Tsumeb Smelter

Consolidated Environmental Management Plan for the Tsumeb Smelter

SLR Project No.: 734.04040.00008

April 2017

Dundee Precious Metals Tsumeb
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CONSOLIDATED ENVIRONMENTAL MANAGEMENT PLAN FOR THE TSUMEB SMELTER

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# ACRONYMS AND ABBREVIATIONS

Below is a list of acronyms and abbreviations used in this report.

<table>
<thead>
<tr>
<th>Acronyms / Abbreviations</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLA</td>
<td>Contaminated Land Assessment</td>
</tr>
<tr>
<td>DPMT</td>
<td>Dundee Precious Metals Tsumeb</td>
</tr>
<tr>
<td>ECC</td>
<td>Environmental Clearance Certificate</td>
</tr>
<tr>
<td>EMP</td>
<td>Environmental Management Plan</td>
</tr>
<tr>
<td>ESIA</td>
<td>Environmental and Social Impact Assessment</td>
</tr>
<tr>
<td>HDPE</td>
<td>High Density Polyethylene</td>
</tr>
<tr>
<td>MET</td>
<td>Ministry of Environment and Tourism</td>
</tr>
<tr>
<td>MMP</td>
<td>Management and Mitigation Plan</td>
</tr>
<tr>
<td>PPE</td>
<td>Personal Protective Equipment</td>
</tr>
<tr>
<td>PM&lt;sub&gt;2.5&lt;/sub&gt;</td>
<td>Particulate matter 2.5 micrometre or less in diameter</td>
</tr>
<tr>
<td>PM&lt;sub&gt;10&lt;/sub&gt;</td>
<td>Particulate matter 10 micrometre or less in diameter</td>
</tr>
<tr>
<td>SLR</td>
<td>SLR Environmental Consulting (Namibia)(Pty) Ltd</td>
</tr>
</tbody>
</table>
1 INTRODUCTION

Various metals have been mined at the DPMT site for over a hundred years. Between 1961 and 1963 the original smelter was replaced with a new copper and lead smelter while an arsenic plant and a cadmium plant were also established for the processing of by-products originating from the smelting process. At the time, the combination of the copper and lead smelter with an arsenic and cadmium plant allowed for the interchange of intermediate products between the smelter lines and provided a suitable bleed for the arsenic and cadmium.

In mid-1998 Goldfields Namibia, the holding company of TCL went into liquidation and the Tsumeb Smelter was shut down. In 2000, the former TCL assets were taken over by Ongopolo Mining and Processing Limited (OMPL) and the copper and arsenic plants were re-commissioned. The cadmium plant was decommissioned and no lead processing has taken place since re-commissioning. In July 2006 the assets of OMPL were sold to Weatherly Mining International who owned and operated the plant for four years before selling it to Dundee Precious Metals Inc. (DPM) in March 2010. The company now operates as Dundee Precious Metals Tsumeb Ltd, a wholly owned subsidiary of DPM that is listed on Canada’s Toronto Stock Exchange. It must be noted that in terms of the sales agreement, DPMT is not considered liable for environmental contamination that took place prior to 2010. Studies are, however, underway in order to investigate the sources of historic and current contamination and to identify practicable remediation measures.

The smelter was constructed in the early 1960s to process concentrate from the Tsumeb copper mine and is one of only five commercial-scale smelters in Africa capable of processing concentrates with a high arsenic content. Currently, it receives copper concentrate from El Brocal (Peru), Chelopech (Bulgaria), Codelco (Chile), Armenia and Opuwo (Namibia) for processing in the smelter.

Following the purchase of the smelter complex in 2010, DPMT have undertaken a series of upgrades and improvement projects, including the following:

- Construction of a hazardous waste disposal site (2012);
- Addition of a second oxygen plant (2012);
- Improvement of the off-gas handling systems (2012-2013);
- Closure of the reverberatory furnace (2013);
- Addition of a 1,540 t/d sulphuric acid plant and associated acid storage and dispatch facilities (mid 2015);
- Addition of two new and larger Peirce-Smith converters (end 2015);
- A new effluent treatment plant; and
The Tsumeb Smelter now comprises of one primary smelting furnace, the refurbished Ausmelt furnace. Blister copper is produced from the copper concentrate and delivered to refineries for final processing. Up to recently, a portion of the arsenic contained in the concentrate feed was converted to arsenic trioxide ($\text{As}_2\text{O}_3$) through the arsenic plant and sold to third parties. The arsenic plant is currently in the process of being decommissioned and has ceased to produce $\text{As}_2\text{O}_3$.

With additional custom concentrates available worldwide and areas for operational improvements identified, DPMT is now proposing to expand their current operations in order to increase their concentrate processing capacity from approximately 240 000 to 370 000 tons per annum (tpa). The proposed expansion would be contained within the existing facility footprint and would include the following components:

- Upgrading of the existing Ausmelt feed and furnace;
- Installation of a rotary holding furnace (RHF);
- Implementation of slow cooling of the RHF and converter slag;
- Upgrading of the slag mill to improve copper recovery and handle the increased tonnage from slow cooled slags;
- Installation of an additional Peirce-Smith (PS) converter; and
- Additional related infrastructure improvements (power supply, etc.).

The new project components and associated service infrastructure is collectively referred to as the ‘Tsumeb Smelter Upgrade and Optimisation Project’.

DPMT currently holds an Environmental Clearance Certificate (ECC) in terms of the Environmental Management Act (No. 7 or 2007; EMA) for its operations at the Tsumeb Smelter. To allow for the proposed Upgrade and Optimisation Project, an amendment of the original Environmental and Social Impact Assessment (ESIA) and Environmental Management Plan (EMP) is required.

DPMT currently also holds various other ECCs and EMPs for different project components established after the original ECC for the Smelter operations was issued. The objective of this project and ESIA Amendment process is further to combine all of the commitments in the separate EMPs into one consolidated EMP for all DPMT’s facilities and operational components and to include additional measures related to the proposed new project components. This is required, as impacts and related management and mitigation measures will be considered cumulatively and it would be easier to manage the environmental aspects if consolidated into one document linked to DPMT’s overarching management system. If approval is granted and an Amended ECC issued, it would then serve as a consolidated ECC for the entire DPMT Smelter complex and would supersede the previous ECCs. Refer to Section 3 for further information relating to previously issued ECCs.
This document serves as a consolidated EMP providing an update to the environmental actions described in the initial approved EMP for smelter operations (Synergistics, 2011 and 2016 ECC renewal), as well as incorporating management actions listed in EMPs approved since 2011 for the following additional project components:

- Hazardous waste site (2012 and included in 2016 ECC renewal);
- Sulphuric acid plant (2013);
- Kliplime Quarry (2013);
- General waste site (2013 and included in 2016 ECC renewal);
- Sewerage system (2014); and
- 11kV power line (2014).

This EMP includes a series of individual mitigation and management plans (MMPs) which are designed to meet legal requirements, avoid, minimise or manage the impacts associated with the construction of new components, operation, decommissioning and closure of the Tsumeb Smelter. The MMPs have been compiled based on a review of the findings and recommendations of the EMPs listed above, as well as those from the ESIA Amendment process for the Tsumeb Smelter Upgrade and Optimisation Project.
2 ENVIRONMENTAL MANAGEMENT PLAN

2.1 OVERARCHING REQUIREMENTS

In order to implement the EMP, DPMT would need to comply with the following overarching requirements:

- Review, update and implement an appropriate integrated environmental and health and safety (EHS) management system in line with international standards. Ensure adequate resources are in place to implement and maintain the EHS.
- Formally adopt international standards where no appropriate Namibian legislation exists, or where Namibian legislation is not deemed in line with best practice. This would apply to all environmental and health aspects, across reasonable timelines. Formally establish targets (interim if needed) against which improvement, compliance / performance can be measured. The targets / standards should meet the objectives of the EMP.
- Undertake ESIA processes in line with best international practice for all subsequent project components and activities that may trigger the need for ESIAs to be done.
- Ensure contractors and sub-contractors are made aware of the requirements of the EMP, their responsibilities in terms of the EMP and how to execute them. Contracts with contractors and sub-contractors would need to reflect these requirements.
- Ensure that all relevant permits, approvals etc. are in place for any activities specified in the EMP (e.g. borehole drilling permits).
- Ensure that all conditions attached to ECCs, approvals and permits are met.
- Review and update Hazard / Aspect Identification and Risk Assessments for processes and plant areas on a regular basis (e.g. every 36 months, or when major changes are made), focusing on environmental aspects and risks. The assessment process should be used to prioritise risk areas and identify controls to avoid or reduce these risks, and should also inform updates to the EMP. The risk assessment should also be used to inform gaps in information (e.g. unknown impacts / risks / levels) and determine studies / gap closing activities. Risk assessments shall be done in accordance with best international practice / standard methods. Risk assessments are to include any contractors working onsite, as and when they come onsite, whether permanent or temporary.
- Area owners need to be specifically made aware of the requirements within their area of responsibility in terms of the EMP, where actions relate to them and their personnel. This includes contractors. For this, DPMT needs to ensure all processes and areas are allocated to specific area owners.
- Ensure that adequate resources (i.e. personnel, equipment, funds) are available to execute the commitments in the EMP within the associated timelines.
2.2 AIMS

The aim of the EMP is to detail the actions required to effectively implement the mitigation measures identified in the amended ESIA. These actions are required to minimise negative impacts and enhance positive impacts associated with the operations at the Tsumeb Smelter.

The EMP sets out the commitments as required by Section 8(j) of the Environmental Management Act Regulations as governed by the Government of the Republic of Namibia’s ministry of Environment and Tourism. The requirements include the following:

(j)(aa) information on any proposed management, mitigation, protection or remedial measures to be undertaken to address the effects on the environment that have been identified including objectives in respect of the rehabilitation of the environment and closure;

(bb) as far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of the activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development; and

(cc) a description of the manner in which the applicant intends to modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation remedy the cause of pollution or degradation and migration of pollutants.

It is important to note that an EMP is a living document in that it will be updated and amended as new information (e.g. environmental data from ongoing studies), policies, authority guidelines and technologies develop. The EMP will also be reviewed and updated, if required, based on the findings and recommendations of periodic internal and external audits and performance assessments (refer to Section 4 for audit frequencies). Should a listed activity(ies) as defined in the Environmental Impact Assessment Regulations: Environmental Management Act, 2007 (Government Gazette No. 4878) be triggered (as a result of future modifications/changes at the Smelter), this EMP will be updated as a result of another ESIA process as stipulated in the Regulations.

2.3 OBJECTIVES

Specific objectives are given for each of the actions described in the EMP. These objectives relate directly to addressing the impacts identified in the EIA processes for the different components of the smelter operations.

2.4 MANAGEMENT ACTIONS

The various actions that need to be implemented in order to ensure that environmental objectives are met are described in the EMP. Each action is given a reference number. The actions are measurable and are therefore easy to monitor. Compliance with the EMP can thus also be audited.
2.5 **Roles and Responsibilities**

The Environmental Contract is between DPMT and the Government of Namibia. DPMT is thus responsible for adherence to the EMP and for providing the necessary funding for implementation of the management measures. The successful implementation of the EMP is however dependent on clearly defined roles and responsibilities for each of the management actions given in the EMP. Table 2-1 sets out the roles and responsibilities prescribed to relevant parties for the implementation of the EMP.

**TABLE 2-1: ROLES AND RESPONSIBILITIES FOR IMPLEMENTATION OF THE EMP**

<table>
<thead>
<tr>
<th>Role</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vice President / Managing Director</td>
<td>Vice President / Managing Director who takes overall responsibility for implementation of the EMP.</td>
</tr>
<tr>
<td>DPMT Management</td>
<td>Responsible for overseeing implementation of EMP in specific Smelter departments and lending support.</td>
</tr>
<tr>
<td>Site/Project Manager</td>
<td>A representative of DPMT responsible for overseeing the day-to-day implementation of the new components construction project and the overall management of the site construction teams.</td>
</tr>
<tr>
<td>Environmental Manager</td>
<td>A member of DPMT management responsible for providing support to the engineering and operations teams and other DPMT staff in terms of implementation of environmental management measures, as appropriate.</td>
</tr>
<tr>
<td>Utilities/Engineering Manager</td>
<td>Engineer responsible for quality control of new project component construction and ongoing monitoring of engineering operations.</td>
</tr>
<tr>
<td>Operations Director</td>
<td>Engineer responsible for management and overseeing of all smelter operations.</td>
</tr>
<tr>
<td>Plant Manager</td>
<td>Engineer responsible for management of a specific smelter component, e.g. sulphuric acid plant, effluent treatment plant, etc. Responsible for implementation of the EMP at a specific smelter component.</td>
</tr>
<tr>
<td>Environmental Consultant</td>
<td>Independent consultants appointed to audit the implementation and compliance with the EMP.</td>
</tr>
<tr>
<td>Service Providers</td>
<td>Companies/contractors awarded a contract by DPMT to undertake a component of the smelter optimisation project and ongoing</td>
</tr>
</tbody>
</table>
maintenance of project components. Responsible for adhering to
DPMT policies, procedures and similar processes in place for
environmental management and EMP implementation.

2.6 SCHEDULE

The schedule serves to give the timeframe in which the environmental management measures are to be implemented. The successful implementation of the action within the specified timeframes is to be monitored. Some of the timeframes are subject to ongoing feasibility studies and may be updated based on findings.
3 PERMITS AND CLEARANCES

DPMT require a number of approval/permits for their Smelter operations in Tsumeb. A list of the permits and ECCs already held by DPMT is provided in Table 3-1. Additional required approval/permits that have been applied for and pending or must still be applied for are listed in Table 3-2.

### TABLE 3-1: LIST OF PERMITS/ECCs HELD BY DPMT

<table>
<thead>
<tr>
<th>Permit Name</th>
<th>Regulator</th>
<th>Period of validity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ECCs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smelter Operations</td>
<td>Ministry of Environment and Tourism</td>
<td>22 September 2019</td>
</tr>
<tr>
<td>Contractor’s Camp Sewage Treatment Plant</td>
<td>Ministry of Environment and Tourism</td>
<td>03 July 2017</td>
</tr>
<tr>
<td>Sewage Treatment Plant</td>
<td>Ministry of Environment and Tourism</td>
<td>23 June 2017</td>
</tr>
<tr>
<td>11kV Power Line</td>
<td>Ministry of Environment and Tourism</td>
<td>18 June 2017</td>
</tr>
<tr>
<td>Kliplime Quarry</td>
<td>Ministry of Environment and Tourism</td>
<td>15 March 2020</td>
</tr>
<tr>
<td><strong>Permits/Registrations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupational Health Clinic Certification</td>
<td>Ministry of Health and Social Services</td>
<td>20 May 2017</td>
</tr>
<tr>
<td>DPMT Guest House Certificate of Fitness/Registration (health, fire and business registrations)</td>
<td>Tsumeb Municipality</td>
<td>30 April 2017</td>
</tr>
<tr>
<td>Smelter Certificate of Fitness/Registration (health, fire and business registrations)</td>
<td>Tsumeb Municipality</td>
<td>30 April 2017</td>
</tr>
<tr>
<td>Radiation Source Registrations for XRF machines</td>
<td>National Radiation Protection Authority</td>
<td>Issued on 18 October 2016 with no set validity period</td>
</tr>
<tr>
<td>Radiation Source Licenses for XRF machines</td>
<td>National Radiation Protection Authority</td>
<td>18 October 2019</td>
</tr>
<tr>
<td>Radiation Sealed Source Registrations</td>
<td>National Radiation Protection Authority</td>
<td>Issued on 05 February 2014 with no set validity period</td>
</tr>
<tr>
<td>Radiation Sealed Source Licenses</td>
<td>National Radiation Protection Authority</td>
<td>18 October 2017</td>
</tr>
<tr>
<td>Borehole Drilling Permits</td>
<td>Ministry of Agriculture, Water and Forestry</td>
<td>Valid</td>
</tr>
<tr>
<td>Air Pollution Control Certificate</td>
<td>Ministry of Health and Social Services</td>
<td>Valid</td>
</tr>
<tr>
<td>Permit name</td>
<td>Regulator</td>
<td>Status</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------</td>
<td>-----------------------------------------------</td>
<td>-------------------------------------------------------------</td>
</tr>
<tr>
<td>Sulphuric Acid Plant</td>
<td>Ministry of Environment and Tourism</td>
<td>Renewal application for the ECC submitted to MET – pending</td>
</tr>
<tr>
<td>Research Permit (for harvesting of seeds/seedlings/cuttings for phytoremediation/rehabilitation purposes)</td>
<td>Ministry of Environment and Tourism</td>
<td>Application submitted – pending</td>
</tr>
<tr>
<td>Onsite Nursery Permit (for phytoremediation/rehabilitation purposes)</td>
<td>Ministry of Environment and Tourism</td>
<td>Application submitted – pending</td>
</tr>
<tr>
<td>Groundwater Abstraction Permit</td>
<td>Ministry of Agriculture, Water and Forestry</td>
<td>Requirement to be confirmed</td>
</tr>
<tr>
<td>Water Discharge Permit (Waste Water and Effluent Disposal Exemption Permit)</td>
<td>Ministry of Agriculture, Water and Forestry</td>
<td>Expired 31 March 2016, renewal to be applied for</td>
</tr>
</tbody>
</table>
4 PERFORMANCE ASSESSMENT

An environmental auditing programme has been developed as part of this ESIA process for the general Tsumeb Smelter operations (see Table 4-1). All components of the operations are to be included in the general environmental auditing programme. The programme is implemented to assess the level of compliance with environmental legislative requirements and the commitments made in the EMP. Environmental auditing is aimed at ensuring continual improvement in environmental performance.

**TABLE 4-1: ENVIRONMENTAL PERFORMANCE ASSESSMENT PROGRAMME**

<table>
<thead>
<tr>
<th>Frequency of Monitoring</th>
<th>Performance Assessment</th>
<th>Responsibility</th>
<th>Reporting Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarterly</td>
<td>Quarterly inspections and critical control verification</td>
<td>Environmental Manager</td>
<td>Internal report submitted to managers for discussion.</td>
</tr>
<tr>
<td>Annually</td>
<td>Management review</td>
<td>Managing Director / Vice President and senior management</td>
<td>Internal reports.</td>
</tr>
<tr>
<td>Annually</td>
<td>Internal Compliance Audit</td>
<td>Environmental Manager</td>
<td>Report to be submitted to environmental authorities and internally.</td>
</tr>
<tr>
<td>Two-yearly (biennial)</td>
<td>External Compliance Audit</td>
<td>Environmental Manager</td>
<td>Report to be submitted to environmental authorities and internally.</td>
</tr>
</tbody>
</table>

The internal and external Compliance Audits shall contain the following information:

- Information regarding the period applicable to the performance assessment;
- The scope of the assessment;
- The procedure used for the assessment;
- The interpreted information gained from monitoring the approved EMP;
- The evaluation criteria used during the assessment;
- The results of the assessment;
- Recommendations on how and when non-compliances and deficiencies will be rectified; and
- Recommendations and motivation for any changes/updates required to the approved EMP.
5. DPMT MANAGEMENT AND MITIGATION PLANS
5. **DPMT MANAGEMENT AND MITIGATION PLANS**

The Management and Mitigation Plans (MMPs), listed in the table below, are applicable to all the relevant activities and facilities of the DPMT smelter. Where a management action is relevant to a specific project component, it has been indicated as such. The MMPs follow in the subsequent sections.

**TABLE 5-1: VARIOUS MMPS AND NUMBERS**

<table>
<thead>
<tr>
<th>Number</th>
<th>Management and Mitigation Plan (MMP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Construction Activities MMP</td>
</tr>
<tr>
<td>2</td>
<td>Public Relations MMP</td>
</tr>
<tr>
<td>3</td>
<td>Air Quality MMP</td>
</tr>
<tr>
<td>4</td>
<td>Soils and Land MMP</td>
</tr>
<tr>
<td>5</td>
<td>Groundwater MMP</td>
</tr>
<tr>
<td>6</td>
<td>Surface Water MMP</td>
</tr>
<tr>
<td>7</td>
<td>Noise MMP</td>
</tr>
<tr>
<td>8</td>
<td>Ecology MMP</td>
</tr>
<tr>
<td>9</td>
<td>Community Health and Safety MMP</td>
</tr>
<tr>
<td>10</td>
<td>Occupational Health and Safety MMP</td>
</tr>
<tr>
<td>11</td>
<td>Socio-Economic MMP</td>
</tr>
<tr>
<td>12</td>
<td>Waste Management MMP</td>
</tr>
<tr>
<td>13</td>
<td>Environmental Awareness and Training</td>
</tr>
<tr>
<td>14</td>
<td>Closure Phase</td>
</tr>
</tbody>
</table>
1

CONSTRUCTION ACTIVITIES MMP
1. Construction Activities Management and Mitigation Plan

1.1. Management and Mitigation

1.2.1 Construction Activities

**Objectives**

- To ensure that all construction staff are aware of the objectives of the EMP as well as the consequences of their individual actions
- To limit construction-phase impacts relating to soil, noise, dust, visual and outside work force.

**Actions**

**TABLE 1: ACTIONS RELATING TO CONSTRUCTION ACTIVITIES**

<table>
<thead>
<tr>
<th>No.</th>
<th>Issue</th>
<th>Management/Mitigation</th>
<th>Responsibility</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EMP administration</td>
<td>The requirements of the EMP are to be included in all tender documentation for all</td>
<td>DPMT Management</td>
<td>Prior to commencement of construction activities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>contractors to allow service providers to make provision for environmental cost</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>requirements and the EMP is to form part of the contract agreement entered into with</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>the service providers awarded contracts.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Environmental Induction Training</td>
<td>Environmental induction training is to be undertaken by all persons undertaking new</td>
<td>Environmental Manager</td>
<td>Immediate / Prior to commencement of any new</td>
</tr>
<tr>
<td></td>
<td></td>
<td>construction work at the smelter site. This is to be in line with DPMT’s current site</td>
<td></td>
<td>construction-related projects</td>
</tr>
<tr>
<td></td>
<td></td>
<td>induction procedures.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Soil Impact</td>
<td>Where disturbed areas cannot be re-vegetated during the life of the operations,</td>
<td>Environmental Manager</td>
<td>Prior to extension of sites.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>appropriate measures need to be taken to prevent further impacts on soil resources.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Footprint</td>
<td>Construction activities must be limited to the areas required for new project</td>
<td>Environmental Manager</td>
<td>During construction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>components.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Soil contamination during construction</td>
<td>Where construction of new components are undertaken on bare soil containing topsoil</td>
<td>Environmental Manager / Construction Manager / Engineering Manager</td>
<td>Ongoing during construction phases</td>
</tr>
<tr>
<td></td>
<td></td>
<td>with vegetative material, the following measures are to be applied:</td>
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<td></td>
<td></td>
<td>• Consult the contaminated land assessment (CLA) and related soil survey information</td>
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<td></td>
<td></td>
<td>for suitability of re-use and appropriate handling of topsoils within the smelter</td>
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<td></td>
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<td>boundary.</td>
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<td>No.</td>
<td>Issue</td>
<td>Management/Mitigation</td>
<td>Responsibility</td>
<td>Schedule</td>
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<td></td>
<td>• If found to be suitable for re-use and handling in line with the above, strip and stockpile ‘topsoil’ from the footprints of new features before construction. Stockpiles to be no higher than 2 m.</td>
<td>Environmental Manager</td>
<td>As required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Store ‘topsoil’ separate from other materials and subsoils. Demarcate stockpile areas and erect appropriate durable signage. Draw up and maintain a soils register with estimates of soil type, quantities and quality.</td>
<td>Environmental Manager</td>
<td>As required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Limit soil compaction, erosion, and contamination on ‘topsoil’ stockpiles/berms.</td>
<td>Environmental Manager</td>
<td>As required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Design all new features to prevent soil pollution of surrounding undisturbed areas.</td>
<td>Environmental Manager</td>
<td>As required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Design all new features to limit/prevent soil erosion.</td>
<td>Environmental Manager</td>
<td>As required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Prevent soil contamination/pollution.</td>
<td>Environmental Manager</td>
<td>As required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Infrastructure that will not be used in future is to be removed from site and footprint areas to be remediated (cleared/ripped/levelled).</td>
<td>Environmental Manager</td>
<td>As required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Areas showing residual contamination (oils, fuel) from construction activities are to be cleaned by lifting contaminated material for disposal in accordance with waste management requirements.</td>
<td>Environmental Manager</td>
<td>As required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• All construction waste material is to be removed from site and disposed of in accordance with waste management requirements.</td>
<td>Environmental Manager</td>
<td>As required</td>
</tr>
<tr>
<td></td>
<td>Air Quality</td>
<td></td>
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</tr>
<tr>
<td>6</td>
<td>Dust Emissions</td>
<td>Wet suppression will be utilised in order to reduce fugitive dust emissions. Should wet suppression not be sufficient, environmentally-friendly soil-binding agents will be utilised.</td>
<td>Environmental Manager</td>
<td>As required</td>
</tr>
<tr>
<td>7</td>
<td>Durable</td>
<td>Durable and environmentally-friendly dust suppression coatings to be in place on permanent haul and other internal roads.</td>
<td>Environmental Manager</td>
<td>Immediate</td>
</tr>
<tr>
<td>8</td>
<td>Undertake</td>
<td>Undertake air quality monitoring during construction in line with the following:</td>
<td>Environmental Manager</td>
<td>Ongoing</td>
</tr>
<tr>
<td></td>
<td>air quality</td>
<td>• Use realtime dust monitors and other samplers, e.g. SO₂ badges, in areas planned for construction in order to establish baseline (pre-construction) levels.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>monitoring</td>
<td>• Ongoing monitoring during construction is to include environmental and occupational health metrics as used on site.</td>
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<tr>
<td></td>
<td>during</td>
<td>• Pay special attention to arsenic levels in dust (PM₁₀ and PM₂.₅) and where construction sites abut areas known to be historically contaminated (in line with CLA) or areas where old lead and cadmium plants operated, the air quality monitoring must take this into account and measure these compounds.</td>
<td></td>
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<tr>
<td>No.</td>
<td>Issue</td>
<td>Management/Mitigation</td>
<td>Responsibility</td>
<td>Schedule</td>
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<tr>
<td>9</td>
<td>Outside Construction Workers</td>
<td>The appointed contractor should make the necessary arrangements for allowing workers from outside the area to return home on a regular basis and must transport workers back to their home towns within a day of their contracts ending in order to limit the impact of the presence of outside workers on the local communities.</td>
<td>Appointed Contractor / Site Manager</td>
<td>Ongoing</td>
</tr>
<tr>
<td>10</td>
<td>Training and Skills Development</td>
<td>Where feasible, training and skills development programmes for locals should be initiated prior to the construction phase for new project components.</td>
<td>DPMT Management</td>
<td>Prior to construction</td>
</tr>
<tr>
<td>11</td>
<td>Heritage sites</td>
<td>All sites of heritage importance within the smelter property should be protected from any construction-related activities. Should construction activities lead to the removal or damage of sites of heritage importance, approach the National Heritage Council for the appropriate permit(s) to be issued in terms of the National Heritage Act.</td>
<td>Appointed Contractor / Site Manager / Archaeologist</td>
<td>Prior to construction</td>
</tr>
<tr>
<td>12</td>
<td>Chance heritage finds</td>
<td>Should any chance heritage finds be encountered in the form of archaeological artefacts or human remains during excavations, work should be ceased in the immediate vicinity and the finds confirmed by an archaeologist. Based on the nature of the find and archaeologist's advice, the National Heritage Council is to be advised and written permission requested to remove finds from the works area. In the event that human remains are discovered, advise and liaise with the National Heritage Council and Police and follow standard recovery procedures to the National Museum or National Forensic Laboratory, as directed.</td>
<td></td>
<td>Ongoing</td>
</tr>
</tbody>
</table>

**Visual**

<table>
<thead>
<tr>
<th>No.</th>
<th>Issue</th>
<th>Management/Mitigation</th>
<th>Responsibility</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Visual Impact</td>
<td>Wet suppression will be utilised in order to reduce fugitive dust emissions that could cause a visual intrusion. Should wet suppression not be sufficient, soil-binding agents will be utilised.</td>
<td>Environmental Manager</td>
<td>As required</td>
</tr>
<tr>
<td>14</td>
<td>Chemical dust suppression to be in place on permanent haul and other roads at the Waste Landfill Site.</td>
<td></td>
<td>Environmental Manager</td>
<td>Immediate</td>
</tr>
<tr>
<td>15</td>
<td>Vegetate inactive areas on site.</td>
<td></td>
<td>Environmental Manager</td>
<td>Immediate and ongoing</td>
</tr>
</tbody>
</table>

**Noise**

<table>
<thead>
<tr>
<th>No.</th>
<th>Issue</th>
<th>Management/Mitigation.</th>
<th>Responsibility</th>
<th>Schedule</th>
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<tbody>
<tr>
<td>16</td>
<td>Noise during Construction</td>
<td>All vehicles and equipment (especially diesel-powered equipment) will be serviced regularly and be kept in good working order to limit vehicle noise.</td>
<td>Procurement Manager / Environmental Manager / Construction Manager</td>
<td>Prior to construction and ongoing</td>
</tr>
<tr>
<td>17</td>
<td>Schedule high noise construction activities for daylight hours.</td>
<td></td>
<td>Site Manager</td>
<td>Construction phase</td>
</tr>
<tr>
<td>18</td>
<td>Undertake construction noise monitoring in line with current on-site noise monitoring programme. Where noise becomes a nuisance, management measures will be</td>
<td></td>
<td>Environmental Manager</td>
<td>Ongoing</td>
</tr>
<tr>
<td>No.</td>
<td>Issue</td>
<td>Management/Mitigation</td>
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<tr>
<td></td>
<td>Waste</td>
<td>Investigate and implement to address these.</td>
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<tr>
<td>19</td>
<td>Waste Management</td>
<td>Provide sufficient capacity in the smelter waste management systems to accommodate additional waste from workers during the construction phase or specify that each contractor is responsible for their own waste management. If the latter, ensure that the contractor’s actions comply with waste management legislation and best practice.</td>
<td>Environmental Manager</td>
<td>Ongoing</td>
</tr>
<tr>
<td></td>
<td>Public Relations</td>
<td>Preference to be given to local service providers and suppliers with capability to provide goods and services required for construction activities.</td>
<td>Project Manager</td>
<td>As Required</td>
</tr>
<tr>
<td>20</td>
<td>Local employment</td>
<td>Preference to be given to local service providers and suppliers with capability to provide goods and services required for construction activities.</td>
<td>Project Manager</td>
<td>As Required</td>
</tr>
<tr>
<td></td>
<td>Consult and update the Tsumeb Municipality's skills database for the area. Make this database available to appointed contractors for the construction phase.</td>
<td></td>
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</tr>
<tr>
<td>21</td>
<td>Construction workers</td>
<td>Set up an Environmental Monitoring Committee (EMC) (or similar body including key stakeholders, community members, local authority, etc.) to monitor construction activities and the implementation of recommended mitigation measures. The EMC should be briefed on potential risks to the local community associated with outside construction workers, e.g. disruption of existing family structures and social networks linked to potential behaviour of male construction workers.</td>
<td>Public Relations Officer / EMC</td>
<td>Construction Phase</td>
</tr>
</tbody>
</table>
2
PUBLIC RELATIONS MMP
2. Public Relations Management and Mitigation Plan

2.1 Components
This plan is made up of the following components:
- General public and community relations

2.2 Management and Mitigation
2.2.1 General Public and Community Relations

Objectives
- To promote transparency and facilitate communication with the affected public
- To promote local employment and improve local economy.
- To minimise disturbance to neighbouring communities due to operational activities.

Actions

TABLE 2: ACTIONS RELATING TO PUBLIC RELATIONS (THESE ISSUES APPLY TO ALL DPMT PLANTS & SITES)

<table>
<thead>
<tr>
<th>No</th>
<th>Issue</th>
<th>Management/Mitigation</th>
<th>Responsibility</th>
<th>Schedule</th>
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</thead>
</table>
|    | Environmental Monitoring Committee | Establish in a transparent and independent manner an Environmental Monitoring Committee (EMC) to monitor environmental and health-related issues associated with smelter operations. Details as set out below:  
  • EMC to consist of representatives of DPMT, local municipality, national government, local community, Non-Government Organisations and labour.  
  • Include input from independent specialists (health and environmental), where required.  
  • Establish EMC within 6 months of project approval.  
  • EMC to initially meet on a quarterly basis. | Public Relations Officer EMC | Establish within 6 months of approval Ongoing |
<table>
<thead>
<tr>
<th></th>
<th>Information availability</th>
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</table>
| 2 | **All monitoring data to be provided to the EMC with measures put in place to prevent / reduce the risk of misinterpretation of data.**  
**All public complaints submitted to DPMT to be provided to the EMC on a quarterly basis.** | Environmental Manager  
Immediate  
Ongoing |
|   | **Information communication** |
| 3 | **All public complaints submitted to DPMT to be provided to the EMC on a quarterly basis.** | Public Relations Officer  
If required |
|   | **Grievances** |
| 4 | **A complaints register (grievance mechanism) is currently in place for members of the public to register their compliments and complaints. The complaints register process is to be actively maintained by presenting the issues raised to the relevant manager and timeously providing feedback to the complainant on the outcome of the complaint.** | Public Relations Officer  
Environmental Manager  
Ongoing |
|   | **Disturbance to neighbouring communities** |
| 5 | **Activities likely to cause a noise disturbance (e.g. blasting) are to be restricted to daylight hours and noise monitoring undertaken on-site in line with a noise monitoring programme in order to identify potential disturbances and avoid disturbance to neighbouring communities.** | Plant / Site Managers  
Ongoing |
|   | **Municipal planning** |
| 6 | **Actively engage with the Tsumeb Municipality and regional government regarding future landuse planning for residential areas in close proximity to the smelter property. Discussions should specifically focus on the closest residential area of Ondundu and farming activities immediately to the northwest of the smelter property.** | Public Relations Officer  
DPMT Management  
Ongoing |
3

AIR QUALITY MMP
3. Air Quality Management and Mitigation Plan

3.1 Components
This plan is made up of the following components:
• Dust control and emissions of chemicals of concern

3.2. Management and Mitigation
3.2.1 Dust control and SO$_2$, arsenic emissions

Objectives
• To reduce SO$_2$ and arsenic emissions from the smelter operations to ensure compliance with DPMT’s environmental emission and health exposure benchmark, reference and limit levels for SO$_2$ and other chemicals of concern. These levels are to be set as agreed with environmental authorities and must be defensible and relate to the smelter conditions and, where applicable, be in line with international standards
• To reduce impacts of fugitive dust emissions
• To monitor the effectiveness of dust management during operations and implement improvements as required.

Actions

<table>
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<tr>
<th>No</th>
<th>Issue</th>
<th>Management/Mitigation</th>
<th>Responsibility</th>
<th>Schedule</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>SO$_2$ emissions</td>
<td>Install and implement a daily (continuous) monitoring system for SO$_2$ emissions from stacks.</td>
<td>Environmental Manager</td>
<td>Within 6 months of approval</td>
</tr>
<tr>
<td>2</td>
<td>SO$_2$ emissions</td>
<td>Regulate and benchmark SO$_2$ emission levels in line with SA NAAQS and WHO standards. Any activities that lead to a sustained increase in SO$_2$ levels above the RSA SANS (SANS: 1929, 2004) will not be allowed. Production and process engineering or optimisation changes where sustained increases within the allowable SANS SO$_2$</td>
<td>Operations Director, Environmental Manager</td>
<td>Ongoing</td>
</tr>
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<tr>
<td>3</td>
<td><strong>SO₂ emissions</strong></td>
<td>Continuous ambient monitoring of SO₂ to provide a warning system when SO₂ levels are above the RSA SANS limits. Environmental Manager Ongoing</td>
<td></td>
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</tr>
<tr>
<td>4</td>
<td>Implement corrective management actions should SO₂ levels exceed guideline levels as per the RSA SANS limits (SANS:1929:2004), and in line with the accepted number of exceedences of RSA standards (refer to measures 13 to 14 and 25 to 27 below). Operations Director Environmental manager Ongoing</td>
<td></td>
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<tr>
<td>5</td>
<td><strong>Arsenic emissions</strong></td>
<td>Converter furnace hood to be used to reduce fugitive emissions. Operations Director Ongoing</td>
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<td>6</td>
<td>Long-term furnace fugitive sampling to be undertaken. Operations Director Ongoing</td>
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<tr>
<td>7</td>
<td><strong>Dust control</strong></td>
<td>Rehabilitation of closed eastern tailings dam surface to reduce dust. In this regard, a rehabilitation plan is to be drafted in line with specialist biodiversity and contaminated land input. Environmental Manager In line with rehabilitation plan - within 2 years of approval</td>
<td></td>
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</tr>
<tr>
<td>8</td>
<td>Investigate options to avoid, reduce and contain fugitive emissions, including dust, associated with conveyors, material crushers, ladle cooling, slag cooling and slag crushing and loading. Based on the investigation, implement feasible measures and investments to avoid, reduce and contain fugitive emissions. Operations Director Within 1 year of approval Ongoing</td>
<td></td>
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</tr>
<tr>
<td>9</td>
<td>Machinery will be regularly monitored and maintained. Maintenance programmes will be established and implemented. Operator</td>
<td></td>
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<tr>
<td>10</td>
<td>Wetting the slag heaps before and during moving of the material and/or enclosure, extraction and hooding with fabric filters, in order to limit fugitive dust during sizing and crushing operations at the slag plant. Site Manager</td>
<td></td>
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<tr>
<td>11</td>
<td>Vehicle speeds on unpaved roads will be limited to 40km/h to limit dust. Wet unpaved roads or consider the use of a durable suppressant coating. Site Manager</td>
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<tr>
<td>12</td>
<td>Control dust on paved internal roads by considering the use of mechanical broom or vacuum sweepers. Metal rich dust may be bagged and redirected to the smelter for metal recovery or to the tailings for disposal, as appropriate. Site Manager</td>
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</tr>
<tr>
<td>13</td>
<td>Implement cattle-grids and vehicle brushes (or sprayers if dirty water is available) on the exit road from the smelter in order to minimise transport of polluted dust on car tyres into Tsumeb. Desludge the water collection bays regularly and dispose of the sludge on the tailings facilities. Site Manager</td>
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</tr>
<tr>
<td>14</td>
<td>Control dust sources by, where feasible, planting shelter belts of indigenous drought-tolerant evergreen trees along roads and around buildings to protect from fugitive dust. Environmental Manager</td>
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and consume polluted runoff.

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</table>
| 16 | RHF emissions | Fume capture and extraction systems at the RHF must be maintained and operated to specifications, in order to ensure minimal fugitive emissions during charging, holding and pour cycles.  
Investigate options to avoid, reduce and contain fugitive emissions generated during the smelting process. Based on the investigation, implement feasible measures and investments to avoid, reduce and contain fugitive emissions from the smelting process.  
Movable and stationary hoods employed at the RHF must be positioned correctly during all cycles of the process in order to prevent fugitive emissions. | Operations Director | Ongoing |
| 17 |   |   |
| 18 | Stack height | The height of the new baghouse stack must be at least 70 m above ground level, to ensure that emissions released do not result in more than 25% of the ambient air quality limits at ground level. | Engineering Manager | Detailed engineering design stage |
| 19 | Regular maintenance | Schedule adequate and regular maintenance activities across all smelter operations in order to ensure stable operations of the plant and related emissions control of dust and gas. | Engineering Manager | Ongoing |

**General Waste Site**

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</table>
| 21 | Dust Control | Wet suppression will be utilised in order to reduce fugitive dust emissions. Should wet suppression not be sufficient, soil binding agents will be utilised.  
Durable dust suppression coating to be in place on permanent haul and other roads at the general waste site. | Site Manager | Ongoing |
| 22 |   |   |
| 23 |   | Vegetate inactive areas on site. | Environmental Manager | Immediate and Ongoing |

**Hazardous Waste Site**

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</table>
| 24 | Dust control | Trucks transferring waste to site are not to be filled above the brim of the trailer.  
Proper handling and disposal of arsenic containing dusts at the waste site. | Site Manager | Ongoing |
<p>| 25 |   |   |
| 26 |   | Leachate and surface water from the return water dam is to be used for dust control on the hazardous waste site. If volumes of recycled water are insufficient for dust control, water is to be supplemented from another source. Overspray of water is to be prevented in order to contain contaminated water within the hazardous waste site footprint. |   |   |</p>
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<tbody>
<tr>
<td>27</td>
<td>Consider the addition of an effective dust suppressant chemical to the water used for dust suppression. The choice of dust suppressant should be in line with the hazardous waste site operational manual, e.g. organic compositions are not allowed.</td>
<td>As required</td>
</tr>
<tr>
<td>28</td>
<td>Suitable cover material (reverberatory furnace slag) to be stockpiled on site and used to cover wastes to suppress dust formation on windy days. Alternatively cover unused areas with a tarpaulin.</td>
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**Sulphuric Acid Plant**

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<tbody>
<tr>
<td>29</td>
<td>Quality of Railway lines for acid transportation (Dust control)</td>
<td>Problems with rail transportation would be minimised through consultation with Transnamib regarding the required modifications to the line, appropriate maintenance, and effective emergency preparedness and response.</td>
</tr>
<tr>
<td>30</td>
<td>SO(_2) emissions</td>
<td>Ongoing management and maintenance of systems feeding off-gas to the sulphuric acid plant and the acid plant itself, in order to maintain improvements in SO(_2) levels in the surrounding area.</td>
</tr>
<tr>
<td>31</td>
<td></td>
<td>Ensure that the plant is optimised and operations are stable in order to reach a 95% acid conversion efficiency.</td>
</tr>
<tr>
<td>32</td>
<td></td>
<td>Establish a procedure for ramping down / shutting down production, should operational problems be experienced at the sulphuric acid plant.</td>
</tr>
<tr>
<td>33</td>
<td></td>
<td>Undertake continuous monitoring of SO(_2) emissions at the acid plant stack. Consider input of monitoring data into a real time atmospheric dispersion model.</td>
</tr>
<tr>
<td>34</td>
<td>Acid rain</td>
<td>Monitor the potential for acid rain generation during the wet season in off-site vegetated and cultivated areas surrounding the smelter property.</td>
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**Kliplime Quarry**

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<tbody>
<tr>
<td>35</td>
<td>Dust control</td>
<td>Dust emitted from operations at the quarry and from transport vehicles on the access road must be managed as this may have an impact on the game and vegetation on the surrounding Tsumore Farm.</td>
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**Emissions Monitoring**

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<tbody>
<tr>
<td>36</td>
<td>Undertake stack emission testing for the full operational cycle of the RHF once the furnace is operational in order to validate theoretical emission estimates.</td>
<td>Operations Director / Environmental Manager</td>
</tr>
<tr>
<td>37</td>
<td>Undertake stack emissions testing on the outlet of the converter baghouse over the full converter cycle and at all other outlets to the atmosphere in order to monitor the efficiency of controls.</td>
<td>Operations Director / Environmental Manager</td>
</tr>
<tr>
<td>38</td>
<td>Measure building fugitive emissions once the RHF has been commissioned. These emissions need to be updated given the decommissioning of the reverberatory furnace.</td>
<td>Operations Director / Environmental Manager</td>
</tr>
</tbody>
</table>
as well as to determine the extent of fugitive emissions from the charging and pouring RHF. Determine arsenic (and other chemicals of concern) content in particulate emissions.

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</thead>
<tbody>
<tr>
<td>39</td>
<td>Improve data availability on the PM$<em>{10}$ analysers installed at the DPMT ambient monitoring stations and include additional equipment for monitoring the PM$</em>{2.5}$ parameter. Also maintain data availability for SO$_2$ and metal parameters by establishing a monitoring station maintenance programme and ensuring that critical spare equipment is kept in stock.</td>
<td>Environmental Manager</td>
</tr>
<tr>
<td>40</td>
<td>Any anomalies or elevated levels in the ambient air quality monitoring station data should be immediately communicated to the site management team in order to ascertain the likely links of such anomalies with specific smelter operations/performance.</td>
<td>Environmental Manager, Ambient air quality data consultant</td>
</tr>
<tr>
<td>41</td>
<td>Consider extending the ambient air quality monitoring network to include two additional monitoring stations, one at the airport and a second 1-2 km northwest of the smelter boundary.</td>
<td>Environmental Manager</td>
</tr>
<tr>
<td>42</td>
<td>Expand the fall-out dust monitoring programme by installing monitoring equipment in strategic places around the smelter site and at ambient monitoring stations.</td>
<td>Environmental Manager</td>
</tr>
</tbody>
</table>
4

SOILS AND LAND MMP
4. Soils Management and Mitigation Plan

4.1 Components
This plan is made up of the following components:

- Reducing the risk of soil contamination

4.2. Management and Mitigation

4.2.1 Reducing the risk of soil contamination

Objectives
- To minimise contamination within the smelter footprint
- To contain spillages of hazardous chemicals from equipment and vehicles and to prevent soil contamination from hydrocarbon spills.
- To protect soils from becoming contaminated by runoff from the waste site and other contaminated areas

Actions

TABLE 4: ACTIONS RELATING TO SOILS

<table>
<thead>
<tr>
<th>No</th>
<th>Issue</th>
<th>Management/Mitigation</th>
<th>Responsibility</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Containment of hazardous material and risk of contamination of smelter footprint</td>
<td>In all areas where there is storage of hazardous substances (i.e. hydrocarbons), there will be containment of spillages on impermeable floors and bund walls that can contain 110% of the volume of the hazardous substances. All re-fuelling and any maintenance of vehicles will also take place on impermeable surfaces.</td>
<td>Operations Director</td>
<td>Within 12 months of approval</td>
</tr>
<tr>
<td>2</td>
<td>Concrete or similar impervious surfaces are to be provided in all areas where concentrates and hazardous smelter wastes (e.g. baghouse dusts) are handled or stored.</td>
<td>Operations Director</td>
<td>Within 12 months of approval</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Regularly inspect concrete surfaces and undertake annual integrity tests in order to ensure that contaminants do not enter into underlying soils.</td>
<td>Operations Director</td>
<td>Immediate and ongoing</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>The handling and storage of hazardous workshop wastes is to take place on concrete and bundled surfaces.</td>
<td>Engineering Manager</td>
<td>Ongoing</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Existing stockpiles of arsenic calcines and baghouse dusts are to be disposed within the hazardous waste disposal site or another registered hazardous waste disposal facility.</td>
<td>Environmental Manager</td>
<td>Ongoing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Action/Measure</td>
<td>Responsible Party</td>
<td>Status</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------------------------------------------</td>
<td>------------------------------------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Baghouse dusts and calcines that cannot be processed are to be disposed of at the hazardous waste site.</td>
<td>Operations Director</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Existing onsite contamination should be managed as part of the broader site contamination management</td>
<td>Site Manager</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Appropriate protective clothing should be worn when in close contact with the soil material to limit dermal and respiratory contact</td>
<td>H&amp;S Manager</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Pollution will be prevented through basic infrastructure design and through maintenance of equipment.</td>
<td>Engineering Manager</td>
<td>Ongoing</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Maintain and update the Hazardous Chemical Substances Emergency Response Plan in line with the increased throughput capacity of the smelter.</td>
<td>Operations Director and Environmental Manager</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Any spills will be contained and cleaned up immediately. Spillages of chemicals during operations are to be reported and investigated through the site incident reporting and investigation procedure. Any contaminated soil must be contained within appropriate containers until such a time that they can be disposed of at an appropriate facility.</td>
<td>Operations Director and Quarry Manager</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Implement cattle-grids and vehicle brushes (or sprayers if dirty water is available) on the exit road from the smelter in order to minimise transport of polluted dust on car tyres into Tsumeb. Desludge the water collection basins regularly and dispose of the sludge on the tailings facilities.</td>
<td>Operations Director and Environmental Manager</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Develop a contamination containment plan for the smelter site in line with the CLA and incorporate the above measures.</td>
<td>Environmental Manager</td>
<td>Within 1 year of approval</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Soil contamination (Smelter Waste Management Facilities)</td>
<td>Operations and Engineering Manager</td>
<td>Ongoing</td>
<td></td>
</tr>
</tbody>
</table>

**Slag Dumps, Non-Designated Dumping Areas, Tailings Storage Facilities, and Evaporation Ponds:**
- Construct and maintain optimum functioning of the 'clean' storm water runoff diversion canals/drains in order to divert 'clean' water around these potential pollution sources;
- Construct and maintain optimum functioning of 'dirty' water runoff intercept canals/drains to the pollution control dams; and
- Remove non-designated waste and non-waste dumps to designated dumping areas.

**Tailings Pipelines:**
- Construct and maintain earth bund walls (vegetated) along entire length of pipelines;
- Immediately repair pipelines where necessary; and
- Immediately clean up spills.
<table>
<thead>
<tr>
<th></th>
<th>Soil Contamination</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>(Process Water</td>
</tr>
<tr>
<td></td>
<td>Storage Facilities,</td>
</tr>
<tr>
<td></td>
<td>and Clean Storm-Water Separation Facilities)</td>
</tr>
<tr>
<td></td>
<td>Pollution Control Dams and ‘Dirty’ Water Canals/Drains:</td>
</tr>
<tr>
<td></td>
<td>• Construct and maintain optimum functioning of these clad (HDPE or concrete) features by attending to leaks, clearing blockages, preventing siltation and purifying the ‘dirty’ water for re-use in the plant.</td>
</tr>
<tr>
<td></td>
<td>‘Clean’ Water Runoff Diversion Canals:</td>
</tr>
<tr>
<td></td>
<td>• Maintain optimum functioning of these earth canals, in order to re-direct ‘clean’ water around these potential pollution sources.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>18</th>
<th>Soil Contamination</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Topsoil’ stockpiles/berms for rehabilitation ‘topsoiling’ purposes)</td>
</tr>
<tr>
<td></td>
<td>Sample/fertilize the ‘topsoil’ once every 3-4 years in order to maintain vegetative basal cover, thereby limiting soil erosion. No Grazing or burning of vegetation should be allowed.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>19</th>
<th>Soil contamination via surface and stormwater runoff</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control and minimise the ingress of stormwater within the plant footprint as part of a stormwater management plan.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>20</th>
<th>Ongoing contaminated soil remediation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Undertake regular monitoring of groundwater and surface water within the smelter footprint and specifically surrounding the sulphuric acid plant.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>21</th>
<th>Ongoing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In line with the CLA findings, the following measures should be considered for implementation on-site:</td>
</tr>
<tr>
<td></td>
<td>• Control contamination sources by planting shelter-belts of indigenous drought-tolerant evergreen trees along roads and around buildings to protect against fugitive dust and to consume polluted run-off.</td>
</tr>
<tr>
<td></td>
<td>• Remove spilled tailings and polluted sediments from the Jordan River in the dry season and dispose of it on the tailings facility.</td>
</tr>
<tr>
<td></td>
<td>• Phytoremediation and stabilisation of the Jordan River stream banks with vegetation to prevent erosion of polluted riparian soils. With minimal disturbance, plant riparian species indigenous to the general region.</td>
</tr>
<tr>
<td></td>
<td>• Removal of the thin layer (&lt;20cm) of surface spilled tailings to expose underlying wetland soils where the Jordan River discharges and planting of indigenous wetland species for phytoremediation.</td>
</tr>
<tr>
<td></td>
<td>• Phytoremediation of patches of polluted soils using plants to extract sulphur and metals, where feasible, without further disturbance.</td>
</tr>
<tr>
<td></td>
<td>• Undertake periodic harvesting of the metal-loaded leaves or branches and dispose on the tailings dam areas for dust suppression or mulch. Allow plants to resprout.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Plant Manager and Environmental Manager</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ongoing</td>
</tr>
</tbody>
</table>
- (perennials) or replant (annuals) after harvesting.
- Excavation of the thin layer (<5cm to 30cm) of polluted soils across the smelter site and use for soil cladding on tailings facilities in preparation for vegetation.
- Establish vegetation cover on the tailings facilities to control seepage to groundwater and prevent run-off of polluted stormwater.
- Continue with nursery operation and trials for phytoremediation.
- See the CLA study through to completion and review and add actions from the CLA for implementation as the studies are completed.

<table>
<thead>
<tr>
<th>General Waste Site</th>
<th>Soil Contamination</th>
<th>The waste site design provides for containment of contaminated water on the site.</th>
<th>Design engineers</th>
<th>Prior to Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>Soil Contamination</td>
<td>Should soils become contaminated; the contaminated soils will be contained and removed for appropriate disposal, either to landfill or to the hazardous waste disposal site, should the soil be contaminated with arsenic at the prerequisite levels for disposal.</td>
<td>Waste Site Operator</td>
<td>Ongoing</td>
</tr>
<tr>
<td>23</td>
<td>Soil Contamination</td>
<td>Soils contaminated with hydrocarbons are to be bioremediated.</td>
<td>Environmental Manager</td>
<td>Ongoing</td>
</tr>
</tbody>
</table>
5
GROUNDWATER MMP
5. Groundwater Management and Mitigation Plan

5.1 Components
This plan is made up of the following components:

- Reducing the risks of groundwater contamination

5.2. Management and Mitigation

5.2.1 Reducing the risks of groundwater contamination

Objectives

- To comply with the Namibian regulatory requirements
- To put measures in place to align the operations with the provisions of international best practices to protect water resources.
- To reduce the impact of the cone of depression caused by groundwater abstraction.
- To reduce the off-site spread of contaminated groundwater.
- To protect groundwater resources from seepage from potential contaminant sources
- To assess the effectiveness of pollution control measures.

Actions

TABLE 5: ACTIONS RELATING TO GROUNDWATER

<table>
<thead>
<tr>
<th>No</th>
<th>Issue</th>
<th>Management/Mitigation</th>
<th>Responsibility</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Contamination risk</td>
<td>East tailings dam is to be rehabilitated to prevent groundwater pollution as required in line with the draft Closure Plan.</td>
<td>Environmental Manager</td>
<td>Within 3 years of approval</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>The use of standard erosion control measures, such as interception drains, contour planting, silt fences, establishment of groundcover species, optimal drainage construction, and silt ponds are applied where appropriate.</td>
<td>Operations Director / Environmental Manager</td>
<td>Within 2 years of approval</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Regular maintenance and proper safety procedures to prevent leaks and spills.</td>
<td>Plant Manager and Transport Manager</td>
<td>Ongoing</td>
</tr>
<tr>
<td>4</td>
<td>Implement and strengthen, where necessary, procedures to respond to emergency product spills in areas of DPMT responsibility. This may extend beyond the immediate boundary of the DPMT site.</td>
<td>Environmental Manager / Plant Manager</td>
<td>Ongoing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Contamination risk</td>
<td>Dispose of waste material at a suitably contained disposal site.</td>
<td>Environmental Manager</td>
<td>Ongoing</td>
</tr>
<tr>
<td>---</td>
<td>-------------------</td>
<td>---------------------------------------------------------------</td>
<td>-----------------------</td>
<td>---------</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Implement the Phytoremediation trials in line with the closure plan.</td>
<td>Environmental Manager</td>
<td>Ongoing, after establishment of nursery</td>
</tr>
<tr>
<td>7</td>
<td>Groundwater monitoring</td>
<td>Maintain the current groundwater site wide sampling programme (i.e. timing, depth, efficiency of testing equipment, record keeping, etc.) in order for a database to be built up on water quality and enable rapid identification of any changes in quality.</td>
<td>Environmental Manager / Plant Manager</td>
<td>Ongoing</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Continued monitoring of groundwater quality and levels for the minimum period as specified by Namibian environmental regulations where applicable (e.g. S 31 EMA and the Water Act).</td>
<td>Environmental Manager / Plant Manager</td>
<td>Ongoing</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>Install one upgradient and two down gradient monitoring boreholes that can be monitored and sampled to determine the potential quality of unsaturated groundwater flow in the immediate vicinity of the sulphuric acid plant.</td>
<td>Environmental Manager</td>
<td>In line with budgetary allocations</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>Regular monitoring of the existing groundwater monitoring system shall occur at least quarterly and reported annually to authorities who regulate the management of the Tsumeb aquifers (Northern OML aquifer resource).</td>
<td>Environmental Manager</td>
<td>Ongoing</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>Any complaints with respect to the management of groundwater quality will be directed to the site management. Complaints and any actions arising from a complaint will be recorded in a complaints register to be maintained by site management.</td>
<td>Environmental Manager</td>
<td>Ongoing</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>Include regional groundwater monitoring from existing farm and municipal boreholes and produce a detailed groundwater monitoring schedule.</td>
<td>Environmental Manager</td>
<td>Ongoing</td>
</tr>
<tr>
<td>14</td>
<td>Identification of pollution sources</td>
<td>Implementation of the planned project for identifying major sources of groundwater pollution and implementing the clean-up and remediation of these sources over the DPMT site, for which a draft scope of work is already in place.</td>
<td>Environmental Manager / Environmental consultant</td>
<td>Within 1 year of approval</td>
</tr>
<tr>
<td>15</td>
<td>Arsenic plume migration</td>
<td>Additional boreholes should be drilled to the north of the site to better detect the arsenic pollution plume migration.</td>
<td>Plant Manager and Environmental Manager</td>
<td>Within 2 years of approval</td>
</tr>
<tr>
<td>16</td>
<td></td>
<td>The currently predicted movement of the arsenic plume needs to be re-evaluated, taking into consideration the groundwater quality data from the TGWS. All other data available from DPMT, GROWAS and the SLR databases for the area should be utilised.</td>
<td>Plant Manager and Environmental Manager</td>
<td>Within 2 years of approval</td>
</tr>
<tr>
<td></td>
<td>Activity</td>
<td>Responsible Party</td>
<td>Timeframe</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>--------------------------------------------------------------------------</td>
<td>-----------------------------------</td>
<td>----------------------------</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Investigate targeted solutions for groundwater treatment and pollution source elimination in order to reduce potential offsite pollution.</td>
<td>Environmental Manager</td>
<td>After refining of groundwater model</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td><strong>Groundwater model</strong></td>
<td>Environmental Manager</td>
<td>Within 1 year of approval</td>
<td></td>
</tr>
</tbody>
</table>
|   | Build on and improve the existing groundwater model by incorporating the existing regional Government model produced in 2003. The following data / results are to be included:  
  - Rest water level data should be collected by monitoring three times a year in all boreholes;  
  - Sampling of boreholes used for irrigation and water supply;  
  - Determine vertical and horizontal gradients in the aquifer system; and  
  - Develop and update a dynamic water balance model to integrate into the future groundwater model updates. | Environmental Manager             | Within 1 year of approval   |
| 19| **Impact on groundwater quantity**                                       | Plant Manager                     | Immediate                  |
|   | Continue to monitor water levels in boreholes on site and off site (including Tsumeb Municipality and DWAF monitoring and production boreholes) to monitor possible cone of depression caused by pumping from Shaft 1. | Plant Manager                     | Immediate                  |
| 21| Obtain a groundwater abstraction permit from Ministry of Agriculture, Water and Forestry | Environmental Manager             | Within 1 year of approval   |
| 22| **Handling and storage of hazardous substances**                         | Environmental and Engineering Managers | Ongoing                   |
|   | In all areas where there is storage of hazardous substances (i.e. hydrocarbons), there will be containment of spillages on impermeable floors and bund walls that can contain 110% of the volume of the hazardous substances. | Environmental and Engineering Managers | Ongoing                   |
| 23| All re-fuelling and any maintenance of vehicles will take place on impermeable surfaces. | Operations Director              | Ongoing                   |
| 24| Pollution will be prevented through basic infrastructure design and through maintenance of equipment. | Operations Director              | Ongoing                   |
| 25| Environmental awareness for contractor and employees to be included during inductions. | Environmental Manager             | Ongoing                   |
| 26| Any spills will be contained and cleaned up immediately.                 | Environmental Manager             | Ongoing                   |
| 27| **Stormwater management**                                                | Environmental Manager             | In a phased manner in line with stormwater management plan |
|   | Implement the surface water infrastructure upgrade project for the improved management of stormwater across the smelter site. Prioritised water infrastructure projects include the following:  
  - Pollution Control Dams;  
  - Drainage channels to Pollution Control Dams;  
  - Concrete lined channels to replace the existing damaged open channels;  
  - Lining of the No 10 Dam; | Environmental Manager             | In a phased manner in line with stormwater management plan |
- Recovering and rerouting contaminated water sources using bunding and pumps;
- Separation of process water and stormwater;
- Clean water separation via an earth embankment and sump; and
- Treatment of effluent for recycling.

### General Waste Site

<table>
<thead>
<tr>
<th>No.</th>
<th>Impact</th>
<th>Action Description</th>
<th>Responsible Officer</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>Groundwater</td>
<td>Clean storm water is to be diverted from all areas that may be contaminated.</td>
<td>Site Manager</td>
<td>In a phased manner in line with stormwater management plan</td>
</tr>
<tr>
<td>29</td>
<td>Groundwater</td>
<td>Water from the waste site is to be contained in a pollution control dam, recycled and re-used.</td>
<td>Site Manager</td>
<td>Ongoing</td>
</tr>
<tr>
<td>30</td>
<td>Groundwater</td>
<td>Monitor water quality near potential pollution sources and the surrounding community boreholes.</td>
<td>Environmental Manager</td>
<td>Continuation from planning phase</td>
</tr>
</tbody>
</table>

### Hazardous Waste Site

<table>
<thead>
<tr>
<th>No.</th>
<th>Containment of contaminants on site</th>
<th>Action Description</th>
<th>Responsible Officer</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>Ensure containment</td>
<td>Monitor and maintain leachate management systems to ensure liner efficiency in accordance with the Operational Manual.</td>
<td>Operations Director</td>
<td>As per requirements of Operational Manual.</td>
</tr>
<tr>
<td>32</td>
<td>Ensure containment</td>
<td>Implement and maintain a leachate treatment and recycling system in accordance with the Operational Manual.</td>
<td>Operations Director</td>
<td>As per requirements of leachate monitoring schedule</td>
</tr>
<tr>
<td>33</td>
<td>Ensure containment</td>
<td>Undertake regular leachate monitoring.</td>
<td>Environmental Manager</td>
<td>As per requirements of leachate monitoring schedule</td>
</tr>
<tr>
<td>34</td>
<td>Ensure containment</td>
<td>Continue to undertake regular groundwater monitoring.</td>
<td>Environmental Manager</td>
<td>As per requirements of groundwater monitoring schedule</td>
</tr>
</tbody>
</table>

### Sulphuric Acid Plant

<table>
<thead>
<tr>
<th>No.</th>
<th>Contamination risk</th>
<th>Action Description</th>
<th>Responsible Officer</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>Contamination risk</td>
<td>Appropriate collection of spillages of acid or contaminated solutions from leaking pipelines in areas that are not bunded, followed by remedial action if required (e.g. neutralisation with lime).</td>
<td>Plant Manager</td>
<td>Ongoing</td>
</tr>
<tr>
<td>36</td>
<td>Contamination risk</td>
<td>Implement and strengthen, where necessary, emergency procedures for product spills in areas of DPMT responsibility. This may extend beyond the immediate boundary of the DPMT site.</td>
<td>Plant Manager</td>
<td>As per requirements of Operational Manual</td>
</tr>
<tr>
<td>Closure Phase</td>
<td>Description</td>
<td>Person</td>
<td>Status</td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>-------------</td>
<td>----------------</td>
<td>-----------------------------</td>
<td></td>
</tr>
<tr>
<td>37 Rehabilitation</td>
<td>Decommissioning and closure procedures will be developed to avoid contamination of the groundwater resources as a result of activities such as the demolition, decontamination and storage of potentially contaminated plant infrastructure and waste.</td>
<td>Plant Manager / Environmental Manager</td>
<td>Ongoing</td>
<td></td>
</tr>
<tr>
<td>38 Rehabilitation of waste stockpiles and tailings facilities in line with the closure plan recommendations.</td>
<td>Environmental Manager</td>
<td>Ongoing and at closure</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6

SURFACE WATER MMP
6. Surface water Management and Mitigation Plan

6.1 Components

This plan is made up of the following components:
- Reducing the risks of surface water contamination

6.2. Management and Mitigation

6.2.1 Reducing the risks of surface water contamination

Objectives
- To minimise contamination risk to groundwater during construction and operation.
- To ensure the continued diversion of clean water around the site and the containment of dirty water on the site.
- To minimise additional contact runoff which could overload the storm water system.
- To upgrade areas where design capacity is reached, to prevent problems.
- To minimise health risks to surrounding communities, livestock and natural fauna and flora.

Actions

TABLE 6: ACTIONS RELATING TO SURFACE WATER

<table>
<thead>
<tr>
<th>No</th>
<th>Issue</th>
<th>Management/Mitigation</th>
<th>Responsibility</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Surface water contamination</td>
<td>The use of standard erosion control measures, such as interception drains, contour</td>
<td>Site Manager</td>
<td>Within 1 year of approval</td>
</tr>
<tr>
<td></td>
<td></td>
<td>planting, silt fences, establishment of groundcover species, optimal drainage</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>construction, and silt ponds are to be applied where appropriate.</td>
<td></td>
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</tr>
<tr>
<td>2</td>
<td></td>
<td>Regular maintenance and proper safety procedures to prevent leaks and spills.</td>
<td>Plant Manager</td>
<td>Ongoing</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Measure the remaining extent of contaminated soil on the smelter property and plant</td>
<td>Environmental</td>
<td>Ongoing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>a shelter belt of indigenous trees or shrubs along the edges of these areas in order</td>
<td>Manager</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>to prevent erosion and transport of contaminated soil into the Jordan River.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Implement phytoremediation and stabilisation of stream banks along the Jordan River</td>
<td>Environmental</td>
<td>Ongoing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>in order to prevent the erosion and spread of polluted riparian soils.</td>
<td>Manager</td>
<td></td>
</tr>
<tr>
<td>#</td>
<td>Category</td>
<td>Description</td>
<td>Responsible Party</td>
<td></td>
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<tr>
<td>5</td>
<td>Quality of Railway lines for acid transportation</td>
<td>Implement and strengthen, where necessary, emergency procedures to respond to emergency product spills in areas of DPMT responsibility. This may extend beyond the immediate boundary of the DPMT site.</td>
<td>Supply Chain Manager</td>
<td>Ongoing</td>
</tr>
</tbody>
</table>
| 6 | Storm Water Management | Implement the surface water infrastructure upgrade project for the improved management of stormwater across the smelter site. Prioritised water infrastructure projects include the following:  
- Pollution Control Dams;  
- Drainage channels to Pollution Control Dams;  
- Concrete lined channels to replace the existing damaged open channels;  
- Lining of the No 10 Dam;  
- Recovering and rerouting contaminated water sources using bunding and pumps;  
- Separation of process water and stormwater;  
- Clean water separation via an earth embankment and sump; and  
- Treatment of effluent for recycling. | Plant and Engineering Managers | Implement in a phased manner, commencing within 1 year of approval |
<p>| 7 | Storm Water Management | Consider the addition of a diversion berm and channel to the east of the smelter in order to achieve clean water separation. This would reduce flooding of the plant during excessive storm events and reduce contamination of the Jordan River with arsenic laden runoff. | Ongoing |
| 8 | Storm Water Management | Undertake regular monitoring of stormwater infrastructure in order to ensure there are no blockages or excessive siltation and contact water is efficiently stored. | Ongoing |
| 9 | Storm Water Management | Undertake regular sampling of runoff water on the site and in the downstream Jordan River in order to monitor pollution levels of water leaving the site. | Environmental Manager | Ongoing |
| 10 | Storm Water Management | A study investigating phytostabilisation measures to control dust is to be completed. Preliminary recommendations include revegetation of exposed areas and the planting of pollution control woodlands at the base of tailings facilities to protect the Jordan River from runoff and sub-surface polluted seepage. | Specialist consultant | Ongoing |
| 11 | Additional surface water run-off | Review storm water calculations with increased contact water from additional slag storage. | Plant Manager | Within 1 year of approval |
| 12 | Emergency procedures | Ensure that emergency procedures are in place do deal with major flood events. | Operational Manager | Within 1 year of approval |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Drinking water</td>
<td>Undertake regular monitoring of on-site drinking water sources in order to ensure quality complies with Namibian drinking water standards.</td>
<td>Environmental Manager</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td><strong>Sewerage Plant</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Contamination source investigation</td>
<td>Complete the investigation into the source of current oil and other waste water in the sewerage system in order to fully commission the sewerage treatment plant.</td>
<td>Environmental Manager/Specialist Consultant</td>
</tr>
<tr>
<td>15</td>
<td>Monitoring</td>
<td>Once fully operational, the sewerage plant will be monitored in accordance with the site water monitoring programme.</td>
<td>Plant Manager and Environmental Manager</td>
</tr>
<tr>
<td>16</td>
<td>Monitoring</td>
<td>Continuously monitor workshops, oil spillages, sewerage pipelines and connections in order to prevent oil and other waste streams that could damage sewerage plant infrastructure from entering the system.</td>
<td>Plant Manager and Environmental Manager</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td><strong>General Waste Site</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Storm Water Management</td>
<td>Clean storm water is to be diverted from all areas that may be contaminated.</td>
<td>Site Manager</td>
</tr>
<tr>
<td>18</td>
<td></td>
<td>Water from potentially contaminated areas to be contained in pollution control dams, recycled and re-used. Implement a water quality monitoring programme at the general waste site area.</td>
<td>Site Manager</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hazardous Waste Site</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Diversion of clean water around the site and containment of dirty water</td>
<td>Monitoring and maintenance of surface water management measures in accordance with Operational Manual.</td>
<td>Site Manager</td>
</tr>
<tr>
<td>20</td>
<td>Implementation and maintenance of stormwater recycling system for run-off collected on site in accordance with Operational Manual.</td>
<td>Site Manager</td>
<td>As per requirements of Operational Manual</td>
</tr>
</tbody>
</table>
7

NOISE MMP
7. Noise Management and Mitigation Plan

7.1. Components
This plan is made up of the following components:

- The monitoring and management of noise impact

7.2. Management and Mitigation

7.2.1 The monitoring and management of noise impact

Objectives

- To minimise noise disturbance to surrounding communities
- To reduce impacts of noise from blasting and drilling on the surrounding areas and on the game on Tsumore Farm.

Actions

<table>
<thead>
<tr>
<th>No</th>
<th>Issue</th>
<th>Management/Mitigation</th>
<th>Responsibility</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Noise complaints</td>
<td>Monitor public complaints related to noise production from the smelter.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Noise complaints</td>
<td>If a complaint regarding noise emissions relating to the continuous audibility of the operations is received, short term (24-hour) ambient noise measurements should be conducted as part of investigating the complaint. The results of the measurements should be used to inform any follow-up interventions. Measurements should be conducted by a trained specialist.</td>
<td>Environmental Manager and trained specialist</td>
<td>Immediate</td>
</tr>
<tr>
<td>3</td>
<td>High noise activities</td>
<td>As far as is practicable, restrict start-up and major plant maintenance activities to daylight hours, should these activities be the source of high noise levels.</td>
<td>Operations Director</td>
<td>Ongoing</td>
</tr>
<tr>
<td>4</td>
<td>Vehicle maintenance</td>
<td>All diesel-powered equipment and plant vehicles should undergo regular maintenance in order to prevent excessive noise levels. Undertake regular inspection of plant and, if necessary, replace intake and exhaust silencers.</td>
<td>Site and Plant Manager</td>
<td>Ongoing</td>
</tr>
<tr>
<td></td>
<td>Plant equipment</td>
<td>Select equipment with lower sound power levels. Vendors should be required to guarantee optimised equipment design noise levels. Implement engineering controls (e.g. installation and maintenance of silencers) in order to limit noise levels.</td>
<td>Supply Chain Manager</td>
<td>Detailed design stage Ongoing</td>
</tr>
<tr>
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</tr>
</tbody>
</table>
| 6 | Traffic noise | For management of noise from truck and vehicle traffic, the following should be implemented:  
- Minimise individual vehicle engine, transmission, and body noise/vibration. This is achieved through the implementation of an equipment maintenance program.  
- Maintain road surface regularly to avoid corrugations and potholes.  
- Avoid unnecessary idling times.  
- Minimise the need for trucks/equipment to reverse. This will reduce the frequency at which disturbing but necessary reverse warnings will occur. | Site and Plant Manager | Ongoing |
| 7 | Plant engineering solutions | Maintain or replace the silencer on the outlet of the No. 2 oxygen plant in order to limit excessive noise levels during start-up. | Plant Manager | Immediately |
| 8 | Noise monitoring | Implement a noise monitoring programme to measure noise levels at sensitive noise receptors outside of the smelter footprint. | Environmental Manager | Ongoing on an annual basis |
| 9 | Noise reduction | Establish a noise reduction action plan in order to manage the impact of noise from current processes on the surrounding environment and employees. Include administrative measures and engineering controls. | Environmental and Health and Safety Manager | Within 1 year of approval |

**Kliplime Quarry**

| 10 | Blasting and drilling noise | Blasting and drilling operations must be limited to daylight hours during the week. | Quarry Manager | Ongoing |
8
ECOLOGY MMP
8. Ecology Management and Mitigation Plan

8.1 Components

This plan is made up of the following components:

- Minimizing the damage and risks to natural ecology

8.2. Management and Mitigation

8.2.1 Minimizing the damage and risks to natural ecology

Objectives

- To prevent damage or risks to natural ecology
- To control encroachment and proliferation of invasive and weed species
- To minimise disturbance to biodiversity and to minimise pressure on natural resources
- To limit the spread of alien invasive vegetation.

Actions

TABLE 8: ACTIONS RELATING TO ECOLOGY

<table>
<thead>
<tr>
<th>No</th>
<th>Issue</th>
<th>Management/Mitigation</th>
<th>Responsibility</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DPMT Smelter Plant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Biodiversity Action Plan</td>
<td>Complete and execute a full Biodiversity Action Plan to address all issues relating to biodiversity management and rehabilitation, including all the below measures.</td>
<td>Environmental Manager and specialist biodiversity consultant</td>
<td>Within 2 years of approval</td>
</tr>
<tr>
<td>2</td>
<td>Damage or risks to natural ecology</td>
<td>Implement measures for the control of SO$_2$ emissions as set out in the Air Quality MMP to reduce risk of damage to vegetative material as a result of SO$_2$ emissions.</td>
<td>Operations Director</td>
<td>Ongoing</td>
</tr>
<tr>
<td>3</td>
<td>Alien vegetation</td>
<td>Implement dust control measures as set out in the Air Quality MMP to reduce release of particulates which results in contamination of soils and vegetation.</td>
<td>Environmental Manager</td>
<td>Ongoing</td>
</tr>
<tr>
<td>4</td>
<td>Alien vegetation</td>
<td><strong>Problem alien invasive species on DPMT property are to be controlled to prevent the spread of such species. Priority species for removal include the rubber vine (Cryptostegia grandiflora), wonderboom (Leucaena leucocephala),</strong></td>
<td>Environmental Manager</td>
<td>Ongoing</td>
</tr>
</tbody>
</table>
wild tobacco (*Nicotiana glauca*) and *Prosopis* species.
- Plan formal debushing operations targeting species and terrain that will provide optimal recovery if removed.
- In the event that alien species provide a stability function, they are to be replaced with suitable indigenous species in a phased manner prior to removal.
- Develop initiatives to contain invasive and alien species in the alien infested habitats along the eastern edge of the smelter property.
- Remove cleared alien vegetation off-site so that it does not pose a fire risk.

| 5 | Weeds | Weeds are to be mechanically removed and/or chemically controlled as appropriate. Disposal methods for cuttings will depend on the species (e.g. burning). | Environmental Manager | Ongoing |
| 6 | No-go areas | Declare the dolomite hill habitat as a no-go area and avoid any further expansion into this habitat in line with the Biodiversity Action Plan. | Operations Director \nEnvironmental Manager | Within 1 year of approval |
| 7 | Plant removal | Reduce access to the dolomite hill habitat and sandy plain habitat within the smelter boundary in order to prevent poaching of indigenous plants for firewood and medicinal purposes. | Environmental Manager | Ongoing |
| 8 | Promote species diversity | Diversify the range of dominant vegetation species across the smelter property through the following:
- Collect seeds of preferred species identified in the Biodiversity Action Plan and reseed areas selected with the purpose to create new base areas from which they can spread naturally, e.g. drainage line banks.
- Target the sandy plains and the old eastern tailings facility.
- Use only indigenous species. | Environmental Manager | Ongoing |
| 9 | Firewood harvesting | Allow legal wood harvesting in the alien infested habitat by allowing ease of access and ensure that only alien and invasive species are targeted. | Operations Director \nEnvironmental Manager | Ongoing |
| 10 | Animals | DPMT will implement a zero tolerance policy with regard to the killing of any animals, including poaching. This applies to people directly employed by DPMT as well as any contractors working on their behalf. | Environmental Manager | Ongoing |
| 11 | Road kills | Prevent large animals (livestock and game) from entering the premises and drinking from contaminated open water sources. | | |
| 12 | Fire | No open fires will be permitted on site, except for fires in a controlled environment used for fire fighting training. | Environmental Manager | Ongoing |
| 13 | Bird strikes | Monitor for bird mortalities by undertaking the following steps: | Environmental Manager | Ongoing |

**Powerline**

| 14 | Bird strikes | Monitor for bird mortalities by undertaking the following steps: | Environmental Manager | Ongoing |
- Undertake quarterly monitoring surveys for bird mortalities along the entire length of powerline infrastructure and transformer structures, as well as on and around the tailings dam and near flood lights.
- The identified "sensitive" sections should especially be closely checked, including the parts that cross drainage lines and other obvious flight corridors, and especially the section closest to the farm dam.
- All mortalities should be recorded and reported to the DPMT Environmental Section and the NamPower/NNF Strategic Partnership to follow up and obtain specific recommendations around management.
- Should collisions start to occur repeatedly in any one area on the line that is not marked, the relevant section(s) should be retro-fitted with appropriate mitigation measures (flaps/markers). Should collisions still take place after mitigation, the marking methods would need to be reassessed.

<table>
<thead>
<tr>
<th>Kliplime Quarry</th>
<th>15</th>
<th>Vegetation removal</th>
<th>Areas (quarry and project footprint area) from which vegetation may be removed are to be delineated prior to removal and vegetation is only to be removed from these areas.</th>
<th>Quarry Manager</th>
<th>During operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td></td>
<td>This material must be removed from the quarry site so that it does not pose a fire hazard.</td>
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<tr>
<td>17</td>
<td></td>
<td>Consider the utilisation of cleared material in the creation of windrows on old tailings facilities within the smelter boundary in order to promote plant growth by providing compost and acting as traps for seeds and plant material.</td>
<td>Environmetal Manager</td>
<td>Ongoing</td>
<td></td>
</tr>
</tbody>
</table>
9

COMMUNITY HEALTH AND SAFETY MMP
9. Community Health and Safety Management and Mitigation Plan

9.1 Components
This plan is made up of the following components:
• Ensuring community health and safety

9.2. Management and Mitigation
9.2.1 Ensuring community health and safety
Objectives
• To monitor the impact of smelter operations on community health and safety
• To protect members of the community from dangers associated with access to the Kliplime Quarry.

Actions

TABLE 9: ACTIONS RELATING TO COMMUNITY HEALTH AND SAFETY

<table>
<thead>
<tr>
<th>No</th>
<th>Issue</th>
<th>Management/Mitigation</th>
<th>Responsibility</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DPMT Smelter Plant</td>
<td>Initiate a process with Government to delineate and establish a buffer zone, taking into account findings of specialist studies in the current ESIA and other ancillary studies. This buffer zone is to exclude agricultural development, collection of plant material (such as marula fruit) and certain commercial activities that place people at risk as a result of historical and future fallout of chemicals of concern from the smelter. The buffer zone is to be maintained in consultation with the appropriate local authorities in order to exclude residences within areas that may result in the exposure of persons to air quality emissions and soils containing high levels of pollutants.</td>
<td>Environmental Manager</td>
<td>Within 6 months of approval</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Buffer zone</td>
<td>Initiate a process with Government to delineate and establish a buffer zone, taking into account findings of specialist studies in the current ESIA and other ancillary studies. This buffer zone is to exclude agricultural development, collection of plant material (such as marula fruit) and certain commercial activities that place people at risk as a result of historical and future fallout of chemicals of concern from the smelter. The buffer zone is to be maintained in consultation with the appropriate local authorities in order to exclude residences within areas that may result in the exposure of persons to air quality emissions and soils containing high levels of pollutants.</td>
<td>Environmental Manager</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Community health monitoring</td>
<td>Regular monitoring programme to be set up for voluntary community urine arsenic level testing. Schedule should be in line with a health specialist’s recommendations. Monitoring should include tap water and drinking water source testing.</td>
<td>Health and Hygiene Manager / Stakeholder Affairs manager</td>
</tr>
<tr>
<td></td>
<td>Actions</td>
<td>Recommendations</td>
<td></td>
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<td>**************************************************************************</td>
<td>**********************************************************************************</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Actions are to be identified to address issues of exposure identified by community health monitoring and to implement measures to reduce such exposure.</td>
<td><em>Plant Manager</em></td>
<td><strong>Ongoing</strong></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Reduce SO₂ exposure Better control fugitive SO₂ emissions at all points, particularly capturing emissions at the furnaces and the converters and from slow cooling of slag. Implement air quality management measures in the Air Quality MMP.</td>
<td><em>Plant Manager</em></td>
<td><strong>Ongoing</strong></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Reduce inorganic arsenic exposure Decommission the arsenic plant.</td>
<td><em>Operations Director</em></td>
<td><strong>Immediate</strong></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Efficient hazardous waste site operation Efficient operation and maintenance of the hazardous waste disposal site and closure and capping in line with the long term operational and closure plans when the approved capacity is reached</td>
<td><em>Operations Director</em></td>
<td><strong>In accordance with the deposition / operations manual</strong></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Emissions monitoring Ensure all air quality monitoring stations are functional for SO₂.</td>
<td><em>Environmental Manager</em></td>
<td><strong>Ongoing</strong></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Ensure that equipment at the monitoring stations is maintained and functional and undertake immediate repairs when necessary.</td>
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</tr>
<tr>
<td>9</td>
<td>Undertake PM₂.₅ monitoring at the monitoring stations.</td>
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</tr>
</tbody>
</table>
| 10 | Arsenic exposure investigation Further arsenic exposure investigations to include the following:  
• Annual determination of arsenic levels in soil and grown vegetables/fruit in areas not covered by existing studies;  
• Hand to mouth behaviour as an arsenic exposure pathway;  
• Undertake more urine arsenic sampling in the most affected areas to the north of Tsumeb;  
• Undertake more urine arsenic sampling in undersampled areas within Tsumeb along with unexposed controls; and  
• Formalise a community arsenic management and monitoring programme to include the above investigations. Include community awareness component to address, e.g. personal hygiene and the related prevention of hand to mouth transmission of arsenic dust. | *Environmental Manager / Health Specialist* | **Ongoing** **Within 1 year of approval** |
<p>| 11 | Harvesting of plant foods No harvesting of wild plant foods or edible insects is to be allowed within the smelter boundary. | <em>Operations Director</em> | <strong>Ongoing</strong> |
| 12 | Fencing and access Fencing around the smelter site, tailings storage facilities and general waste site is to be maintained and access controlled. | <em>Utilities Manager</em> | <strong>Ongoing</strong> |</p>
<table>
<thead>
<tr>
<th></th>
<th>Dangers associated with access to the Kliplime Quarry</th>
<th>Quarry Manager</th>
<th>Ongoing</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>The fencing around the Kliplime Quarry is to be maintained and access to the site is to be prohibited (gate is to be locked at all times).</td>
<td></td>
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</tr>
<tr>
<td>14</td>
<td>Warning signage is to be put in place.</td>
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<tr>
<td>15</td>
<td>Provide site security during drilling and blasting.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quarry Manager</td>
<td>Ongoing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hazardous Waste Site</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Control access</td>
<td>Plant/Site Manager</td>
<td>Ongoing</td>
</tr>
<tr>
<td>17</td>
<td>Maintain the fence and gate at the access point to the hazardous waste site.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Maintain warning / access restriction signs at entrance to site.</td>
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<td></td>
</tr>
<tr>
<td>18</td>
<td>Access to site is to be controlled and no unauthorised entry is to be allowed.</td>
<td></td>
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</tbody>
</table>
10

OCCUPATIONAL HEALTH AND SAFETY MMP
10. Occupational Health and Safety Management and Mitigation Plan

10.1 Components

This plan is made up of the following components:

- Ensuring health and safety of DPMT employees

10.2. Management and Mitigation

10.2.1 Ensuring community health and safety

Objectives

- To monitor the impact of smelter operations and expansion on occupational health and safety
- To improve the current occupational health and safety programmes to align with the increased smelter throughput capacity

Actions

TABLE 10: ACTIONS RELATING TO OCCUPATIONAL HEALTH AND SAFETY

<table>
<thead>
<tr>
<th>No</th>
<th>Issue</th>
<th>Management/Mitigation</th>
<th>Responsibility</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Arsenic exposure</td>
<td>Implement engineering controls for reducing arsenic exposure pathways rather than emphasising reliance on personal protective equipment (PPE).</td>
<td>Engineering Manager</td>
<td>Ongoing</td>
</tr>
<tr>
<td>2</td>
<td>Continued to implement job rotations, but at lower arsenic cut-off values.</td>
<td>Operational Manager and Health and Safety Manager</td>
<td>Within 6 months of approval</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Emissions control</td>
<td>Investigate options to avoid, reduce and contain fugitive emissions and dust associated with the various operational processes, especially with regards to the increased throughput capacity. Based on the options analysis, implement reasonable measures.</td>
<td>Operational Manager and Environmental Manager</td>
<td>Ongoing</td>
</tr>
<tr>
<td>4</td>
<td>Noise control</td>
<td>Investigate options to avoid and reduce noise exposure associated with the various operational processes, especially with regards to the increased throughput capacity. Based on the options analysis, implement reasonable measures.</td>
<td>Operational Manager and Environmental Manager</td>
<td>Ongoing</td>
</tr>
<tr>
<td></td>
<td>Task</td>
<td>Description</td>
<td>Responsible Party</td>
<td>Timeframe</td>
</tr>
<tr>
<td>---</td>
<td>----------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>5</td>
<td>Update monitoring programmes</td>
<td>Review and update occupational hygiene and biological monitoring programmes to include considerations as a result of the increased throughput capacity. This should include dust, noise, heat and fume exposure, amongst others. Strengthen the industrial hygiene programme with more emphasis on industrial hygiene led exposure control rather than monitoring.</td>
<td>Environmental and Health and Safety Manager</td>
<td>Within 6 months of approval</td>
</tr>
<tr>
<td>6</td>
<td>Reduce inorganic arsenic exposure</td>
<td>Decommission the arsenic plant.</td>
<td>Operations Director</td>
<td>Immediate</td>
</tr>
<tr>
<td>7</td>
<td>Efficient hazardous waste site operation</td>
<td>Efficient operation and maintenance of the hazardous waste disposal site and closure and capping in line with the long term operational and closure plans when the approved capacity is reached</td>
<td>Operations Director</td>
<td>In accordance with the deposition / operations manual</td>
</tr>
</tbody>
</table>
11

SOCIO-ECONOMIC MMP
11. Socio-Economic Management and Mitigation

11.1 Components

This plan is made up of the following components:

- Promoting local employment and improve local economy

11.2 Management and Mitigation

11.2.1 Promoting local employment and improve local economy

**Objectives**

- To increase contribution to local and regional economy

**Actions**

**TABLE 11: ACTIONS RELATING TO SOCIO-ECONOMIC ASPECTS**

<table>
<thead>
<tr>
<th>No</th>
<th>Issue</th>
<th>Management/Mitigation</th>
<th>Responsibility</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>To promote local employment and improve local economy.</td>
<td>Priority to be given to employment of local persons</td>
<td>Human Resources Manager</td>
<td>Ongoing</td>
</tr>
<tr>
<td>2</td>
<td>Procurement to be given to local service providers within the district as far as practical.</td>
<td></td>
<td>Procurement Manager and Human Resources Manager</td>
<td>Ongoing</td>
</tr>
<tr>
<td>3</td>
<td>DPMT procurement procedures to address capacity building within the community skill sector to meet potential job opportunities available at the plant or any future DPMT operations.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Gender equality</td>
<td>The recruitment selection process should continue to promote gender equality and the employment of women where possible.</td>
<td></td>
<td>Ongoing</td>
</tr>
<tr>
<td>5</td>
<td>Local SMME’s</td>
<td>In consultation with the Tsumeb Municipality, ensure that the database of local companies, specifically Small Medium and Micro Enterprises (SMME’s), that qualify as potential service providers is kept up to date. These companies should be notified of the tender processes and invited to bid for project-related work. Where possible, assist local SMME's to complete and submit tenders.</td>
<td></td>
<td>Ongoing</td>
</tr>
<tr>
<td></td>
<td>Action</td>
<td>Description</td>
<td>Responsible Party</td>
<td>Notes</td>
</tr>
<tr>
<td>---</td>
<td>--------</td>
<td>-------------</td>
<td>-------------------</td>
<td>-------</td>
</tr>
<tr>
<td>6</td>
<td>Tsumeb Community Trust</td>
<td>Continue to monitor the needs of the community in order to optimise the contribution of DPMT (e.g. via the Community Trust) to benefit the local and regional economy.</td>
<td>DPMT Management</td>
<td>Ongoing</td>
</tr>
<tr>
<td>7</td>
<td>Concentrate transport</td>
<td>Consider increasing the percentage of concentrate transported by rail from the Port of Walvis Bay in order to reduce safety risks posed by truck traffic to other road users.</td>
<td>Operational Manager Walvis Bay bulk handling facility operator</td>
<td>Investigate within 1 year of approval</td>
</tr>
<tr>
<td>8</td>
<td>Concentrate handling</td>
<td>Consider loading concentrate into bags before loading onto trucks at the bulk handling facility in the Port of Walvis Bay.</td>
<td></td>
<td>Investigate within 1 year of approval</td>
</tr>
</tbody>
</table>
| 9 | Sulphuric acid transport | The following measures shall be implemented when transporting sulphuric acid from the sulphuric acid plant:  
- The transporter must be provided with accurate information about the nature and properties of the load;  
- The load must be properly loaded and secured on site.  
- The transport operator must ensure that the Hazchem placards are properly fitted to the vehicle.  
- The responsible person must ensure that before the vehicle leaves the consignor's premises it is not overloaded or showing any obvious defect that would affect its safety.  
- Ensure that adequate steps are taken to minimise the effect an accident or incident may have on the public and on the environment; and  
- Initiate remedial action to clean up any spillage remaining on a site after an accident. | | |
12

WASTE MANAGEMENT MMP
12. Waste Management and Mitigation

12.1 Components

This plan is made up of the following components:

- Effective waste management strategies

12.2 Management and Mitigation

12.2.1 Effective waste management strategies

Objectives

- To minimise the impacts associated with waste generation and management on site

Actions

**TABLE 12: ACTIONS RELATING TO WASTE MANAGEMENT**

<table>
<thead>
<tr>
<th>No</th>
<th>Issue</th>
<th>Management/Mitigation</th>
<th>Responsibility</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Waste Management Plan</td>
<td>The current DPMT Waste Management Plan is to be updated to an Integrated Waste Management Plan in order to cover all aspects of waste production, reuse, recycling, treatment and disposal.</td>
<td>Plant Managers</td>
<td>Ongoing</td>
</tr>
<tr>
<td>2</td>
<td>Lining of new waste storage facilities</td>
<td>Ensure that all new waste-storage facilities are properly designed and constructed, as well as properly lined so as to prevent seepage into subsoil and the surrounding environment. These precautions will also restrict unwanted contact with humans and possible incompatible materials.</td>
<td>DPMT Management</td>
<td>When designing new waste storage facilities</td>
</tr>
<tr>
<td>3</td>
<td>Asbestos management</td>
<td>Review and upgrade the current asbestos management programme and drive actions in this plan for the appropriate management of asbestos waste products.</td>
<td>Environmental Manager</td>
<td>Within 1 year of approval</td>
</tr>
</tbody>
</table>
| 4  | Impacts associated with waste generation   | General requirements for storage and handling of waste:  
  - General and hazardous wastes are to be separated at source across all smelter operations;  
  - Formalise a general waste handling area(s) appropriate to the type and volume of wastes | Environmental Manager    | Ongoing                                |
received and processed;

- The waste handling area should be equipped to manage specific hazardous waste streams or a specific hazardous waste handling area(s) must be developed separately;
- Ensure that waste storage containers, are intact and not corroded or in any other way rendered unfit for the safe storage of waste;
- Clearly demarcate and provide signage on and around waste storage areas;
- Implement adequate measures to prevent accidental spillage of waste products;
- Ensure that waste storage areas are secured to prevent waste being blown offsite;
- Ensure that nuisances such as odour, visual impacts and breeding of vectors do not arise; and
- Prevent pollution of the environment and harm to health.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>General waste disposal site</td>
<td>Open air burning of general waste must not be allowed on site.</td>
</tr>
<tr>
<td>6</td>
<td>Establish a formal general waste landfill site in line with the approved landfill design or further investigate the feasibility of establishing a waste incinerator or disposing of general waste offsite in association with the Tsumeb Municipality.</td>
<td>DPMT Management</td>
</tr>
<tr>
<td>7</td>
<td>No hazardous waste is to be disposed of at the general waste disposal site.</td>
<td>Site Manager</td>
</tr>
<tr>
<td>8</td>
<td>A detailed waste management protocol will be developed for the site</td>
<td>Environmental Manager</td>
</tr>
<tr>
<td>9</td>
<td>Waste generated is to be separated at source into recyclable and non-recyclable waste.</td>
<td>All</td>
</tr>
<tr>
<td>10</td>
<td>No hazardous waste may be disposed of at the site. This requirement must be communicated in all induction and awareness training material.</td>
<td>Environmental Manager</td>
</tr>
<tr>
<td>11</td>
<td>Waste collection points have been established on site. Care will be taken to ensure that these have sufficient capacity and that they are serviced frequently. Different skips are provided for wood, scrap metal, hazardous waste and general waste.</td>
<td>All</td>
</tr>
<tr>
<td>12</td>
<td>Contain contaminated run-off from waste storage sites</td>
<td>A well-designed drainage system around waste-generating and storage sites will be required so as to intercept any spillage and contaminated run-off that might result from loading and transporting of waste on the Smelter’s site. Waste water collected at a central drainage sump can be returned to the plant as process water or be tied-in with the feed to the Effluent Treatment Facility.</td>
</tr>
<tr>
<td>13</td>
<td>Emergencies</td>
<td>Emergency and safety protocols need to be in place in case of an incident which could lead to endangering the environment and human health. Emergency procedures are to consider events such as a potential tailings dam failure, pollution from erosion of the arsenic calcine dams,</td>
</tr>
</tbody>
</table>
### Waste transport

Proper construction of waste-transporting pipelines, made of compatible and durable material, and their inclusion in periodical maintenance and inspection schedules will minimise the risk of leaks, spills and pollution, as well as human injury.

**Transport management**

**Ongoing**

### Operator, driver, consignor and consignee

**Ongoing**

### Hazardous waste management

Non-arсенic hazardous waste, not suitable for disposal at the on-site hazardous waste disposal site, will be collected by a contractor with the relevant permits and will be removed to a permitted hazardous waste disposal facility. Hazardous waste may only be stored on site, in a fenced off area with access control.

Management of hazardous wastes not disposed to the DPMT hazardous waste disposal site must include the following:

- Classify all wastes in terms of the Globally Harmonised System (SANS 10234);
- Label containers and provide Safety Data Sheets for all hazardous wastes;
- Ensure chain of custody records/waste manifest documents for each hazardous waste departing the Tsumeb Smelter is kept;
- Audit all external waste service providers to ensure that waste management operations are legally compliant;
- Implement the Minimum Requirements for waste Disposal to Landfill and Minimum Requirements for the handling, Classification and Disposal of Hazardous Waste (Second Edition 1998, South African Department of Water Affairs and Forestry). These requirements are in line with IFC standards and are set out in the table below this MMP.

Arsenic hazardous waste, including baghouse dusts and calcines that cannot be processed are to be disposed of at the DPMT hazardous waste disposal site. Existing historic stockpiles of arsenic calcines and baghouse dusts are also to be disposed of at the hazardous waste disposal site or another registered hazardous waste disposal facility. A specific action plan and schedule

### Ongoing
must be established for disposal of old calcine dump material.

<table>
<thead>
<tr>
<th></th>
<th>Hazardous waste disposal site expansion</th>
<th></th>
</tr>
</thead>
</table>
| 18 | The additional construction of Cell 2 of the hazardous waste disposal site as per the approved 201 500 m³ site capacity will be undertaken in line with minimum best practices as per the original agreements for a H:He disposal site. In addition to the measures included in the Construction MMP, the following measures are to be implemented during the construction phase:  
  - Areas designated for site development are to be clearly demarcated and no disturbance is to take place outside of demarcated areas.  
  - No vegetation is to be removed or damaged outside of areas demarcated for the development of the waste site.  
  - If borrow pit areas are to be utilised for construction materials the following measures should be implemented:  
    - Existing infrastructure is to be relocated in accordance with the landowner’s requirements.  
    - Access to site to be undertaken in accordance with landowner’s requirements.  
    - All infrastructure erected during borrowing activities to be removed from site at the end of operations unless agreed otherwise with the landowner.  
    - Borrow pit areas to be fenced to restrict access of persons and cattle.  
    - Faces of excavation are to be sloped to a maximum slope of 1:3.  
    - Soil covering material is to be stripped and stockpiled prior to excavation.  
    - Stockpiled soil is to be placed over excavated area as part of rehabilitation.  
    - Rehabilitation of site to ensure free drainage of stormwater and to prevent water from collecting in excavated area. | Site and Project Manager |

<table>
<thead>
<tr>
<th></th>
<th>Hazardous waste disposal site operation</th>
<th>Operations Director</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>Ensure operation of the hazardous waste disposal site is in line with the long term operational and closure plans. Ensure that these plans are regularly reviewed and kept up to date.</td>
<td>Ongoing</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Hazardous waste disposal alternatives</th>
<th>DPMT Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>Further investigate alternative options for the disposal of hazardous arsenic waste.</td>
<td>Within 3 years of approval</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Recycling initiatives</th>
<th>DPMT Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>Consider implementing a system for the reuse or recycling of certain waste items generated by smelter operations in collaboration with a local waste contractor.</td>
<td>Within 1 year of approval</td>
</tr>
</tbody>
</table>

**Sewage Plant**

<table>
<thead>
<tr>
<th></th>
<th>Sewage Plant operations</th>
<th>Plant Manager</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>Undertake required repairs to the sewage treatment plant and fully commission the plant.</td>
<td>As soon as possible after study into plant problems has been finalised</td>
</tr>
</tbody>
</table>
Rehabilitation of reed beds

Once the sewage treatment plant is fully operational, the current reed beds effluent discharge area should be rehabilitated to remove sewage contaminant risks.

Plant Manager / Environmental Manager

Once sewage plant is operational

**MINIMUM REQUIREMENTS FOR HAZARDOUS WASTE HANDLING, STORAGE AND TRANSPORTATION (DWAF, 1998)**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Minimum Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualification as disposal site</td>
<td>If a waste is held at a storage site for a period exceeding three months, the site automatically qualifies as a Waste Disposal Site, and must be registered as such and meet all the requirements of a disposal site.</td>
</tr>
<tr>
<td>Temporary storage area</td>
<td>A temporary storage area must have a firm, waterproof base and drainage system. It must be so designed and managed that there is no escape of contaminants into the environment.</td>
</tr>
<tr>
<td>Identification of waste</td>
<td>The transporter must be provided with accurate information about the nature and properties of the load.</td>
</tr>
<tr>
<td>Documentation</td>
<td>The transport operator must be provided with the relevant transportation documentation for the consignment.</td>
</tr>
<tr>
<td>Security of load</td>
<td>The load must be properly loaded and secured on site.</td>
</tr>
<tr>
<td>Hazchem placard</td>
<td>The transport operator must be supplied with the appropriate Hazchem placards and must ensure that it is properly fitted to the vehicle.</td>
</tr>
<tr>
<td>Vehicle roadworthiness</td>
<td>The responsible person must ensure that before the vehicle leaves the consignor’s premises it is not overloaded or showing any obvious defect that would affect its safety.</td>
</tr>
<tr>
<td>Escape of hazardous spillage at site</td>
<td>The competent authority must be advised immediately whether it prove impossible to contain spillage of a hazardous waste on the site.</td>
</tr>
<tr>
<td>Protection against effect of accident</td>
<td>The waste generator – or his representative, i.e. transporter – must ensure that adequate steps are taken to minimise the effect an accident or incident may have on the public and on the environment.</td>
</tr>
<tr>
<td>Spillage on site</td>
<td>The waste generator must initiate remedial action to clean up any spillage remaining on a site after an accident.</td>
</tr>
<tr>
<td>Notification</td>
<td>All road accidents must be reported to the competent transport authority on the prescribed documentation.</td>
</tr>
</tbody>
</table>
13
ENVIRONMENTAL AWARENESS AND TRAINING MMP
13. Environmental Awareness and Training Management and Mitigation

13.1 Components

This plan is made up of the following components:

- General environmental awareness and training

13.2 Management and Mitigation

13.2.1 General environmental awareness and training

Objectives

- To ensure that all persons working at the smelter are aware of the objectives of the EMP as well as the consequences of their individual actions

Actions

TABLE 13: ACTIONS RELATING TO ENVIRONMENTAL AWARENESS AND TRAINING

<table>
<thead>
<tr>
<th>No</th>
<th>Issue</th>
<th>Management/Mitigation</th>
<th>Responsibility</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Environmental induction training is to be undertaken by all persons undertaking work at the smelter (to be incorporated into normal induction training) including permanent workers, contractors and consultants.</td>
<td>Environmental manager</td>
<td>Ongoing</td>
</tr>
<tr>
<td>1</td>
<td>Environmental awareness and training</td>
<td></td>
<td>Environmental Manager / Plant Managers</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Environmental aspects and controls are to be included in the area specific induction training.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>An environmental awareness and risk / job specific training programme to be implemented for smelter work force addressing pertinent topics as required, building on current awareness programmes.</td>
<td>Environmental Manager</td>
<td>Ongoing</td>
</tr>
</tbody>
</table>
14

CLOSURE PHASE
14. Closure Phase

In preparation for the closure phase of the DPMT smelter operations, a Closure Plan has been compiled that is continuously updated as changes are made to smelter operations and new specialist information and rehabilitation methodology becomes available. The broad closure objectives as included in the Closure Plan are listed below:

- **Physical stability:** To remove and/or stabilise surface infrastructure and unavoidable mining and mineral processing residue which are present on the DPMT site to facilitate the implementation of the planned end land use;

- **Environmental quality:** To ensure that local environmental quality is not adversely affected by possible physical effects and chemical contamination arising from the DPMT site during the tenure of DPMT, as well as to sustain catchment yield as far as possible after closure;

- **Health and safety:** To limit the possible health and safety threats to humans and animals using the rehabilitated site as it becomes available;

- **Land use and land capability:** To re-instate suitable land capabilities over the various portions of the site to facilitate the progressive implementation of the planned land use;

- **Aesthetic quality:** To leave behind a rehabilitated DPMT site that, in general, is not only neat and tidy, giving an acceptable overall aesthetic appearance, but which in terms of this attribute is also aligned to the respective land uses;

- **Biodiversity:** To encourage, where appropriate, the re-establishment of indigenous vegetation on the rehabilitated sites such that terrestrial biodiversity is largely re-instated over time; and

- **Socio-economic mitigation:** To ensure that the infrastructure transfers, if applicable, measures and/or contributions made by the facility towards the long-term socio-economic benefit of the local communities are sustainable.
The below table sets out closure objectives/measures as included in previously approved EMPs and lists specific objectives included in the 2016 draft version of the Closure Plan (Golder, 2016). Specific measures to be implemented in order to meet the closure objectives will be further refined as part of the continuous updating of the Closure Plan. Closure planning will be conducted progressively and refined as information becomes available, resulting in an appropriate and up-to-date final closure plan at the time of closure.

**TABLE 14: CLOSURE OBJECTIVES**

<table>
<thead>
<tr>
<th>No</th>
<th>Issue</th>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Soils</td>
<td>Regain pre-disturbance soil depth and slope where possible; maximise ‘topsoil’ depth utilising all stockpiled ‘topsoil’ reserves; limit compaction; limit contamination; optimise fertility; and limit erosion.</td>
</tr>
</tbody>
</table>
| 2  | Land Capability | - Regain pre-disturbance land capability wherever possible, based on the non-disturbed land capability of the surrounds.  
- Attain post-disturbance grazing capability ('topsoiling' depth >25cm; and specified maximum slope) in those areas where it is not possible to regain the pre-disturbance land capability. |
| 3  | Land Use | - Re-vegetate with sustainable indigenous (to the area) plants.  
- Implement Phytoremediation and Phytostabilisation utilizing indigenous trees and shrubs (mostly). |
| 4  | Soils | - Maintain/optimise fertility.  
- Limit contamination/pollution.  
- Limit erosion. |
| 5  | Contaminated Land Management | - Maintain post-disturbance capability by maintaining soil fertility and limiting further soil contamination/pollution, thus resulting in a high grass basal cover and healthy ‘woodlands’ ‘compartments’ (Phytoremediation); that limit soil erosion, and function effectively to reduce water-tables (evapotranspiration) and ameliorate the existing soil (uptake of certain pollutants) and air (covering litter layer and reduced wind flow) pollution.  
- Provide the required measures to limit at source the generation of contaminants which could adversely affect soils and land capability, surface and groundwater quality.  
- Remove all potential process-related contaminants, for safe disposal, to ensure that no hazardous waste is present on the respective sites once these have been rehabilitated.  
- Remove hazardous/contaminated material on an on-going basis and appropriately treating/disposing of. As removal is an on-going process, no hazardous waste build-up on-site should occur;  
- Demonstrate by means of suitable sampling and analysis that the threshold levels of salts, metals and other potential contaminants over the rehabilitated sites are acceptable, aligned to the end land use plan. |
<table>
<thead>
<tr>
<th>6</th>
<th>General Surface Rehabilitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Limit dust generation on the rehabilitated sites that could cause nuisance and/or health effects to surrounding landowners/communities.</td>
<td></td>
</tr>
<tr>
<td>• Upfront zoning of the overall operational site to align to the end land use, thus creating ecological &quot;management&quot; units;</td>
<td></td>
</tr>
<tr>
<td>• Ensure that the rehabilitated portions of the site are safe and stable in the long-term;</td>
<td></td>
</tr>
<tr>
<td>• Limit the possible loss of topsoil by committing the available topsoil to key pre-determined rehabilitation areas;</td>
<td></td>
</tr>
<tr>
<td>• Stabilise disturbed areas to prevent erosion in the short- to medium-term until a suitable vegetation cover has established;</td>
<td></td>
</tr>
<tr>
<td>• Establish viable self-sustaining vegetation communities that will encourage the re-introduction of local fauna, as far as possible, once rehabilitated areas are established;</td>
<td></td>
</tr>
<tr>
<td>• Assess whether the rehabilitated facilities, with limited intervention and change, could be adapted to provide suitable habitats for fauna, improving the overall biodiversity;</td>
<td></td>
</tr>
<tr>
<td>• Identify those aspects/obstacles once site rehabilitation has been completed which could inhibit and/or deter animal life from returning to the rehabilitated site;</td>
<td></td>
</tr>
<tr>
<td>• Remove the identified obstacles without compromising the adopted final land use(s).</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>7</th>
<th>Infrastructure</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Close, dismantle, decontaminate, remove and dispose of all surface infrastructure and equipment, that has no beneficial post-closure use.</td>
<td></td>
</tr>
<tr>
<td>• Shape and level disturbed footprint areas to create landforms that emulate the surroundings landscape as far as possible.</td>
<td></td>
</tr>
<tr>
<td>• Shape, rip and vegetate access roads that do not have a post-closure use, haul roads and hardstand areas, and integrate these areas with the surrounding surface topography as far as possible.</td>
<td></td>
</tr>
<tr>
<td>• Shape remaining earth embankments of dams to stable slopes, integrate with surrounding surface topography as far as possible, and establish vegetation.</td>
<td></td>
</tr>
<tr>
<td>• Ensure that the rehabilitated site is free-draining and that run-off is routed to local/natural drainage lines as far as possible.</td>
<td></td>
</tr>
<tr>
<td>• Remove, for safe disposal, all potential process-related contaminants to ensure that no hazardous waste is present once the site has been rehabilitated.</td>
<td></td>
</tr>
<tr>
<td>• Remove hazardous material on an on-going basis off-site or at an appropriate and licenced facility onsite.</td>
<td></td>
</tr>
<tr>
<td>• As removal and/or appropriate disposal is an on-going process, no hazardous waste build-up should occur.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>8</th>
<th>Water Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Provide the required measures to limit at source the generation of contaminants which could adversely affect surface and groundwater quality.</td>
<td></td>
</tr>
<tr>
<td>• Provide additional measures to abstract contaminated groundwater according to existing geophysical site characteristics and preferential flow paths.</td>
<td></td>
</tr>
<tr>
<td>• Reinstate natural drainage lines as far as possible.</td>
<td></td>
</tr>
<tr>
<td>• Ensure that the rehabilitated site is free-draining and run-off is routed to local/natural drainage lines as far as possible.</td>
<td></td>
</tr>
<tr>
<td>• Demonstrate by means of suitable sampling and analysis that the threshold levels of salts, metals and other potential contaminants over the rehabilitated sites allocated in terms of the end land use plan are acceptable.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Ecology</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>• Demonstrate through a review of monitoring data that no possible surface and/or groundwater contaminant sources remain on the rehabilitated sites that could compromise the planned land use and /or pose health and safety threats. Groundwater monitoring is to continue up to at least five years after closure.</td>
<td></td>
</tr>
<tr>
<td>• Actively remove invasive species established in rehabilitated areas.</td>
<td></td>
</tr>
<tr>
<td>• Monitor vegetation establishment on rehabilitated areas after the first rain season following rehabilitation in terms of species diversity and density to ensure it resembles surrounding natural vegetation cover.</td>
<td></td>
</tr>
<tr>
<td>• Based on monitoring results, vegetation establishment is to be augmented where required by seeding and hand planting prior to the following rain season.</td>
<td></td>
</tr>
<tr>
<td>• Repair eroded areas.</td>
<td></td>
</tr>
</tbody>
</table>

### Residue and Stockpile Facilities

<table>
<thead>
<tr>
<th>10</th>
<th>Post-closure management</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Provide the required measures to limit at source the generation of contaminants which could adversely affect soils and land capability, surface water and groundwater quality; i.e. limit/prevent the water ingress into the facility which could result in seepage from the facility.</td>
<td></td>
</tr>
<tr>
<td>• Rehabilitate residue facilities via shaping/profiling and/or additional environmental engineering to be physically stable and safe.</td>
<td></td>
</tr>
<tr>
<td>• Demonstrate, through a review of monitoring data and/or predictive modelling, if required, that the effect of contaminants that could arise from the facilities could be managed via at-source controls.</td>
<td></td>
</tr>
<tr>
<td>• Demonstrate by means of suitable sampling and analysis that the threshold levels of constituents of concern (CoCs) are acceptable.</td>
<td></td>
</tr>
<tr>
<td>• Limit dust generation from remnant residue facilities that could cause nuisance and/or health effects to surrounding landowners/communities.</td>
<td></td>
</tr>
<tr>
<td>• Landscape remnant residue facilities to render these “soft”, blending in with the surrounding landscape, as far as possible.</td>
<td></td>
</tr>
</tbody>
</table>

### General Waste Site

<table>
<thead>
<tr>
<th>11</th>
<th>Post-closure management</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Monitor rehabilitated areas in terms of vegetation establishment and erosion.</td>
<td></td>
</tr>
<tr>
<td>• Augment vegetation establishment where required by reseeding.</td>
<td></td>
</tr>
<tr>
<td>• Repair eroded areas.</td>
<td></td>
</tr>
<tr>
<td>• Ground and surface water monitoring should continue to be monitored post-closure.</td>
<td></td>
</tr>
<tr>
<td>• Ensure that health and safety of people, flora and fauna are safeguarded from hazards resulting from the decommissioned waste site.</td>
<td></td>
</tr>
<tr>
<td>• Ensure that environmental damage or residual environmental impacts are minimised to the extent that they are acceptable to all parties involved.</td>
<td></td>
</tr>
<tr>
<td>• Rehabilitate land to achieve a condition approximating its natural state, or so that the envisaged end use can be achieved.</td>
<td></td>
</tr>
<tr>
<td>• The physical and chemical stability of the remaining structures must be such that risk to the environment through naturally occurring forces is eliminated.</td>
<td></td>
</tr>
</tbody>
</table>
- Ensure that the waste site closure is achieved efficiently, cost effectively, and in compliance with the law.

### Hazardous Waste Site

<table>
<thead>
<tr>
<th>No.</th>
<th>Environment</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>Groundwater</td>
<td>Placement of capping and cover materials at the end of each phase in accordance with the Rehabilitation and Closure Plan.</td>
</tr>
<tr>
<td>13</td>
<td>Leachate collection systems including return water dam to remain after closure.</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Surface Water</td>
<td>Provide suitable surface water drainage to ensure free drainage, as well as erosion protection.</td>
</tr>
<tr>
<td>15</td>
<td>Air Quality</td>
<td>- Capping and cover to be put in place at the end of each phase, in accordance with the Rehabilitation and Closure Plan.</td>
</tr>
<tr>
<td></td>
<td>Environment</td>
<td>- Limit dust generation that could cause nuisance and/or health effects to surrounding landowners/communities.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Progressively close if long-term storage of arsenic dust is reduced due to other arsenic dust treatment processes being implemented.</td>
</tr>
<tr>
<td>16</td>
<td>Land use</td>
<td>- Cap and cover any exposed areas of the waste body prior to site closure.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Retain leachate management measures (seepage collection manhole and return water dam) on site.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Retain fencing, access gates and warning signage on site after decommissioning.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- All infrastructure not required in the future is to be removed from site and where necessary the footprint areas remediated and the rubble</td>
</tr>
<tr>
<td></td>
<td></td>
<td>disposed of.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Provide the required long-term permanent (at least 100 years) solution/measures to limit at source the generation of contaminants which could</td>
</tr>
<tr>
<td></td>
<td></td>
<td>adversely affect the environment and adjacent land uses and users, while being sufficiently robust to withstand the effects of the elements over</td>
</tr>
<tr>
<td></td>
<td></td>
<td>this period (including resistance to animal burrows and the like);</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Progressively cap the site as soon as final height and slopes are achieved on practically sized sections or phases of the landfill.</td>
</tr>
<tr>
<td>17</td>
<td>Post closure</td>
<td>- Must be sufficiently robust to minimise the risk of human intervention through the cover into the waste body.</td>
</tr>
<tr>
<td></td>
<td>Management (Cover</td>
<td>- Must accommodate long-term consolidation settlement.</td>
</tr>
<tr>
<td></td>
<td>System)</td>
<td>- Must not be adversely affected by the chemicals within the waste and possible leachate emanating from the landfill.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Must be stable on the landfill slopes under all conditions and be able to withstand long-term erosion.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Must have low maintenance requirements.</td>
</tr>
<tr>
<td>18</td>
<td>Waste Management</td>
<td>- Demolish and remove all infrastructure (if applicable) upon closure of the quarry. No machinery may be left behind.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Check all demolished material and footprint areas for contamination with hazardous substances and remove hazardous material for disposal as</td>
</tr>
<tr>
<td></td>
<td></td>
<td>hazardous waste.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Separate waste materials.</td>
</tr>
</tbody>
</table>

### Kliplime Quarry

- Demolish and remove all infrastructure (if applicable) upon closure of the quarry. No machinery may be left behind.
- Check all demolished material and footprint areas for contamination with hazardous substances and remove hazardous material for disposal as hazardous waste.
- Separate waste materials.
<table>
<thead>
<tr>
<th>19</th>
<th>Land use</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Remove salvageable waste from site for re-use.</td>
<td></td>
</tr>
<tr>
<td>• Dispose of general waste (not contaminated with hazardous substances) at a general waste disposal facility.</td>
<td></td>
</tr>
<tr>
<td>• Dispose of hazardous waste at a hazardous waste facility.</td>
<td></td>
</tr>
<tr>
<td>• Rehabilitate footprint areas using available soil.</td>
<td></td>
</tr>
<tr>
<td>• Topsoil stripped (if any) is to be used to cover all laydown areas and access roads.</td>
<td></td>
</tr>
<tr>
<td>• Where soil supply is insufficient or not available, compacted surfaces are to be ripped (to a minimum of 300 mm) at intervals of no more than 2 m to provide for an effective rooting depth required to the establishment of self sustaining vegetation.</td>
<td></td>
</tr>
<tr>
<td>• Shape and level rehabilitated areas to create landforms that emulate the surroundings as far as possible and that are physically stable and safe.</td>
<td></td>
</tr>
<tr>
<td>• Ensure that rehabilitated areas are free draining.</td>
<td></td>
</tr>
</tbody>
</table>
6. ENVIRONMENTAL MONITORING

6.1 SURFACE WATER MONITORING

The existing surface water monitoring programme is to be improved by including annual sampling (after rain events) of surface run-off water leaving the site and entering the Jordan River.

Sampling sites are to include five sampling locations along the Jordan River to the west of the smelter complex as indicated in Figure 6-1. An additional sampling site (SW6) downstream (north) of SW5 at a point beyond where the main drainage line from the site enters the Jordan River is to be added. This would enable monitoring of water discharged from the DPMT site. A site approximately 1 km north of SW5 near the BH18 groundwater monitoring borehole (see Figure 6-2) could be sufficient for this purpose and for comparison to water flowing towards the site (as sampled at SW2).
6.2 LEACHATE MONITORING

Leachate from the hazardous waste disposal site is drained to a contaminated stormwater pond and then pumped from a sump to the west of the facility where it is sprayed over the deposited waste as a form of dust suppression and to help reduce the liquid content through evaporation and aid compression to maximise storage space.

Leachate should be monitored for quality purpose from the stormwater pond. Leachate monitoring should be undertaken on a monthly basis for indicator parameters, with a full analytical suite undertaken on a quarterly basis.

The proposed analytical suite for leachate monitoring is presented in Table 6-1.

**TABLE 6-1: PROPOSED ANALYTICAL SUITE FOR LEACHATE**

<table>
<thead>
<tr>
<th>Monthly Suite</th>
<th>Quarterly Suite</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>pH</td>
</tr>
<tr>
<td>Electrical Conductivity</td>
<td>Electrical Conductivity</td>
</tr>
<tr>
<td>Alkalinity as CaCO$_3$</td>
<td>Alkalinity as CaCO$_3$</td>
</tr>
<tr>
<td>Total dissolved solids</td>
<td>Total dissolved solids</td>
</tr>
<tr>
<td>Ammonia as N</td>
<td>Ammonia as N</td>
</tr>
<tr>
<td>Chloride as Cl</td>
<td>Chloride as Cl</td>
</tr>
<tr>
<td>Sulphate as SO$_4$</td>
<td>Sulphate as SO$_4$</td>
</tr>
<tr>
<td>Arsenic as As</td>
<td>Fluoride as F</td>
</tr>
<tr>
<td>Cadmium as Cd</td>
<td>Nitrate as N</td>
</tr>
<tr>
<td></td>
<td>Nitrite as N</td>
</tr>
<tr>
<td></td>
<td>Aluminium as Al</td>
</tr>
<tr>
<td></td>
<td>Arsenic as As</td>
</tr>
<tr>
<td></td>
<td>Calcium as Ca</td>
</tr>
<tr>
<td></td>
<td>Cadmium as Cd</td>
</tr>
<tr>
<td></td>
<td>Chromium as Cr</td>
</tr>
<tr>
<td></td>
<td>Copper as Cu</td>
</tr>
<tr>
<td></td>
<td>Iron as Fe</td>
</tr>
<tr>
<td></td>
<td>Potassium as K</td>
</tr>
<tr>
<td></td>
<td>Magnesium as Mg</td>
</tr>
<tr>
<td></td>
<td>Manganese as Mn</td>
</tr>
<tr>
<td></td>
<td>Sodium as Na</td>
</tr>
<tr>
<td></td>
<td>Nickel as Ni</td>
</tr>
<tr>
<td></td>
<td>Phosphorus as P</td>
</tr>
<tr>
<td></td>
<td>Lead as Pb</td>
</tr>
<tr>
<td></td>
<td>Sulphur as S</td>
</tr>
<tr>
<td></td>
<td>Antimony as Sb</td>
</tr>
<tr>
<td></td>
<td>Selenium as Se</td>
</tr>
<tr>
<td></td>
<td>Vanadium as V</td>
</tr>
<tr>
<td></td>
<td>Zinc as Zn</td>
</tr>
</tbody>
</table>
6.3 GROUNDWATER MONITORING

A Water Monitoring Programme was initiated at the Tsumeb Smelter in 2010. Eight additional monitoring wells were constructed within the smelter area for this purpose. Monitoring commenced in March 2011. Since 2011, the groundwater monitoring points have been increased to 20 boreholes within the smelter precinct. The groundwater monitoring locations are provided in Figure 6-2. The groundwater monitoring parameters to be tested at the monitoring boreholes are set out in Table 6-2.

The groundwater monitoring schedule should include quarterly on-site and biannual off-site (regional) monitoring. The off-site monitoring should be conducted at water supply boreholes of the down-gradient groundwater users and at proposed additional monitoring boreholes to the north of the smelter complex.

### TABLE 6-2: GROUNDWATER MONITORING PARAMETERS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Applicability to Monitoring Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>pH-unit</td>
<td>All monitoring points</td>
</tr>
<tr>
<td>Electrical Conductivity</td>
<td>mS/m</td>
<td>All monitoring points</td>
</tr>
<tr>
<td>Total Dissolved Solids</td>
<td>mg/l</td>
<td>All monitoring points</td>
</tr>
<tr>
<td>Total Alkalinity as CaCO₃</td>
<td>mg/l</td>
<td>All monitoring points</td>
</tr>
<tr>
<td>Chloride as Cl</td>
<td>mg/l</td>
<td>All monitoring points</td>
</tr>
<tr>
<td>Sulfate as SO₄</td>
<td>mg/l</td>
<td>All monitoring points</td>
</tr>
<tr>
<td>Fluoride as F</td>
<td>mg/l</td>
<td>All monitoring points</td>
</tr>
<tr>
<td>Nitrate as N</td>
<td>mg/l</td>
<td>All monitoring points</td>
</tr>
<tr>
<td>Orthophosphate as P</td>
<td>mg/l</td>
<td>All monitoring points</td>
</tr>
<tr>
<td>Free &amp; Saline Ammonia as N</td>
<td>mg/l</td>
<td>All monitoring points</td>
</tr>
<tr>
<td>Sodium as Na</td>
<td>mg/l</td>
<td>All monitoring points</td>
</tr>
<tr>
<td>Potassium as K</td>
<td>mg/l</td>
<td>All monitoring points</td>
</tr>
<tr>
<td>Calcium as Ca</td>
<td>mg/l</td>
<td>All monitoring points</td>
</tr>
<tr>
<td>Magnesium as Mg</td>
<td>mg/l</td>
<td>All monitoring points</td>
</tr>
<tr>
<td>Aluminium as Al</td>
<td>mg/l</td>
<td>All monitoring points</td>
</tr>
<tr>
<td>Arsenic as As</td>
<td>mg/l</td>
<td>All monitoring points</td>
</tr>
<tr>
<td>Cadmium as Cd</td>
<td>mg/l</td>
<td>All monitoring points</td>
</tr>
<tr>
<td>Cobalt as Co</td>
<td>mg/l</td>
<td>All monitoring points</td>
</tr>
<tr>
<td>Copper as Cu</td>
<td>mg/l</td>
<td>All monitoring points</td>
</tr>
<tr>
<td>Iron as Fe</td>
<td>mg/l</td>
<td>All monitoring points</td>
</tr>
<tr>
<td>Lead as Pb</td>
<td>mg/l</td>
<td>All monitoring points</td>
</tr>
<tr>
<td>Manganese as Mn</td>
<td>mg/l</td>
<td>All monitoring points</td>
</tr>
<tr>
<td>Mercury as Hg</td>
<td>mg/l</td>
<td>All monitoring points</td>
</tr>
<tr>
<td>Zinc as Zn</td>
<td>mg/l</td>
<td>All monitoring points</td>
</tr>
<tr>
<td>Phenols</td>
<td>µg/l</td>
<td>Tar monitoring point only</td>
</tr>
<tr>
<td>Parameter</td>
<td>Units</td>
<td>Applicability to Monitoring Points</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>Total Petroleum Hydrocarbons</td>
<td>µg/l</td>
<td>Tar monitoring point only</td>
</tr>
</tbody>
</table>

All water released from the plant must comply with the recommended maximum limits for livestock watering in accordance with the South African Guidelines for Livestock Watering. These limits are recognised as a minimum requirement by the Namibian Ministry of Agriculture, Water and Forestry.
FIGURE 6-2: GROUNDWATER MONITORING BOREHOLE SITES
6.4 **Ambient Air Quality Monitoring**

DPMT currently owns and operates five ambient air quality monitoring stations in and around Tsumeb. The location of the monitoring stations are provided in Figure 6-3. The parameters to be tested on a daily basis are listed in Table 6-3.

**TABLE 6-3: Ambient Air Quality Monitoring Parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Applicability to Monitoring Stations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weather</td>
<td>All monitoring stations</td>
</tr>
<tr>
<td>Sulphur Dioxide as SO₂</td>
<td>All monitoring stations</td>
</tr>
<tr>
<td>Arsenic as As</td>
<td>All monitoring stations</td>
</tr>
<tr>
<td>Copper as Cu</td>
<td>All monitoring stations</td>
</tr>
<tr>
<td>Lead as Pb</td>
<td>All monitoring stations</td>
</tr>
<tr>
<td>Cadmium as Cd</td>
<td>All monitoring stations</td>
</tr>
<tr>
<td>Particulate Matter as PM₁₀</td>
<td>All monitoring stations</td>
</tr>
<tr>
<td>Particulate Matter as PM₂·₅</td>
<td>Community monitoring stations</td>
</tr>
</tbody>
</table>

As part of this EMP the following recommendations are made for the air quality monitoring procedure:

- Add two new ambient monitoring stations, one at the airport to the south of the smelter and one approximately 1 to 2 km northwest of the smelter boundary (see Figure 6-3); and
- Improve data availability on the PM₁₀ analysers installed at the DPMT monitoring stations and maintain data availability for all other parameters by implementing a monitoring equipment maintenance programme.

**Within the plant operational area**

- Undertake continuous SO₂ monitoring at the sulphuric acid plant emissions stack;
- Undertake stack emission testing for the full operational cycle of the Rotary Holding Furnace (RHF) once it is operational;
- Undertake stack emissions testing on the outlet of the converter baghouse over the full converter cycle; and
- Measure building fugitive emissions once the RHF is operational. These emissions need to be updated given the decommissioning of the reverberatory furnace as well as to determine the extent of fugitive emissions from the charging and pouring RHF.
FIGURE 6-3: LOCATION OF DPMT AIR QUALITY MONITORING STATIONS

Approximate location of proposed new monitoring stations
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</tbody>
</table>

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