, such as offices and warehouses, and permanent brick structures;
• Breaking/ripping of any hard-standing areas and compacted ground; and
• Re-grading of areas to establish suitable local topography.

19.3.10 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 landfill areas with at least 1 m of earth/rock; and
• Minor re-grading of the area to blend with local topography.

19.4 Environmental Management, Monitoring and Maintenance
Appropriate management and monitoring activities will be carried out both during and after closure 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 focus on those activities associated with the monitoring of closed pit lake and groundwater and primary activities associated with residual fluid management. Additionally, routine inspections on the continued reclamation success will continue during the post closure period.

Water rebound and quality will also be monitored in the open pits.

TMLSA 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 three years post closure followed by five 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.

19.5 Rehabilitation and Closure Costs

An estimate has been provided of the costs associated with the decommissioning and rehabilitation of Phase 2 Project components. Rehabilitation and closure costs for previous EIAs have not been included in Table 19-1, as these costs have been accounted for in the previous EIAs and financial assurance is already in place.

The closure costs presented in Table 19-1 are based on the closure and rehabilitation of Phase 2 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 concurrent reclamation will be evaluated throughout the mine life and implemented where reasonably feasible; as the costs of progressive and the overall closure costs will be adjusted as necessary to reflect such actions.

These costs are indicative only and will be refined in more detail in the detailed RCP, submitted two years prior to Mine closure. The total estimated cost of decommissioning and rehabilitating Phase 2 Project components is in the order of US$ 64,038,017 as summarised in Table 19-1. As noted, TMLSA will provide appropriate incremental financial assurance for proposed activities and associated reclamation and closure liabilities.

**Table 19-1: Rehabilitation and Closure Costs for Phase 2 Project Components**

<table>
<thead>
<tr>
<th>Component</th>
<th>Area (ha)</th>
<th>Total Cost (US$)</th>
<th>Closure Strategy Summary</th>
</tr>
</thead>
</table>
| Expanded Open Pit    | 1,349.00  | N/A              | • Open pits to be retained  
• Safety berm to be retained/placed around perimeter with appropriate storm water drainage |
| CIL Process Plant    | 14.21     | 6,815,211        | • Structures will be dismantled and demolished or removed for re-use or sale  
• Foundation will be broken up and buried to a depth of at least 500 mm, if necessary, the area regraded |
| Dump Leach Facility  | 133.00    | 2,226,554        | • The leach facilities will be a permanent feature  
• Rinse with water to reduce residual cyanide concentrations  
• Draindown collected and used in CIL or by passive evaporation in ponds  
• Minimal profiling where needed to establish safe slopes.  
• Upon final closure, pond will be reclaimed. Any sediments will be removed for disposal and pond liners will be cut and folded into pond floor. Areas filled to blend with adjacent topography for positive drainage.  
• Routing of all run-off to existing perimeter areas. |
| Heap Leach Facility  | 535.75    | 12,015,674       | • The leach facilities will be a permanent feature  
• Rinse with water to reduce residual cyanide |

As noted, TMLSA will provide appropriate incremental financial assurance for proposed activities and associated reclamation and closure liabilities.
<table>
<thead>
<tr>
<th>Component</th>
<th>Area (ha)</th>
<th>Total Cost (US$)</th>
<th>Closure Strategy Summary</th>
</tr>
</thead>
</table>
| Waste Rock Dumps                  | 3,552.00  | 408,480         | - Waste rock dumps will be permanent features  
- Waste rock dumps to be constructed to allow for natural rehabilitation  
- Routing of all run-off to existing perimeter areas. |
| TSF 3                             | 1,271.00  | 26,929,174      | - The TSF will be a permanent feature and will be capped with approximately 0.6 m of average fill  
- Drainage managed by passive evaporation  
- Design of the TSF outer slope angles and final cap gradient, to ensure that they are less susceptible or more resistant to erosion  
- Upon final closure, pond will be reclaimed. Any sediments will be removed for disposal and pond liners will be cut and folded into pond floor. Areas filled to blend with adjacent topography for positive drainage. |
| Power Plant and Distribution System | 2.54    | 3,330,862       | - This facility will be dismantled and demolished or removed for re-use or sale  
- Foundation will be broken up and covered to a depth of at least 500 mm, if necessary, areas re-graded |
| Offices, Workshops and Fuelling Stations | 26.54  | 1,935,299       | - Structures will be dismantled and demolished or removed for re-use or sale  
- Foundation will be broken up and buried to a depth of at least 500 mm, if necessary, the area |
| Accommodation Camp                | 14.25    | 316,388         | - Structures will be dismantled and demolished or removed for re-use or sale  
- Foundation will be broken up and buried to a depth of at least 500 mm, if necessary, the area re-graded |
| Internal Roads                    | 69.50    | 79,925          | - Road will be ripped and, if necessary, re-graded to local topography |
| Waste Management facility         | 27.00    | 31,050          | - Compaction followed by capping with 500 mm depth rock fill cover |
| Raw Water Storage Pond            | 4.00     | 4,600           | - Pond will be used for initial TSF draindown |
| Concentrations                    |          |                 | - Draindown collected and recycled to CIL or by passive evaporation in ponds  
- Minimal profiling where needed to establish safe slopes.  
- Upon final closure, pond will be reclaimed. Any sediments will be removed for disposal and pond liners will be cut and folded into pond floor. Areas filled to blend with adjacent topography for positive drainage. Routing of all run-off to existing perimeter areas. |
### Component: RO Plant

- **Area (ha):** 1.00
- **Total Cost (US$):** 22,300

**Closure Strategy Summary:**
- This facility will be dismantled and removed for reuse or sale.
- Foundation will be broken to a depth of 500 mm why different and, if necessary, areas regraded.

### Component: Management and Monitoring

- **Area (ha):** N/A
- **Total Cost (US$):** 9,922,500

### Total

- **Component:**
  - RO Plant
  - Management and Monitoring

- **Area (ha):** 6,999.79
- **Total Cost (US$):** 64,038,017
20 Stakeholder Engagement

This Section outlines the national and international requirements for stakeholder engagement and presents the consultation process for the Project and the Environmental Impact Assessment (EIA), in particular for Phase 2.

In addition, this Section outlines the social initiatives which Tasiast Mauritanie Limited SA (TMLSA) have implemented and propose to implement in order to ensure the socio-economic benefits of the Project reach local communities.

20.1 Consultation Requirements

In order to attain full compliance with the laws and requirements of Mauritania it is important to obtain broad community support for the Project.

Consultation is a formal Mauritanian and international requirement for EIAs. The national requirements for public consultation is summarised below. Relevant international guidance is also outlined.

20.1.1 National Legislative Requirements

The Environment Code, Law No. 2000-045, outlines the requirement for EIAs with the specific requirements for consultation stipulated in Decree No. 2004-094 and Decree No. 2007-105.

Mauritanian legislation requires that public consultation and participation be undertaken during the EIA in cooperation with the relevant Ministries, administrative region(s) and commune(s). Consultation is required during the following EIA stages:

- Terms of Reference (ToR): During this initial scoping phase, the promoter must inform the relevant Ministries, Hakem, mayor and the local residents within the Project affected area of the proposed Project and provide an outline of the consultation and approval process for the Project's EIA.

  Following submission of the ToR report, a meeting is held between the relevant Ministries and the promoter to discuss the proposed Project and scope of the EIA. Following Ministry approval of the ToR, public consultation is undertaken for 14 days and includes:

  o One or more public meetings to present the Project to Ministries, local authorities, Non-Governmental Organisations (NGOs), the local community and other relevant organisations; and

  o The opening of a formal register by the territorially competent Hakem to which local communities have access and in which are recorded public evaluations, comments and suggestions formulated in relation to the Project.

  Comments raised during the ToR public consultation are to be included and addressed as appropriate in the EIA.

- EIA: Following the submission of the final EIA report and the accompanying Non-Technical Summary (NTS) to the relevant Ministries, a formal public inquiry process is normally initiated for large scale Projects. The public inquiry is coordinated by the Department of Environmental Control (DEC) of the Delegated Ministry of Environment and Sustainable Development (MESD), and includes the placement of the NTS of the EIA into the public domain for review and comment for a period of 30 days. The comments raised during the
20.1.2 International Legislative Framework

Public consultation on EIA is a formal requirement of the International Finance Corporation (IFC) Performance Standards. IFC Performance Standard 1 - Social and Environmental Assessment and Management System, has the objective of gaining broad community support for the Project through a process of “free” (free of intimidation or coercion), “prior” (timely disclosure of information) and “informed” (relevant, understandable and accessible information) consultation. It also outlines the need for on-going community engagement in order to ensure the transparent disclosure of information to relevant stakeholders and allow for a positive and constructive relationship to evolve over time.

IFC Performance Standard 1 requires that consultation with affected communities and local stakeholders be undertaken in a three part process involving:

- **Disclosure**: Timely disclosure of relevant Project information on the purpose, nature and scale of the Project by the proponent to affected stakeholders;
- **Consultation**: The process of prior consultation must occur if stakeholders are potentially subject to adverse risks or impacts resulting from the proposed Project. Stakeholders must have the opportunity to express their views on the risks, impacts and mitigation measures associated with the Project; and
- **Grievance Mechanism**: There must be a Grievance Mechanism that allows the proponent to deal with and respond to communities’ concerns relating to the Project.

Following EIA approval, the proponent is to disclose periodic performance reports to affected communities, describing progress implementing the Project and the associated mitigation action plans, including clarification of any changes in impacts or mitigation strategies.

20.2 Project Consultation Process

TMLSA recognises the importance and requirement for consultation throughout the Project EIA process and thereafter for the life of the Mine’s operation. To ensure consultation meets national, international and corporate requirements, TMLSA has defined a Public Consultation and Disclosure Plan (PCDP) for both existing operations and the Project, including the EIA process.

TMLSA’s Community Relations Team has overall responsibility for all public stakeholder consultation and disclosure activities.

20.2.1 Public Consultation and Disclosure Plan (PCDP)

The PCDP is a TMLSA document which is intended to facilitate a transparent and effective process for the involvement of affected communities and other stakeholders in the identification and management of environmental and social impacts of the Mine. It sets out the company’s approach for implementing and adopting a comprehensive range of engagement and consultation techniques to suit individual stakeholders’ concerns and ensure respect for any cultural sensitivity considerations.

The implementation of the PCDP is achieved in accordance with the relevant standards from the Corporate Responsibility Management System and customised local procedures, which
Outline how to undertake and record both on-going consultation for the Mine and the specific consultation process for the Phase 2 EIA. The TMLSA PCDP procedures include:

- **Disclosure**: The community-centred approach to disclosure incorporates various techniques such as the dissemination of information and documents, either directly in hard copy or through the TMLSA website, face-to-face meetings, wider public meetings, and workshops. These disclosure mechanisms are undertaken to ensure that appropriate information relating to the Mine’s operations, the Project development and its associated risks and impacts are provided to all stakeholders, particularly the most vulnerable and disadvantaged, as a means of ensuring that their comments can be incorporated into the Project's development and the Mine’s mitigation strategies.

- **TMLSA-led Stakeholder Consultation**: Implementing and adopting both planned/formal and unplanned/informal meetings with local stakeholder groups and individuals, in order to provide them with updates on the Project and elicit feedback from participants. The community outreach strategy for informal consultation includes face to face interviews or ad hoc ‘focus groups’ is aimed at developing trust and facilitating a transparent communication and information exchange with stakeholders.

- **Government-led Stakeholder Consultation**: Formal public consultation and public enquiry meetings regarding the Project are organised by the relevant Ministries in accordance with Mauritanian laws and customs. Appropriate assistance with for these formal events is provided by TMLSA; for example, to ensure stakeholders are aware of public meetings and are able to attend them (assistance can include provision of transport, invitation letters and other reasonable logistical support). The purpose of the formal stakeholder consultation is to determine stakeholder’s interest in the Mine and identify any issues which may be of importance or value to local communities so that they can be taken into account. A standard approach for such meetings is outlined in Table 20-1.

**Table 20-1: Formal Stakeholder Consultation Meetings**

<table>
<thead>
<tr>
<th>Formal Stakeholder Consultations Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notification / advance warning of meetings in advance in a suitable manner</td>
</tr>
<tr>
<td>Distribution of relevant information about the Project in advance, e.g. the through ‘awareness-raising’ or sensitisation campaigns, making the NTS of EIA report(s) available in the local language(s)</td>
</tr>
<tr>
<td>Ensuring that the stakeholders being consulted are truly representative (i.e. adequate representation of women, vulnerable groups and ethnic minorities) or holding separate meetings for various groups if considered necessary</td>
</tr>
<tr>
<td>Presenting stakeholders with clear information at public meetings regarding the Mine and any potential impacts on the environment and livelihoods</td>
</tr>
<tr>
<td>Conducting meetings with a break to allow for a period of reflection and/or to accommodate refreshments or prayers</td>
</tr>
<tr>
<td>Avoiding ‘consultation fatigue’ (this can occur where public / formal consultation is found to be intimidating or is not adapted to local sensitivities)</td>
</tr>
<tr>
<td>Accounting for any gender sensitivity issues</td>
</tr>
<tr>
<td>Facilitating the recording of stakeholder remarks and suggestions on the EIA findings (i.e. via the formal ‘register’ or otherwise)</td>
</tr>
</tbody>
</table>
- **Ensuring accurate records (minutes) of proceedings’ decisions and actions**

- **Grievance Mechanism:** The Grievance Mechanism provides a transparent, responsive and efficient system for TMLSA to receive, respond to and seek resolution of stakeholder concerns in a systematic manner. The Grievance Mechanism seeks to build trust and a positive rapport between TMLSA and its stakeholders. The grievance mechanism is outlined in Figure 20-1.

- TMLSA has produced a grievance book composed of forms that are used to record the details of any complaints (in French and/or in Arabic). Each original form has two copies; the complainant retains the original form, Community Relations retains the second copy as a working copy, and the third remains in the book as a formal record. Grievance books will be distributed to the appropriate local authorities and community coordination committees and will also be made available in TMLSA’s three field offices, the Mine site and the Nouakchott office. All grievances are registered in a logbook which is maintained by the Community Relations Specialist. When a complainant is unable to write his/her complaint, the TMLSA Community Relations Officer receiving the verbal grievance has the responsibility of recording the nature of the compliant and all pertinent details.

**Figure 20-1: Grievance Mechanism Procedure**

- Complainant submits grievance
- Form 6.2: Grievance Form
  - Step 1: Confirm receipt of grievance in writing to complainant
  - Form 6.3: Receipt Letters
  - Resolve Grievance: timely, effectively with stakeholders
  - Second TMLSA management, government, authorities resolve grievances with stakeholders
  - Step 2: Investigate grievances and seeking of resolution
  - Step 3: Invite third party TMLSA staff (and external parties) to report
  - Form 6.4: Resolution or Accord
  - Step 4: Close out grievance
  - Step 5: Undertake timely follow-up with complainant to ensure satisfactory grievance redress
- Legal process resolves grievance
- Step 7: If no resolution can be agreed, complainant of aggrieved party may take legal action
20.2.2 Project EIA Consultation

20.2.2.1 Phase 1 Consultation

In addition to the public meeting consultation for Phase 1b at El Asma on May 18, 2011 (see the P1b EIA report, URS Scott Wilson 2011c), a follow-up meeting was held at the Parc du Nord on July 24, 2011 for stakeholders of the Nouamghar Moughataa and the Dakhlet-Nouâdhibou Wilaya. This meeting was attended by 47 various representatives and citizens but was held too late in the EIA reporting process for the stakeholders’ comments and observations recorded in the official Register to be included in the P1b report. Accordingly, copies of each page in the Register are reproduced in Appendix 9 and the stakeholders’ observations are included in the analysis of Table 20-2.

20.2.2.2 Ongoing Stakeholder Consultation

TMLSA has created a Community Relations service within the External Relations Department, which is based in Nouakchott. It has recruited a Community Relations Specialist, four Community Relations Officers (CROs) and one field assistant to ensure the prior and informed consultation needed to achieve broad community support from its stakeholders.

Consultation is regarded by TMLSA to be an on-going process and a long-term commitment which requires the company to keep the community informed of its activities, and to seek to address the valid concerns of local stakeholders in a responsible manner.

Since the community relations division was created, the CROs have carried out visits in both the Inchiri and Dakhlet-Nouâdhibou Wilayas in order to reach out and establish contacts with elected authorities, key stakeholders, notables, civil society organisations and, in particular, women’s groups. An open line of communication has been established with the various local authorities and other key groups to keep them informed of CRO field visits, open community meetings and discussions with community leaders.

In localities around the Mine, Community Coordination Committees have been established to facilitate Project-Community relations. TMLSA is considering the extension of this initiative into other communities within the Project’s area of influence.

Between July and October 2011, approximately 130 stakeholder consultation exercises (involving approximately 300 to 400 people) were undertaken in the form of community meetings, visits to the CR team in the Nouakchott office, plus telephone calls and letters.

TMLSA also plans to open recruiting and information centres in Nouâdhibou, Akjoujt and Bennichab. With the installation of these offices, TMLSA will be able to keep the local residents informed of its activities, deadlines and responsibilities. These offices will provide information on Project-specific activities such as construction progress, job openings and the recruitment process, environmental mitigation measures and community investment programs.

20.2.2.3 Phase 2 Scoping Meetings

The process of public consultation for Phase 2 began with a scoping meeting held on 27 October 2011 to present the ToR to the relevant Ministries, including the Delegated Ministry of the Environment (MESD), the Ministry of Petroleum Energy and Mines (MPEM) and the Ministry of Water and Sanitation (MWS) to obtain their comments to be addressed as necessary in the EIA report.

---

23 Public consultation of Phase 2 and Phase 3 of the Project is being undertaken concurrently.
Prior to the public events, a meeting with the Hakem and Wali of Akjoujt and representatives of various local services and civil society local was held in Akjoujt on November 2, 2011. The purpose of this meeting was to recap the public meeting process and raise awareness about the Project and the specific components of Phase 2. During this meeting, the TMLSA team presented the Hakem with its programme to conduct a series of focus groups in several localities in the Wilaya.

The aim of these focus groups was to share information with stakeholders on the components of the Project and provide them with an initial opportunity to offer comments, express concerns and/or ask for further information. The focus group sessions also inform the social impact assessment element of the EIA (see Section 11).

A similar meeting was held in Nouâdhibou on November 16, 2011 with the mayor of Nouâdhibou to present a similar programme for the organisation of information dissemination focus groups from that Wilaya.

20.2.2.4 Stakeholder Focus Group Meetings

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 2 and to formally invite them to the public meeting.

TMLSA Community Relations Officers (CROs) worked with a local consultant from the Inchiri Wilaya to identify suitable stakeholders to participate in the focus groups and provide immediate feedback on the proposed Project. These comprised community leaders, women’s groups, elderly and other vulnerable community members and mixed groups. In addition to the small focus groups, a larger meeting was convened in Akjoujt with 46 community members, including civil society representatives, to present the Mine’s Project.

Between November 13 and 26, 2011, the TMLSA CROs conducted focus groups in the Inchiri Wilaya at El Asma, Bergeimat, Lebeidhatt, Lemdena, PK 20, PK 60, PK 120, Lewjad, Akjoujt, and Bennichab, as well as in two small settlements close to the Mine site (Dawass and Imkebeden); further focus groups were undertaken during the same period in the Dakhlet-Nouâdhibou Wilaya at Nouâdhibou, Boulanouar (including Wadi Chibka) and Nouamghar (for Iwik and Teichitt).

Immediate feedback from these events showed stakeholders had concerns in relation to the following topics, which are ranked according to the number of focus groups the subject was raised:

- Employment (all 13 focus groups);
- Income generating activities (11 / 13 focus groups);
- Water (10 / 13 focus groups);
- Health (8 / 13 focus groups);
- Environment / ecology / sanitation (7 / 13 focus groups);
- Transportation (7 / 13 focus groups);
- Education and training (6 / 13 focus groups); and
- Agriculture / animal husbandry / fishing (4 / 13 focus groups).
Other topics raised included the need for direct consultation without intermediaries, respect for cultural heritage, community / civil society role in monitoring and the working of the proposed Community Coordination Committees (e.g. provide with identity badges to facilitate access to the Mine; need to ensure balance between rival, divergent groups; participation in selection / monitoring of contracted services for the community (e.g. water and transport); and compensation for expenses incurred in attending meetings).

The needs and concerns raised during these focus groups are also included in Table 20-2 below, which also includes the observations from the public meetings.

### 20.2.2.5 Public Meetings (Terms of Reference Consultation)

**Public consultation meetings** were convened with local administrative officers of both the Inchiri and Dakhlet-Nouâdhıbou Wilayas at Bennichab on November 29, Nouâdhıbou on December 1 and Gare du Nord on December 4, 2011. 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.

The public meetings were well attended with up to 65-75 stakeholders at Bennichab, approximately 30-35 at Nouâdhıbou and up to 60-70 at the Gare du Nord. Note that some people attended more than one of these meetings. There was no formal record of all who attended as there was some fluctuation in the numbers attending throughout the events and some people may have just been curious passers-by. Members of the press were also present along with representatives from TMLSA. Other participants included:

- Representatives from the Ministry of Environment and Sustainable Development and Ministry of Petroleum, Energy and Mines;
- Regional and Local Officials: the Hakems the Moughataa of Akjoujt and of Dakhlet-Nouâdhıbou; District Heads (the Bennichab, Nouamghar, Boulanour,…) and the Commander of the Bennichab Brigade and Police Force;
- Elected officials: The Mayors of Bennichab, El Asma, Inal, Nouamghar; 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 the Commune of Bennichab, the Moughataa of Akjoujt, the Wilaya of Inchiri, the Wilaya of Dakhlet-Nouâdhıbou, the Commune of Mamghar and the Commune of Boulanour, university graduates and job seekers.

### 20.3 Comments Raised During Consultation

Appendix 9 reproduces the pages of the official Registers used to record stakeholder observations at each of the public meetings. In addition, a number of stakeholders were selected from the attendees to address the meetings. There were 25 speakers at the Bennichab event, with 22 at Nouâdhıbou and 30 at the Gare du Nord, including 7, 4 and 2 women speakers respectively.

All stakeholder speeches and expressed concerns made during the meeting were recorded. Table 20-2 outlines the key themes and issues reflected in the comments raised in both the focus groups of the sensitisation process and in the public meetings. The table also directs readers to the where these issues are addressed in this EIA or alternatively through TMLSA own policies and commitments.
The TMLSA Community Relations team is in the process of analysing all the concerns that were expressed during the Phase 2 consultation process and will endeavour to respond to each issue in an appropriate manner as soon as possible.

Table 20-2: Key stakeholder comments raised during public consultation

<table>
<thead>
<tr>
<th>Subject</th>
<th>Comments</th>
<th>Relevant Section of Report</th>
</tr>
</thead>
</table>
| **Access to / Provision of Employment** | • Provision of employment opportunities for local people, particularly for young men and women and Arabic speakers;  
• Need for a transparent recruitment procedure for both skilled and unskilled labour (allegations of preferential treatment);  
• Need for transport provisions to/from the Mine for potential workers;  
• Local contractors should be employed rather than international companies. | Section 11: Socioeconomics – see 11.4.1.1 Worker Well-Being (Mauritanisation, recruitment and employment) |
| **Education**                      | • Provision of schools and training facilities in the surrounding areas;  
• Provision of scholarships;  
• Need for education / awareness in regards to environmental impacts and hazardous substances involving schools, universities and civil societyarten | Section 11: Socioeconomics – see 11.4.1.4 Community Investment |
| **Health**                           | • Exposure of workers and local community to ‘toxic emissions’ and dusts from mining operations.                                                                                                                                                                                                                                           | Section 7 - Air Quality                                      |
| **Health**                           | • Provision of health care (both diagnostic and reactive) / sanitation facilities for local community;  
• Provision of health care coverage and vaccination for women, children and families with disabled members;  
• Provision of community health education and training in First Aid and midwifery; and  
• Provision of an ambulance / evacuation support for medical emergencies in the community. | Section 11: Socioeconomics – see 11.4.1.4 Community Investment |
| **Water**                            | Water resources:                                                                                                                                                                                                                                                                                                                                     | Section 6 - Surface and Groundwater                              |
| **Water**                            | • Water is already contaminated and there is further potential for groundwater pollution;  
• Severance of wadi flows that irrigate pastureland; and  
• Depletion / over-exploitation of groundwater resources, including Bennichab and Boulanouar aquifers. | Section 11: Socioeconomics – see 11.4.1.4 Community Investment |
| **Water**                            | Water provision:                                                                                                                                                                                                                                                                                                                                     | Section 11: Socioeconomics – see 11.4.1.4 Community Investment |
| **Water**                            | • Compensation for lost well(s) within the Mine’s perimeter fence;  
• Provision of additional drinking water supplies (tanks, bladders, pipelines, | Section 11: Socioeconomics – see 11.4.1.4 Community Investment |
<table>
<thead>
<tr>
<th>Subject</th>
<th>Comments</th>
<th>Relevant Section of Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Use</td>
<td>- Protect the coastal area; and</td>
<td>Section 9 - Soils and Land Use</td>
</tr>
<tr>
<td></td>
<td>- Compensation demanded for environmental degradation, effects on human and animal health, loss of access to pastureland and boreholes within fenced area.</td>
<td></td>
</tr>
<tr>
<td>Role of civil society</td>
<td>- Involvement in environmental performance monitoring</td>
<td>Section 11: Socioeconomics – see 11.4.1.4 Community Investment</td>
</tr>
<tr>
<td></td>
<td>- Environmental awareness (e.g. asbestos (sic – not present at Tasiast, cyanide, etc.)</td>
<td></td>
</tr>
<tr>
<td>Archaeology and Culture</td>
<td>- Loss of cultural heritage</td>
<td>Section 12 – Archaeology</td>
</tr>
<tr>
<td></td>
<td>- Respect for graves and other archaeological features within the Mine site;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Provide support for Imraguen culture</td>
<td></td>
</tr>
<tr>
<td>Electricity</td>
<td>- Request for the provision of solar panels for local communities and training on renewable energy technologies for young people.</td>
<td>Section 11: Socioeconomics – see 11.4.1.4 Community Investment</td>
</tr>
<tr>
<td>Waste</td>
<td>- Previous contamination of land (reference to 2010 waste oil disposal incident) / further soil contamination;</td>
<td>Section 15 - Waste Management</td>
</tr>
<tr>
<td></td>
<td>- Provisions for waste removal within local community; and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Waste treatment at the Mine.</td>
<td></td>
</tr>
<tr>
<td>Air Quality</td>
<td>- Lack of national monitoring infrastructures (e.g. laboratories to check impact).</td>
<td>Section 7 - Air Quality</td>
</tr>
<tr>
<td>Transport</td>
<td>- Provision of transportation for local community, such as a bus service;</td>
<td>Section 11: Socioeconomics – see 11.4.1.4 Community Investment</td>
</tr>
<tr>
<td></td>
<td>- Development of road between Bennichab and El Gaiche;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Development of access to remote areas; and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Maintenance of and removal of sand from roads.</td>
<td></td>
</tr>
<tr>
<td>Agriculture / Ecology</td>
<td>- Quarries and borrow pits prevent rain water flowing downstream through the wadis to irrigate pasture.</td>
<td>Section 6 - Surface and Groundwater</td>
</tr>
<tr>
<td></td>
<td>- Immediate rehabilitation of site by re-vegetation with indigenous plants.</td>
<td>Section 10 – Ecology and Biodiversity</td>
</tr>
<tr>
<td>Subject</td>
<td>Comments</td>
<td>Relevant Section of Report</td>
</tr>
<tr>
<td>---------</td>
<td>----------</td>
<td>---------------------------</td>
</tr>
</tbody>
</table>
|         | • Request revegetation area to prevent spreading of dunes and to mitigate dust  
• Support for veterinary services / vaccination programs for livestock;  
• Development market gardening scheme for local community. | Section 11: Socioeconomics – see 11.4.1.4 Community Investment |
| Social initiatives | • TMLSA website should be in French and Arabic;  
• Improvement of basic living conditions (e.g. build homes in local communes);  
• Develop sustainable business / income generation opportunities, including financing of small businesses, new initiatives for women, etc;  
• Specific requests for Kinross to provide finance for:  
  o Infrastructure investment in surrounding villages and towns (e.g. schools, clinics, sports stadium, mosque, etc.);  
  o A radio network for Inchiri region;  
  o Fish conservation measures; and  
  o Water desalination equipment.  
• Assistance for disadvantaged groups such as orphans, the disabled, the aged, the destitute, victims of floods, etc.; and  
• Build a modern town close to the Mine (i.e. as done by MIFARMA in 1963 and SOUMIMA in 1969);  
• Capacity-building and support for Community Coordination Committees | Section 11: Socioeconomics – see 11.4.1.4 Community Investment |
21 Timeline

Once the Phase 2 Environmental Impact Assessment (EIA) has been approved and the permit has been issued by the Delegated Ministry of Environmental and Sustainable Development (MESD), the physical construction of the Project components will commence and commissioning of the Phase 2 is expected in 2015 as summarised in Figure 3-4 and Figure 21-1. The overall Project is anticipated to have a 16 year life; although there is potential to further extend the mine life.

Each Phase of the Project is subject to EIA processes and any cumulative impacts are being assessed and mitigation actions will be incorporated into and implemented via the Mine’s Corporate Responsibility Management System and the detailed Kinross Standards.

As required by Mauritanian legislation, the Mine is legally obligated to report on all of the embedded and other ESMP mitigation and monitoring actions in Section 18 – including the status of internal audits and any corrective actions needed to correct any shortcomings - in a periodic Declaration (note that the basic requirement is an Annual Declaration but Article 35, EIA decree 105/2007 requires a 6-monthly Declaration). The first Declaration in respect of Phase 2 will be submitted to the Government after the first year of construction and thereafter in the agreed format (e.g. to amalgamate ongoing reporting from previous EIAs/EMPs with new reporting for the Project) and at the agreed frequency for the duration of the operational life of the Project.

Following the operational period (estimated to be to 2029), 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 Tasiast Mauritanie Limited SA (TMLSA) will submit an application to Government for release of the Financial Guarantee.

Figure 21-1 illustrates the timeline of the Project and TMLSA and the authorities roles.
Figure 21-1: Project Timeline

TML SA Actions

- EIA Submission for permit
- Agreement of financial guarantee
- Construction period
- Annual environmental audits
- Product commissioning
- Development of detailed rehabilitation and closure plan
- Rehabilitation and closure commences
- Completion of rehabilitation and closure works
- Application for closure certificate and financial guarantee release

Mauritania Government Actions

- EIA review and public consultation
- EIA approval and granting of permit
- Approval of annual environmental audits
- Approval of detailed rehabilitation and closure plan
- Approval of application and release of financial guarantee

Timeline

- Construction Phase (2012-2015)
- Operational Phase (2015-2020)
- Closure Phase (2030-2037)

* Construction of some Phase 2 components will be ongoing during The Mine life.
References


British Standard, 2009. BS 5228 Control of Noise on Construction and Open Sites.


Daddah, M.O., 2011a Rapport sur l’avifaune de Tasiast.

Daddah, M.O., 2011b Rapport sur l’avifaune de Tasiast.


http://www.ifc.org/ifcext/policyreview.nsf/Content/IBHRandIFCPoliciesPS.

www.ifc.org/ifcext/climatebusiness.nsf/.../IFC_CEET/.../IFC_CEET.xlsx


Islamic Republic of Mauritania. *Programme D’Action National de Lutte Contre La Desertification en Mauritanie PAN/LCD*.

Ismail, A. 2011a *Rapport de mission relatif à la Flore autour du Site de Kinross-Tasiast (du 15 au 24 Février 2011)*

Ismail, A. 2011b *Rapport sur la mission au site de Kinross-Tasiast du 11 au 15 Septembre 2011*


List_of_countries_by_greenhouse_gas_emissions, citing Climate Analysis Indicators Tool (CAIT), Version 7, World Resources Institute.


ONG-AFE, 2011a. *Awareness of the populations on the Extension of Installation mining for salt water improvement project and the réfectionnement of the road to the site Kinross - Tasiast – Mauritania*.


ONG-AFE, 2011c. *Rapport Compte rendu à propos d'informations concernant l’accès à l’eau et son utilisation par la communauté locale auprès du champ de forage (sondage sale)*.

ONG-AFE, 2011d. *Sensibilisation des populations sur le projet d'Extension D'Installation MINIERE d'amélioration de l'eau salée et la réfectionnement de la route vers le site Kinross - Tasiast - Mauritanie*.

ONG-AFE, 2011e. *Summary of the Public Consultation of May 18th, 2011 in El Asma, Commune of Benichab, Concerning the EIA for the Proposed Expansion of the Tasiast First Phase Held by the Company KINROSS Tasiast*.


Ould Mohammed Kaber, N et al., 1997. *Les sites néolithiques de Berouaga*. Travaux du Laboratoire d'anthropologie et de préhistoire de la Méditerranée occidentale (LAPMO), Aix en Provence.


Scott Wilson, 2010b. *Framework Environmental Management System, Specific plans and procedures include Environmental Programme SGDE01 and Environmental Monitoring Plan SGDE04*.

Scott Wilson, 2010c. *Tasiast Gold Mine, Preliminary Environmental and Social Appraisal*.

Scott Wilson, July 2010. *Geotechnical Audit/Review. D127020/R*


United Nations, 2011. The Food and Agriculture Organization of the United Nations


URS Scott Wilson, 2011e. Tasiast Gold Mine Expansion Project – Phase 1 and 2, Baseline Ecology Survey.

URS Scott Wilson, 2011f. Tasiast Gold Mine Expansion Project- Phase 1 and 2, Baseline Birds Survey.

URS Scott Wilson, 2011g. Tasiast Gold Mine Expansion Project- Phase 1 and 2, Archaeology Baseline Survey.

URS Scott Wilson, 2011h. Tasiast Gold Mine Expansion Project- Phase 1 and 2, Social Baseline Survey.

URS Scott Wilson, 2011i. TMSLA Rehabilitation and Closure Plan.

URS Scott Wilson, 2011j. Assessment of Acid Rock Drainage Characterisation and Associated Environmental Geochemistry. 2011


