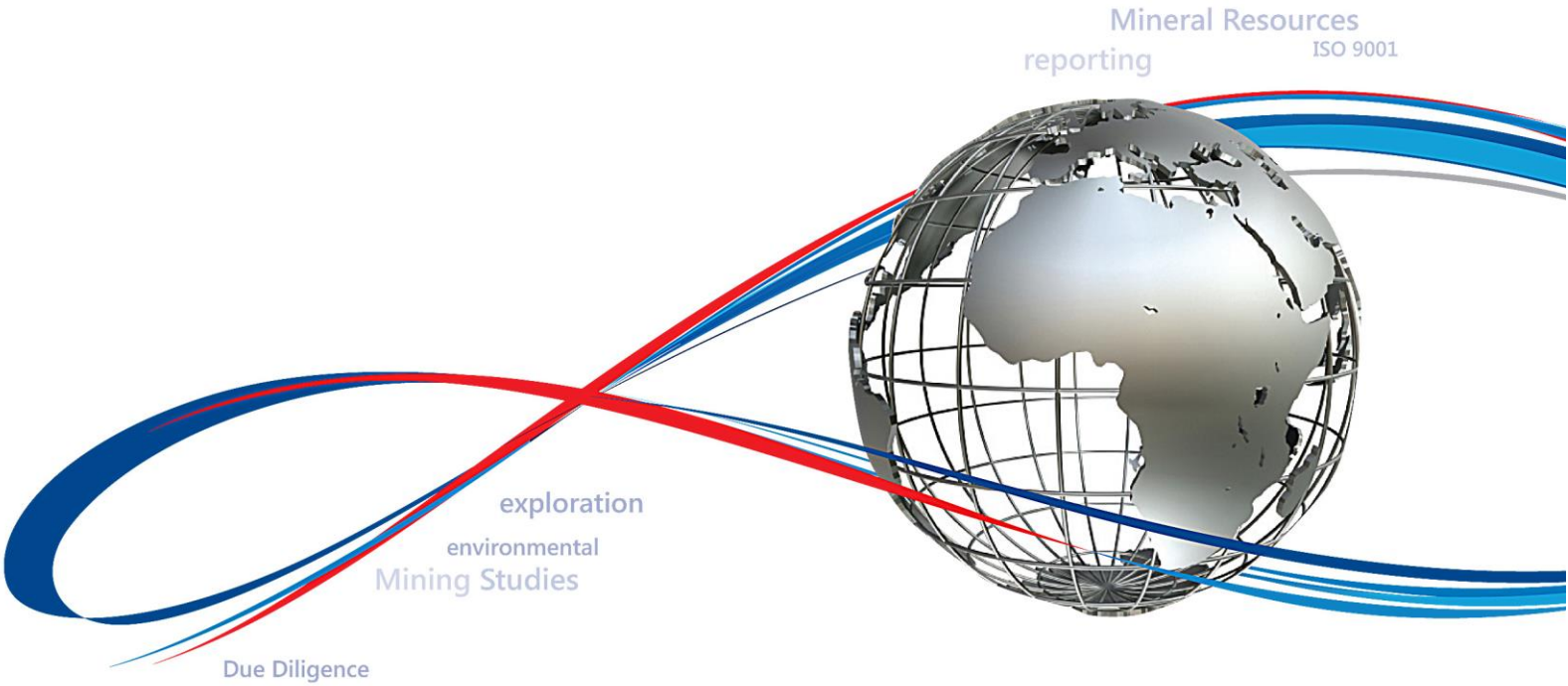
THE MSA GROUP

Specialist Consultants to the Mining Industry

Anglo American Platinum

Mortimer Smelter SO_2 Abatement Plant Closure Assessment



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J3573

Draft Report Submitted on 13 April 2017

Final Report Submitted on 25 May 2017

Report prepared by The MSA Group (Pty) Ltd on behalf of: WSP | Parsons Brinckerhoff

Author(s):	Lisa Otten	Environmental Project Manager	The MSA Group
	Stephan Herb	Environmental Project Manager	The MSA Group
Date:	25 May 2017		
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Primary Authors
Lisa Otten
Stephan Herb

Supervising Principal
Robin Bolton

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
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Date Received:	

Application for integrated environmental authorisation and waste management licence in terms of the-

(1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014; and

(2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 921, 2013

PROJECT TITLE

Anglo American Platinum Mortimer Smelter SO_2 Abatement Plant Closure Assessment

Specialist:	**The MSA Group**		
Contact person:	**Mr Stephan Herb**		
Postal address:	**PO Box 81356, Parkhurst**		
Postal code:	**2120**	Cell:	**+27(0)82 716 8636**
Telephone:	**+27(0)11 880 4209**	Fax:	**+27(0)11 880 2184**
E-mail:	stephanh@msagroupservices.com		
Professional affiliation(s) (if any)	**Professional Registration with SACNASP in the field of Environmental Science (Pr.Sci.Nat. member number 400171/14)**		

Project Consultant:	**WSP | Parsons Brinckerhoff**		
Contact person:	**Ms Anri Scheepers**		
Postal address:	**PO Box 98864, Sloane Park**		
Postal code:	**2151**	Cell:	**+27(0) 82 701 7690**
Telephone:	**+27(0)11 300 6089**	Fax:	**+27(0)11 361 1381**
E-mail:	Anri.Scheepers@WSPGroup.co.za		

4.2 The specialist appointed in terms of the Regulations_

I, **Stephan Herb**, declare that -- General declaration:

I act as the independent specialist in this application;

I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;

I declare that there are no circumstances that may compromise my objectivity in performing such work;

I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;

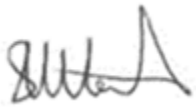
I will comply with the Act, Regulations and all other applicable legislation;

I have no, and will not engage in, conflicting interests in the undertaking of the activity;

I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;

all the particulars furnished by me in this form are true and correct; and

I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.



Signature of the specialist:

The MSA Group

Name of company (if applicable):

25 May 2017

Date:

EXECUTIVE SUMMARY

The MSA Group (Pty) Ltd (MSA) has been appointed by WSP | Parsons Brinckerhoff (WSP) to assess the financial provision and update the closure plan for the proposed SO_2 Abatement Plant at the Anglo American Platinum Limited (AAP) Mortimer Smelter, North-West Province.

The proposed SO_2 Abatement Plant will include a Wet gas Sulphuric Acid plant; an effluent treatment plant (ETP) to treat all streams of waste water; an acid plant cooling water (including evaporative cooling towers and a hot water tank); and a dangerous goods' storage and handling area (i.e. storage of acid in two tanks). The Plant will be located within the Mortimer Smelter Complex of the Union Section.

The existing financial provision for Union Section was calculated based on the Department of Mineral and Energy (DME) 2005 published "*Guideline Document for The Evaluation of the Quantum of Closure-Related Financial Provision Provided by a Mine*". Prior to the Financial Provisioning Regulation published in November 2015 (GN R1147), the DME Guideline document was considered to be an industry accepted approach of calculating closure liability. However, a holder of an existing Mining Right is only legally required to review and update the closure liability in terms of GN R1147 by February 2019. Therefore, the DME Guideline document has been used to update the closure liability to include the SO_2 Abatement Plant.

The proposed SO_2 Abatement Plant is still in the environmental authorization application phase, therefore no infrastructure has been developed. The closure cost determination has been based on the Final Scoping Report (WSP, 2017), from which the quantities used in the closure cost assessment were extracted. The total estimated closure cost is R 3,011,973.46 however, AAP will update the Closure Cost as part of their annual Closure Cost update for the Mortimer Smelter once the plant has been constructed.

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Acronyms

AAP	Anglo American Platinum
BAP	Biodiversity Action Plan
DME	Department of Minerals and Energy
EMPr	Environmental Management Programme
ETP	Effluent Treatment Plant
H_2SO_4	Sulphuric acid
ktpm	Thousand tonnes per month
MES	Minimum Emission Standards
MHSA	Mine Health and Safety Act (Act 29 of 1996)
MKLM	Moses Kotane Local Municipality
MPRDA	Mineral and Petroleum Resources Development Act
MSA	The MSA Group
NEMA	National Environmental Management Act (Act No.107 of 1998)
NEM:AQA	National Environmental Management Air Quality Act (Act No. 39 of 2004)
NO_x	Nitrogen oxide
NWA	National Water Act (Act No. 36 of 1998)
PCLU	Post closure land use
PGMs	Platinum group metals
RPM-US	Union Section Operations
SO_2	Sulphur Dioxide
TSF	Tailings Storage Facility
WRD	Waste Rock Dump
WSA	Wet gas Sulphuric Acid Plant
WSP	WSP | Parsons Brinckerhoff
WUL	Water Use Licence

1 INTRODUCTION AND SCOPE OF REPORT

The MSA Group (Pty) Ltd (MSA) has been appointed by WSP | Parsons Brinckerhoff (WSP) to assess the financial provision and update the closure plan for the proposed SO_2 Abatement Plant at the Anglo American Platinum Limited (AAP) Mortimer Smelter, North-West Province.

1.1 Project Description

AAP owns and operates the Mortimer smelting complex, located at the Union Section Operations (RPM-US). The Mortimer Smelter is situated approximately 15km west of the town of Northam, on the border between the Limpopo and North West Provinces, South Africa.

The Mortimer Smelter is an existing metallurgical industrial furnace where sulphide ores are smelted. Wet concentrate is received and dried in flash driers. The dry concentrate is smelted in an electric furnace, resulting in the recovery of platinum group metals (PGMs) and other base metals. The furnace matte is then tapped, cast and crushed. The resulting furnace slag is currently stockpiled.

The Mortimer Smelter has been upgraded with Phase One of the upgrade occurring in 2008/2009 and Phase Two in 2011, resulting in an increase in the furnace power from 19 MW to 38 MW. The off-gas is currently being treated via an electrostatic precipitator (ESP); exhaust from the ESP is vented into the atmosphere via a stack at 80m above the ground. The emissions include particulate matter (PM), sulphur dioxide (SO_2) and nitrogen oxide (NO_x).

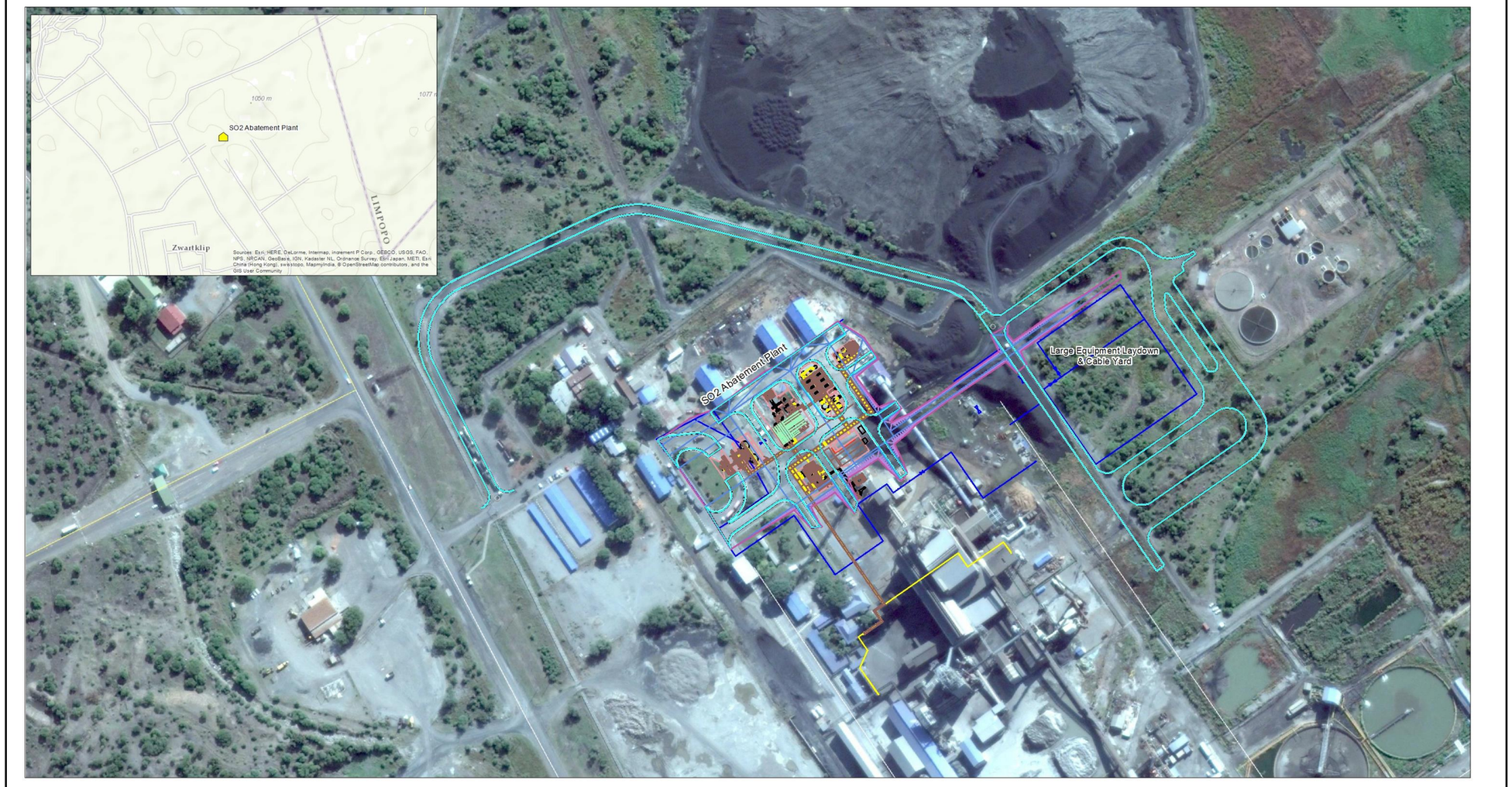
The National Environmental Management Air Quality Act (No. 39 of 2004) (NEM:AQA) requires that furnaces at metallurgical industries be operated with efficient SO_2 abatement systems by 2015, however Mortimer Smelter was given an extension until 2020. In order to comply with new South African legislation and the stringent emission standards, an SO_2 abatement system must be installed at the Mortimer Smelter.

The proposed strategy to reduce SO_2 to achieve the Minimum Emission Standards (MES) is the installation of a Wet gas Sulphuric Acid (WSA) Plant that will convert the SO_2 contained in the off-gas into commercial-grade concentrated sulphuric acid (H_2SO_4). The exhaust from the WSA plant (containing reduced SO_2 concentrations) will be vented into the atmosphere, and the commercial grade sulphuric acid will be temporarily stored before being dispatched into the commercial market. The different components of the Plant include:

- The WSA acid plant;
- An effluent treatment plant (ETP) to treat all streams of waste water;
- Acid plant cooling water (including evaporative cooling towers and a hot water tank); and
- A dangerous goods' storage and handling area (i.e. storage of acid in two tanks).

The area upon which the WSA Plant and associated SO_2 Abatement Plant will be located, is within the Mortimer Smelter complex, and is hereafter referred to as the development site (refer to Figure 1-1).

Figure 1-1
Development Site Locality Map



SO2 Abatement Plant

Closure Assessment

1.2 Details of the Specialists

Mr Stephan Herb is an Environmental Project Manager with MSA and holds a Master's degree in Environmental Management which focussed on mine rehabilitation. Stephan has 8 years' experience related to mining and the environment and has compiled several closure and rehabilitation plans for mining clients across Africa as well as in South Africa. His experience extends to Environmental Project Management, Ecology and Land Management, ESIA coordination and compliance auditing.

Ms Lisa Otten is an Environmental Project Manager and has close to 5 years of experience in the field of environmental management. Her key areas of focus lie in undertaking various environmental licencing processes, including mining right applications, environmental authorisations and water use licences. Her field of expertise extends to undertaking environmental compliance monitoring and due diligences for the mining and oil and gas sectors. Lisa is also familiar with the financial sector, in particular the IFC Performance Standards and the World Bank Equator Principles.

Refer to detailed Curriculum Vitae attached as Appendix 1.

1.3 Scope of Study

The closure plan and the financial provision needs to be determined as part of the application for environmental authorisation for the SO_2 Abatement Plant. This closure assessment is therefore limited to the proposed listed activities being applied for and will be considered in future updates for the RPM-US closure plan.

The existing financial provision for the Union Section was calculated based on the Department of Mineral and Energy (DME) 2005 published "*Guideline Document for The Evaluation of the Quantum of Closure-Related Financial Provision Provided by a Mine*". Prior to the Financial Provisioning Regulation published in November 2015 (GN R1147), the DME Guideline document was considered to be an industry accepted approach of calculating closure liability. However, a holder of an existing Mining Right is only legally required to review and update the closure liability in terms of GN R1147 by February 2019. Therefore, the DME Guideline document has been used to update the closure liability to include the SO_2 Abatement Plant (refer to Section 6).

2 SITE CONTEXT

2.1 Mine Context

The Mortimer Smelter, and hence SO_2 Abatement Plant, is situated within the Union Section mining area for which an old order mining licence was granted (GME 14/182/614) by the Department of Minerals and Energy in accordance with Section 9 of the Minerals Act (No. 50 of 1991). The mine uses underground mining methods and is operated at a depth ranging between 150 m and 1 500 m beneath the surface. Two-thirds of underground mining is done through conventional breast stoping method with strike pillars, while hybrid mining is carried out at the declines. The ore is smelted at Anglo Platinum's Mortimer Smelter located near the mine, while converting is done at the Waterval Smelter located in Rustenburg.

Union Section plans to continue its operations for at least the next fifty years at a nominal production rate of 410 ktpm (thousand tonnes per month) over the medium term (SRK, 2016).

The ore is beneficiated in the on-site concentrators and Mortimer smelter and sent to the Rustenburg operation refineries to produce the final products, platinum and other PGMs (WSP, 2017).

2.2 Environmental Context

The relevant bio-physical and socio-economic environmental context is broadly provided below in Table 2-1. This information has been sourced from the Final Scoping Report with Reference: NW30/5/1/2/3/2/1/366EM (WSP, March 2017).

Table 2-1
Environmental Context

Aspect	Description
Bio-Physical Environment	
Geology	• Development site is underlain by the gabbro, norite and anorthosites of the Pyramid Gabbro-norite Formation of the Rustenburg Layered Suite, which forms part of the Bushveld Igneous Complex. • There are no sensitive areas associated with the geology.
Topography	• The majority of the development site is located within an area that has already been levelled and is sloping gently to the north. • The proposed new roads and contractors' laydown area will be situated on area not yet cleared or levelled which may result in a minimal change to the topography. • There are no sensitive areas associated with the topography.
Climate	• RPM-US falls within the summer rainfall climatic zone. • The annual average number of rain days with rainfall in excess of 0.25 mm is 64. • Rainfall conditions are highly variable and droughts and floods do occur. • Temperatures vary between the extremes of 0°C and 34°C, with an average of 19°C.

Aspect	Description
	• The prevailing wind direction at RPM-US is north-easterly and winds are generally light to moderate with calm conditions occurring on average 38% of the time.
Soils and Land Capability	• Majority of development site has previously been transformed from its natural state due to levelling and construction activities associated with the development of the Mortimer Smelter. • Proposed new roads and contractors' laydown area will be situated on areas not yet cleared or levelled which may result in a minimal change to the soil and land capability. • Ongoing construction at Mortimer Smelter has resulted in varying quantities of fill, concrete, paving and asphalt occurring above the insitu transported and residual soils. • There are no sensitive areas associated with the soils and land capability.
Flora and Fauna	• The site is generally devoid of any flora and therefore habitat areas. • Flora is limited to sparse grass cover and shrubs in vacant areas and manicured gardens. • No rare or endangered species are known to occur in any of the mining, process or support areas which have been surveyed within the RPM-US. • Based on the Critical Biodiversity Areas (2015) for North West, there are no Critical Biodiversity Areas or Ecological Support Areas at RPM-US
Air Quality	• Potential sources of air pollution within the RPM-US include: o Open cast mining; o Crushing and concentrator plants; o Transfer of ore from shaft to the concentrator plant; o Waste Rock Dump (WRD); o Smelter; o Slag dump; o Tailings Storage Facility (TSF); and o Road infrastructure. • Seven sensitive areas (sensitive receptors/resources) in relation to air quality have been identified for RPM-US
Surface Water	• Sensitive areas in relation to water quality include the Bierspruit and the Brakspruit. • Sensitive areas will be susceptible to the release of pollution within the Mortimer Smelter as a result of inadequacy or failure of the site stormwater management system
Groundwater	• Groundwater level in the vicinity of the Mortimer Concentrator Complex is approximately 3m below ground level. • Groundwater quality south east of the Smelter is more impacted on than north of the Smelter. • Irrigation or livestock watering are sensitive areas should the groundwater quality not be within the required limits.
Environmental Noise	• The noise levels within the development area vary depending on proximity to the processing areas of the RPM-US; typically ranging between 2 and 22 dBA.
Visual	• The development site is characterised by the industrial activities associated with the Mortimer smelter.
Socio-Economic Environment	
Socio-Economic Structure	A regional description of the socio-economic structure is provided: • According to the 2011 Census, the Moses Kotane Local Municipality (MKLM) has a total population of 242 554 people, of which 98,3% are black African, 0,8% are white, with the other population groups making up the remaining 0,9 %. • The proposed project falls within ward 7, 8 and 34 of the Municipality.

Aspect	Description
	• Nearly 81% of the 75 193 households in the MKLM have access to piped water either in their dwellings or in the yard. • Approximately 90% of households have access to electricity for lighting. • There are 74 744 people in the municipality who are economically active (employed or unemployed but looking for work), and of these 37,9% are unemployed.
Land use	• The land use on the development site consists of industrial activities associated with the Mortimer smelter. • The proposed new roads and contractors' laydown area will be situated on area not yet cleared or levelled which may result in a minimal change to the land use, however it is anticipated that these areas have already been disturbed by existing activities at the Smelter.
Archaeology and Cultural Heritage	There are no archaeological sites that are known to occur at the locations where new developments are planned at RPM-US. There are no known records of archaeological sites that were available at the existing infrastructure areas

3 ENVIRONMENTAL RISK ASSESSMENT

3.1 Methodology

A risk assessment was undertaken using the Anglo American Plc risk assessment process, whereby the risk is described and a determination is taken to assess the nature of the risk. Five categories are considered to describe the nature of the risk, with the primary category being the one that the assessors determine is impacted most significantly should the risk manifest. The nature of the risk is assessed to fall into one of the following categories:

- Health and Safety
- Environment
- Financial
- Legal and regulatory obligations
- Reputational, Social or Community

The risk is then ranked according to predetermined criteria for probability and consequence. A matrix (Table 3-1) listing the probability and consequence is then used to numerically rank the risk and determine whether the risk level is: High, Significant, Medium or Low.

Table 3-1
Risk Assessment Matrix

		Consequence				
		1	2	3	4	5
Health and Safety Environment Financial Legal and regulatory obligations Reputational, Social or Community		Insignificant	Minor	Moderate	High	Major
Probability		**Risk Ranking**				
Almost certain	5	11(M)	16 (S)	20 (S)	23 (H)	25 (H)
Likely	4	7 (M)	12 (M)	17 (S)	21 (H)	24 (H)
Possible	3	4 (L)	8 (M)	13 (S)	18 (S)	22 (H)
Unlikely	2	2 (L)	5 (L)	9 (M)	14 (S)	19 (S)
Rare	1	1 (L)	3 (L)	6 (M)	10 (M)	15 (S)

AAP is of the opinion that the Health and Safety and Environmental risks typically represent external risks to the biophysical and socio-economic environment that may exist at closure and the Financial, Legal and Reputational risks are internal and represent how risks at closure influence AAP.

3.2 Outcomes of the Risk Assessment

Table 3-2 presents the full risk assessment. Although attention is given to mitigation of the significant and high risks in this section, conceptual closure strategies have also been prepared for the risks assessed as being low as documented in Section 5. This has been undertaken as although a low risk is potentially acceptable to AAP, there are opportunities to reduce the residual risk after management to a lower category, with risk mitigation being one of the primary drivers associated with AAP closure planning activities.

Table 3-2
Outcomes of Risk Assessment

Risk		Consequence: Pre-Mitigation															Consequence: Post Mitigation													
		Environment			Financial			Health and Safety			Legal and Regulatory			Reputational, Social or Community			Environment			Financial			Health and Safety			Legal and Regulatory			Reputational, Social or Community		
		Probability	Consequence	Ranking	Probability	Consequence	Ranking	Probability	Consequence	Ranking	Probability	Consequence	Ranking	Probability	Consequence	Ranking	Probability	Consequence	Ranking	Probability	Consequence	Ranking	Probability	Consequence	Ranking	Probability	Consequence	Ranking	Probability	Consequence	Ranking
Post Closure Land Use Planning																														
Physical Closure	Potential surface and groundwater contamination as a result of residual organic and inorganic contamination that may be present after rehabilitation of the SO2 Abatement Plant and associated infrastructure	2	5	19 (S)	1	3	6 (M)	1	1	1 (L)	2	2	5 (L)	2	3	9 (M)	2	2	5 (L)	1	3	6 (M)	1	1	1 (L)	2	2	5 (L)	2	2	5 (L)
Physical Closure	Potential soil contamination at the smelter plant and adversely affecting soil fertility and beneficial post-mining land use alternatives.	3	2	8 (M)	3	2	8 (M)	2	2	5 (L)	3	2	8 (M)	3	3	13 (S)	2	2	5 (L)	2	2	5 (L)	2	2	5 (L)	2	2	5 (L)	2	3	9 (M)
Physical Closure	Requirement to remove all foundations	3	2	8 (M)	3	2	8 (M)	2	2	5 (L)	2	1	2 (L)	2	2	5 (L)	2	2	5 (L)	2	2	5 (L)	2	2	5 (L)	2	1	2 (L)	2	2	5 (L)
Physical Closure	Inadequate removal and rehabilitation of infrastructure resulting in a visual impact	2	2	5 (L)	2	2	5 (L)	2	2	5 (L)	2	2	5 (L)	2	3	9 (M)	2	2	5 (L)	2	2	5 (L)	2	2	5 (L)	2	1	2 (L)	1	3	6 (M)
Closure Planning	Longer rehabilitation period than planned	3	1	4 (L)	3	2	8 (M)	2	2	5 (L)	3	2	8 (M)	3	2	8 (M)	2	1	2 (L)	2	2	5 (L)	2	2	5 (L)	2	1	2 (L)	2	2	5 (L)
Closure Planning	Progressive rehabilitation is deferred to shutdown	4	2	12 (M)	4	2	12 (M)	3	1	4 (L)	3	1	4 (L)	3	2	8 (M)	3	2	8 (M)	3	2	8 (M)	3	1	4 (L)	3	1	4 (L)	3	1	4 (L)
Land Use	Possibility that rehabilitation work conducted in the past not to the required standard and/or not sustainable – placing the effort towards closure and eventual site relinquishment at jeopardy	2	3	9 (M)	2	3	9 (M)	2	1	2 (L)	2	3	9 (M)	2	3	9 (M)	2	2	5 (L)	2	2	5 (L)	2	1	2 (L)	2	2	5 (L)	2	2	5 (L)
Land Use	Contradiction of SDFs of the two district and local municipalities, therefore the possibility exists that the end land use planning is not aligned with SDF's.	3	2	8 (M)	3	3	13 (S)	2	1	2 (L)	3	2	8 (M)	3	3	13 (S)	2	3	9 (M)	2	3	9 (M)	2	1	2 (L)	2	2	5 (L)	2	3	9 (M)
Land Use	Non-integration and alignment of site-wide rehabilitation plans resulting in non-achievement of the desired sustainable final land capability and end land use.	3	2	8 (M)	3	2	8 (M)	2	1	2 (L)	2	1	2 (L)	3	2	8 (M)	2	2	5 (L)	2	2	5 (L)	2	1	2 (L)	2	1	2 (L)	2	2	5 (L)
Biophysical Closure																														
Invasive species	Clearance of natural vegetation will encourage the growth of invasive species.	3	3	13 (S)	3	2	8 (M)	2	1	2 (L)	2	2	5 (L)	2	2	5 (L)	2	2	5 (L)	2	1	2 (L)	2	1	2 (L)	2	1	2 (L)	2	1	2 (L)

Risk		Consequence: Pre-Mitigation															Consequence: Post Mitigation													
		Environment			Financial			Health and Safety			Legal and Regulatory			Reputational, Social or Community			Environment			Financial			Health and Safety			Legal and Regulatory			Reputational, Social or Community		
		Probability	Consequence	Ranking	Probability	Consequence	Ranking	Probability	Consequence	Ranking	Probability	Consequence	Ranking	Probability	Consequence	Ranking	Probability	Consequence	Ranking	Probability	Consequence	Ranking	Probability	Consequence	Ranking	Probability	Consequence	Ranking	Probability	Consequence	Ranking
Land Degradation	Degradation of re-established vegetation cover due to trampling and grazing by large herbivores prior to adequate sustainable coverage obtained resulting in erosion, visual impact and not achieving biodiversity objectives	3	2	8 (M)	2	2	5 (L)	2	2	5 (L)	2	2	5 (L)	2	2	5 (L)	2	1	2 (L)	2	1	2 (L)	2	1	2 (L)	2	1	2 (L)	2	2	5 (L)
Contamination	Contamination from hydrocarbon and dangerous material storage	3	3	13 (S)	2	2	5 (L)	3	2	8 (M)	2	3	9 (M)	3	3	13 (S)	2	2	5 (L)	2	2	5 (L)	2	2	5 (L)	2	2	5 (L)	2	3	9 (M)
Soil Quality	Quantity and/or quality of topsoil is not adequate for successful rehabilitation	4	3	17 (S)	3	3	13 (S)	3	2	8 (M)	2	2	5 (L)	3	2	8 (M)	3	2	8 (M)	3	2	8 (M)	2	2	5 (L)	2	2	5 (L)	2	2	5 (L)
Regulatory																														
Legal	Lack of consultation with regulators to agree on implemented closure and rehab measures resulting in delayed site relinquishment.	3	2	8 (M)	3	3	13 (S)	2	2	5 (L)	3	2	8 (M)	3	3	13 (S)	2	1	2 (L)	3	2	8 (M)	2	1	2 (L)	2	2	5 (L)	2	2	5 (L)
Legal	Change in regulatory requirements guiding closure planning and/or costing	4	2	12 (M)	4	3	17 (S)	2	1	2 (L)	4	2	12 (M)	3	2	8 (M)	3	2	8 (M)	3	2	8 (M)	2	1	2 (L)	3	2	8 (M)	2	2	5 (L)
Legal	Failure to capture all legal requirements for closure	3	2	8 (M)	3	3	13 (S)	3	2	8 (M)	3	3	13 (S)	3	2	8 (M)	2	1	2 (L)	2	2	5 (L)	2	2	5 (L)	2	2	5 (L)	2	2	5 (L)
Legal	Inadequately addressing EMP, SLP and closure-related commitments during operations that could result in the need for additional financial resources	3	2	8 (M)	3	3	13 (S)	2	2	5 (L)	3	2	8 (M)	3	4	18 (S)	2	2	5 (L)	2	3	9 (M)	2	1	2 (L)	2	2	5 (L)	2	3	9 (M)
Legal	Costs associated with removal of site infrastructure and remediation of site contamination above estimate in provision	3	2	8 (M)	3	4	18 (S)	3	1	4 (L)	2	3	9 (M)	2	2	5 (L)	2	2	5 (L)	2	2	5 (L)	2	1	2 (L)	2	2	5 (L)	2	2	5 (L)
Financial	Insufficient financial provision made impacting on future care and maintenance.	3	2	8 (M)	3	4	18 (S)	3	2	8 (M)	3	2	8 (M)	3	2	8 (M)	2	2	5 (L)	2	2	5 (L)	2	2	5 (L)	2	2	5 (L)	2	2	5 (L)
Reputation	Negative perception of company due to reduction in government services because of site closure	3	2	8 (M)	3	2	8 (M)	2	1	2 (L)	2	1	2 (L)	3	4	18 (S)	2	2	5 (L)	2	2	5 (L)	2	1	2 (L)	2	1	2 (L)	2	3	9 (M)

4 BASIS OF CLOSURE DESIGN

The design of the Closure Plan considers a number of interconnected components including legal and other obligations, closure objectives, environmental and social considerations, technical design criteria, closure assumptions, health and safety hazards, and relinquishment conditions.

4.1 Legal Obligations

There are several legal and regulatory frameworks with which AAP must comply. The legislation influencing closure is varied, however, a common thread, is that after mitigation, the impacts of the operation on the environment need to be mitigated and the solutions implemented are required to be sustainable within the existing constraints presented by the biophysical environment, with there being no significant residual impact that water resources will be impacted on. The **key** legislation applicable to closure includes:

- Constitution of the Republic of South Africa (Act 108 of 1996) (Constitution);
- Mineral and Petroleum Resources Development Act (Act 28 of 2002) (MPRDA);
- National Environmental Management Act (Act 107 of 1998) (NEMA); and
- National Water Act (Act 36 of 1998) (NWA).

The following sections provide a brief description of the legislation as it pertains to the closure of the SO_2 Abatement Plant.

4.1.1 The Constitution

Section 24 of the Constitution states that "*Everyone has the right - to an environment that is not harmful to their health or well-being; to have the environment protected, for the benefit of present and future generations*". It is a constitutional requirement to ensure that post-closure measures that protect the rights of people to an environment that is not harmful to health or well-being are considered during closure planning.

4.1.2 Minerals and Petroleum Resources Development Act

The MPRDA came into effect on the 1 May 2004 and sets out the legal framework for the regulation of the mining industry. Regulations in support of the MPRDA were published in April 2004 (Government Gazette 26275, Regulation 527) which provide principles for mine closure. These Regulations state that the holder of a mining right must ensure that:

- The closure of its mining operation incorporates a process which starts at the commencement of operation and continues throughout the life of mine;
- Risks pertaining to environmental impacts are quantified and managed proactively, which includes gathering relevant information throughout the mine's operations;

- Safety and health requirements of the Mine Health and Safety Act (MHSA) 29 of 1996 are complied with;
- Residual and possible latent environmental impacts are identified and quantified;
- The land is rehabilitated, as far as practicable, to its natural state, or to a predetermined and agreed standard or land use which conforms to the concept of sustainable development;
- Mining operations are closed efficiently and cost effectively;
- Key objectives for mine closure to guide project design development and management of environmental impacts are included in the Environmental Management Programme (EMPr);
- The EMP includes broad future land use objectives; and
- The EMP includes proposed closure costs.

4.1.3 National Environmental Management Act

The Duty of Care Principle is set out in Sections 28 (1) and (3) of the NEMA which is applicable to all types of pollution and must be taken into account in considering any aspects of potential environmental degradation. Measures pertaining to the Duty of Care Principle may include measures to –

- Investigate, assess and evaluate the impact on the environment;
- Inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution or degradation of the environment;
- Cease, modify or control any act, activity or process causing the pollution or degradation;
- Contain or prevent the movement of pollutants or the source of degradation;
- Eliminate any source of the pollution or degradation; or
- Remedy the effects of the pollution or degradation.

4.1.4 National Water Act

Section 19 of the Act sets out the principles for "*an owner of land, a person in control of land or a person who occupies or uses land*" to:

- Cease, modify or control any act or process causing pollution;
- Comply with any prescribed waste standard or management practice;
- Contain or prevent the movement of pollutants;
- Eliminate any source of pollution;
- Remedy the effects of the pollution; and
- Remedy the effects of any disturbance to the bed and banks of a watercourse.

These principles place the obligation to mitigate any aspects that cause or have caused pollution on AAP as well as the obligation to remediate any residual contaminated water at closure.

4.2 Anglo American Corporate Standards and Guidelines

Corporate Standards and Guidelines that are relevant to closure include the Rehabilitation Performance Standard and the Anglo Closure Toolbox.

4.2.1 Rehabilitation Performance Standard

The purpose of this standard is to ensure that all Anglo American projects rehabilitate disturbed land safely and responsibly to avoid or mitigate potential adverse impacts on the environment (Anglo American 2009). Rehabilitation of on-site disturbances needs to ensure that there is no detrimental effect on future land use, resource access, ground and surface water quality and quantity. Anglo American shall ensure, where possible, that no residual risks remain without an on-going and sustainable management plan. For the purpose of annual rehabilitation plans, the implementation of environmental programmes and operational controls will include, as appropriate:

- Progressive rehabilitation maintenance, in accordance with the approved closure and post closure plan;
- Measures to prevent rehabilitation being used for purposes other than its intended use/capability;
- Monitoring programmes to confirm the rehabilitation stability and effectiveness;
- Soil fertility and content for deterioration, vegetation and soil covers will be monitored where appropriate for stability, land use and productivity; and
- Progress of, and expenditure on, rehabilitation activities should be monitored.

4.2.2 Closure Toolbox

The Anglo Mine Closure Toolbox, launched in 2008, details what is needed to achieve a successful mine closure that leaves the positive and sustainable legacy for the host communities after operations have closed.

4.3 Closure Vision and Objectives

The overall closure goal for the RPM-US, and therefore the development site for the SO_2 Abatement Plant is to progressively re-instate an area that is safe, stable, and non-polluting with the final landform not adversely affecting water resources.

The closure objectives for the SO_2 Abatement Plant are in line with the Union Section's closure objectives (SRK, 2016), which are as follows:

- Identify potential post-closure uses of the land occupied by mine infrastructure in consultation with the surrounding landowners and land users (this is to be done during the operational phase). Should a suitable use for mine infrastructure not be found, it will be removed;
- Rehabilitate all disturbed land to a state that facilitates compliance with applicable environmental quality objectives (air quality objectives and water quality guidelines);
- Reduce the visual impact of the site through rehabilitation of all disturbed land and residue deposits;
- Rehabilitate all disturbed land and residue deposits to a state where limited post-closure management is required;
- Limit the impact on staff whose positions become redundant on closure of the mine;
- Keep relevant authorities informed of the progress of the decommissioning phase;
- Submit monitoring data to the relevant authorities;
- Maintain required pollution-control facilities and rehabilitated land until closure; and
- Preparation of a closure EMPr.

To meet the objectives the following general measures will apply:

- Chemical reagent residues will be collected by registered waste disposal companies and transported for final neutralization and disposal at permitted hazardous waste sites.
- Soil that has been contaminated will be sampled and analysed. If necessary, it will be treated, ameliorated or removed to a suitable site.
- Disturbed areas will be rehabilitated through landscaping, soil replacement and the establishment of vegetation in these areas. Where practical, rehabilitation will take place during all phases of the project however it is likely that the majority of the rehabilitation will only be undertaken at the end of the operation of the Smelter Plant. On closure, all disturbed areas will have been rehabilitated.
- Landscaping will be undertaken to restore the natural topography of the areas that have been disturbed or, at least, to reduce slopes to stable gradients (no steeper than 1:3).
- The soil, which has been conserved in stockpiles, will be used strategically in the rehabilitation of disturbed land.
- Vegetation establishment in disturbed areas will be undertaken as soon as is practical, with growing season and water availability being the primary time constraints. Indigenous pasture species will be used where possible but emphasis will be on commercially available seeds that will germinate reliably (high seed viability). The species used will be selected on the basis of their ability to bind and cover soil (to afford effective erosion protection) and their tolerance of the prevailing environmental conditions.

- Prior to re-vegetating soil samples will be collected and analysed and if necessary the soil will be fertilized in accordance with the findings of the soil analysis.
- Following re-vegetation, the site will be monitored and maintained until an acceptable cover has been achieved. The spread of invader species on disturbed land will be controlled until the vegetation cover is capable of providing sufficient natural weed control.

5 CLOSURE ACTIONS (AT DECOMMISSIONING)

Closure and rehabilitation actions that AAP intends undertaking at the end of the life of the SO_2 Abatement Plant are described below. These actions are aligned with the Union Section Liability Assessment (SRK, 2016) and the Mortimer Smelter EMPr (WSP, 2009). These actions are intended to mitigate and manage closure risks identified in the environmental risk assessment (Refer to Section 3). The adequacy of the closure actions need to be continually reviewed throughout the life of the operation.

5.1 Infrastructure Areas

On closure of the SO_2 Abatement Plant, all disused infrastructure will be demolished. Building foundations will be removed to a depth of 500 mm or will be suitably covered. All land exposed by the demolition of infrastructure and other land distributed by the plant's activities will be rehabilitated as outlined in the EMPr for the SO_2 Abatement Plant. Further closure actions include:

- Salvageable equipment will be removed and transported offsite prior to the commencement of demolition.
- The excavations will be filled in with soil, the top 0.15m being topsoil.
- Inert ceramics such as bricks, concrete, gravel etc. will be used as backfill or disposed of in a permitted waste disposal site.
- Inert waste, which is more than 0.5m underground, such as pipes will be left in place.
- Inert ceramic and buried waste with a salvage value to individuals such as scrap metal, building materials, etc. will be removed and disposed of at a proper facility.
- All disturbed and exposed surfaces will be covered with 0.15m topsoil and re-vegetation must be allowed to take place naturally.
- The contractor lay down area will be demolished and rehabilitated.
- All power and water services to be disconnected and certified as safe prior to commencement of any demolition works. These services will then be demolished.
- All remaining inert equipment and demolition debris will be placed in the nearest general waste disposal facility.
- All fittings, fixtures and equipment within buildings will be dismantled and removed to designated temporary disposal yards.

- All above ground electrical, water and other service infrastructure and equipment to be removed and placed in the designated temporary salvage yards.
- Electrical, water and other services that are more than 400 mm below ground surface will remain.
- All pipes and structures deeper than 400 mm need to be sealed to prevent possible ingress and ponding of water.
- Non-hazardous concrete slabs and footings will be broken. This concrete (and metal) will be broken up and disposed of in a proximate mining void.
- All concrete below 500 mm depth will remain underground with the invert of all structures broken/sealed to prevent possible ingress and ponding of water.
- Soils beneath the plant, storage tanks and chemical storage areas will be sampled. Any contaminated soils found will be removed for disposal.
- All excavations resulting from demolition of plant, buildings, roads, conveyor platforms, etc. and earth structures will be left in a safe manner.

5.2 Roads and Parking Areas

The following closure actions related to roads and parking areas are taken from the Union Section Liability Assessment (SRK, 2016). The access road to the SO_2 Abatement Plant that is not needed for closure and post-closure uses at the site (e.g. security and monitoring) will be closed. Closure actions will include:

- Removal of all signage, fencing, shade structures, traffic barriers, etc.;
- All 'hard top' surfaces to be ripped and bitumen/concrete removed along with any culverts and concrete structures;
- The disturbed surfaces will be covered with 0.15m topsoil and re-vegetation must be allowed to take place naturally.
- All concrete lined drainage channels and sumps will be broken up and removed;

5.3 Stormwater Management

Hardstanding areas and roads will be concreted as per Mortimer Smelter requirements, but the water captured in these areas will report to normal pollution control dams via the existing stormwater system. Therefore, stormwater management closure actions will be as per the Union Section Liability Assessment (SRK, 2016) which states that prior to closure a water management plan will be prepared to identify which structures are required at closure and which can be decommissioned. No new stormwater management infrastructure will be constructed as part of the SO_2 abatement plant.

5.4 Fencing

The fencing that will be installed around the contractor laydown and the SO_2 Abatement Plant will be removed as the areas are reclaimed. The fence will not be retained due to the associated maintenance costs. Removal of the fencing includes dismantling the fencing for salvage and the fence line will be ripped to de-compact the soil. The cost associated with the dismantling of the fence have been excluded as part of this assessment and is assumed to be included in the overall closure cost for the Smelter.

5.5 Remediation of Contaminated Areas

- All tanks, sumps and pipes containing non-biodegradable chemicals (liquid, solid or gas) will be flushed to ensure that chemical residues are removed from the site;
- Liquid storage tanks (including septic tanks) will be emptied, the structure demolished and sub-surface holes filled; and
- All equipment and plant in which chemicals have been stored or transported will be cleaned and disposed of in a suitable disposal facility.

5.6 Vegetation

The establishment of non-invasive vegetation in disturbed areas will help control impacts to soil (i.e. erosion and loss of productivity) and sediment loading of streams. Invasive species will be controlled and managed to prevent the spread of these species in accordance with the Biodiversity Action Plan (BAP).

5.7 Waste Management

Closure actions related to waste management activities includes:

- Hazardous waste will be managed as per the operational Waste Management Plan and will be disposed of off-site;
- Non-hazardous demolition rubble will be disposed of as per the operational Waste Management Plan; and
- It may be necessary to fence temporary salvage yards for security reasons, particularly where these are located close to public roads.

5.8 Post Rehabilitation Monitoring and Maintenance

Post rehabilitation and monitoring of the development site will be done in accordance with the RPM-US monitoring programme. The objective of this monitoring programme is to track the recovery of the site towards the long-term post-closure land use goals, in accordance with the

overall closure objectives. The monitoring programme will be designed to collect information to demonstrate that the relinquishment criteria have been achieved for the entire mining area including the Mortimer Smelter and SO_2 Abatement Plant. The closure monitoring programme outlined in the current closure plan includes:

- Surface Water – Quality monitoring against parameters as required by the Water Use License (WUL). Sampled monthly for a three-year post-closure period;
- Groundwater – Quality monitoring of both the shallow and deep aquifers against the parameters required by the WUL. Sampled quarterly for a three-year post-closure period;
- Erosion monitoring. This will take the form of developing a representative reference site on the disturbed both footprints and undertaking visual and topographic assessments to determine erosion rate, using standard erosion monitoring techniques. This will be undertaken once a year at the end of the wet season for a three-year post-closure period;
- Vegetation establishment: Vegetation condition will be monitored using standard field techniques to determine whether the vegetation has been established with a species composition and density similar to that of a reference analogue site established in a similar ecotype, for a three-year post-closure period; and
- Bio-monitoring: upstream and downstream of the mining activities. A long-term bio-monitoring programme will be implemented to monitor physico-chemical and biological components of the aquatic ecosystems within the mining area. Appropriate biological index will be included in order to quantify and classify the longer-term changes in biotic integrity.

5.9 Final Land Use

Post closure land use (PCLU) is determined in consultation with stakeholders so that the PCLU meets the requirements of the stakeholders, within the context of the closure plan. This activity is undertaken for the whole mine lease area affected by mining activities and integrates stakeholder requirements with risk mitigation.

Specific consultation regarding PCLU has not been undertaken at this stage of the closure planning process. However, for purposes of this assessment, the assumption is made that all disturbed areas will be rehabilitated to "grazing land" as defined by the Chamber Mines Guideline for the Rehabilitation of Mined Land (CM, 2007) and as presumed in the EMP (WSP, 2009) and Union Section – Liability Assessment (SRK, 2016). This implies a growth medium cover of a minimum of 25cm on average across the footprints rehabilitated.

6 CLOSURE COST ESTIMATION

As per WSP's requirements, this closure cost estimation has been based on the DME 2005 published "*Guideline Document for The Evaluation of the Quantum of Closure-Related Financial Provision Provided by a Mine*". Prior to the Financial Provisioning Regulations published in November 2015 (GN R1147), the DME Guideline document was considered to be an industry accepted approach of calculating closure liability. However, a holder of an existing Mining Right is only legally required to review and update the closure liability in terms of GN R1147 by February 2019. Therefore, the DME Guideline document has been used to determine the closure liability for the SO_2 Abatement Plant and associated infrastructure. The step-by-step methodology for closure as prescribed by this document is provided in Table 6-1, while the closure costs are determined in the sections that follow.

Table 6-1
DME Guideline Document Methodology for Closure

Step No.	Description
1	Determine mineral mined and saleable by-products
2	Determine primary risk class
3	Determine environmental sensitivity of mine area
4.1	Determine level of information available to calculate quantum
4.2	Identify closure components
4.3	Identify unit rates for closure components
4.4	Identify and apply weighting factors
4.5	Identify areas of disturbance
4.6	Identify closure costs from specialist studies
4.7	Calculate closure costs

6.1 Step 1: Determine Mineral Mined and Saleable By-Products

RPM-US exploits the Merensky and UG2 reefs of the Bushveld Complex for PGMs (Platinum, Palladium, Rhodium, Iridium, Ruthenium, Osmium and Gold) (WSP, 2017).

6.2 Step 2: Determine Primary Risk Class

The risk class of the mine is **Class B** (medium risk) implying that there is a moderate probability of occurrence of the impact with a manageable consequence.

6.3 Step 3: Determine Environmental Sensitivity of Mine Area

The environmental sensitivity is assessed by considering biophysical, social and economic impacts listed in Table 6-2. The overall sensitivity is established by accepting the most sensitive of the three individual assessments.

Table 6-2
Table of Criteria used to Determine Area Sensitivity

Sensitivity	Sensitivity Criteria		
	Biophysical	Social	Economic
Low	**Largely disturbed from natural state. Limited natural fauna and flora remains, exotic plant species evident. Unplanned development. Water resources disturbed and impaired.**	The local communities are not within sighting distance of the mining operation. Lightly inhabited area (rural).	The area is insensitive to development. The area is not a major source of income to the local communities.
Medium	Mix of natural and exotic fauna and flora. Development is a mix of disturbed and undisturbed areas, within an overall planned framework. Water resources are well controlled.	**The local communities are in the proximity of the mining operation (within sighting distance). Peri-urban area with density aligned with a development framework. Area developed with an established infrastructure.**	**The area has a balanced economic development where a degree of income for the local communities is derived from the area. The economic activity could be influenced by indiscriminate development.**
High	Largely in natural state. Vibrant fauna and flora, with species diversity and abundance matching the nature of the area. Well planned development. Area forms part of an overall ecological regime of conservation value. Water resources emulate their original state.	The local communities are in close proximity of the mining operation (on the boundary of the mine). Densely inhabited area (urban/dense settlements). Developed and well established communities.	The local communities derive the bulk of their income directly from the area. The area is sensitive to development that could compromise the existing economic activity.

Environmental sensitivity is **medium** based on the table above.

6.4 Step 4.1: Determine Level of Information Available to Calculate Quantum

Extensive — Extensive information will include the following:

- An approved EMP as contemplated in Section 39 of the MPRDA, or an EMP that is in the process of being approved or amended,
- A detailed Closure Plan, based on the EMP, that covers all aspects of rehabilitation and closure of the mining operation, and
- A detailed breakdown of the costs envisaged for rehabilitation and closure, signed off by a competent person.

Limited — Limited information is a level of information that is less comprehensive, in any way, than that given above.

While **extensive** information is available, WSP have commissioned MSA to follow the "rule-based" approach to determine the quantum of the financial provision required for the closure of the SO_2 Abatement Plant.

6.5 Step 4.2: Identify Closure Components

The applicable closure components for the SO_2 Abatement Plant are shown in Table 6-3 below.

Table 6-3
Closure Components applicable to the SO_2 Abatement Plant

No.	Main Description	Applicability
1	Dismantling of processing plant & related structures (including overland conveyors & power lines)	
2(A)	Demolition of steel buildings & structures	✓
2(B)	Demolition of reinforced concrete buildings & structures	
3	Rehabilitation of access roads	✓
4(A)	Demolition & rehabilitation of electrified railway lines	
4(B)	Demolition & rehabilitation of non-electrified railway lines	
5	Demolition of housing and facilities	
6	Opencast rehabilitation including final voids & ramps	
7	Sealing of shafts, adits & inclines	
8(A)	Rehabilitation of overburden & spoils	
8(B)	Rehabilitation of processing waste deposits & evaporation ponds (basic, salt producing waste)	
8(C)	Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)	
9	Rehabilitation of subsided areas	
10	General surface rehabilitation, including grassing of denuded areas	✓
11	River diversions	
12	Fencing	
13	Water Management	
14	2 to 3 years of maintenance and aftercare ^	✓

6.6 Step 4.3: Identify Unit Rates for Closure Components

The Master Rates provided in the DME Guideline have been used to identify the unit rates for the closure components (Table 6-4). As per instruction by the DMR, an average CPIX of 6% has been applied for each year to produce the current rates.

Table 6-4
Summary of Unit Rates for Closure Components

No.	Main Description	Unit	2004 Master Rate (ZAR)	2017 Master Rate (ZAR)
1	Dismantling of processing plant and related structures (including overland conveyors and power lines)	m^3	6.82	14.48

No.	Main Description	Unit	2004 Master Rate (ZAR)	2017 Master Rate (ZAR)
2(A)	Demolition of steel buildings and structures	m^2	95.00	201.65
2(B)	Demolition of reinforced concrete buildings and structures	m^2	140.00	297.17
3	Rehabilitation of access roads	m^2	17.00	36.09
4(A)	Demolition and rehabilitation of electrified railway lines	m	165.00	350.24
4(B)	Demolition and rehabilitation of non-electrified railway lines	m	90.00	191.04
5	Demolition of housing and facilities	m^2	190.00	403.31
6	Opencast rehabilitation including final voids and ramps	ha	99,600.00	205,261.83
7	Sealing of shafts, adits and inclines	m^3	51.00	108.26
8(A)	Rehabilitation of overburden and spoils	ha	66,400.00	140,945.04
8(B)	Rehabilitation of processing waste deposits and evaporation ponds (basic, salt-producing waste)	ha	82,700.00	175,544.50
8(C)	Processing waste deposits and evaporation ponds (acid, metal)	ha	240,200.00	509,864.45
9	Rehabilitation of subsided areas	ha	55,600.00	118,020.25
10	General surface rehabilitation, including grassing of all denuded areas	ha	52,600.00	111,652.25
11	River diversions	ha	52,600.00	111,652.25
12	Fencing	m	60.00	127.36
13	Water management (Separating clean and dirty water, managing polluted water and managing the impact on ground water, including treatment when required)	ha	20,000.00	42,453.33
14	2 to 3 years of maintenance and aftercare	ha	7,000.00	14,858.66

6.7 Step 4.4: Identify and Apply Weighting Factors

Weighting Factors 1 and 2 (Table 6-5) are used as multipliers to calculate quantum totals once quantities and rates for each relevant component are summed up.

Table 6-5
Weighting Factors

Weighting Factor	Multipliers		
	1.00	1.10	1.20
Weighting Factor 1 (WF1)			
Nature of the terrain/ accessibility	**Flat: Generally flat area over the mine**	Undulating: A mix of sloped and undulating areas within the mine area	Rugged: Steep natural ground slopes (greater than 1:6) over the majority of the mine area
Weighting Factor 2 (WF2)			
Proximity to urban area where goods and services are to be supplied	Urban: Within a developed urban area	**Peri-urban: Less than 150 km from a developed urban area**	Remote: Greater than 150 km from a developed urban area

Based on the risk class (Class B) and environmental sensitivity assigned to the development site, a multiplication factor of "**1**" is applicable to WF1 and a multiplication factor of "**1.1**" is applicable to WF2.

6.8 Step 4.5: Identify Areas of Disturbance

Areas of disturbance were calculated by mapping out various applicable components (refer to Section 6.5) using Google Earth. Information provided in the Final Scoping Report (WSP, 2017) and GIS software was then used to measure quantities for applicable components. Measured quantities for each area are summarised in Table 6-6.

Table 6-6
Measured Quantities for Areas of Disturbance

Component	Description of Component	Unit	Quantity
3	Access Road	m^2	20 556
Component 3 Total			**20 556**
2(A)	Secondary Gas Cleaning	m^2	500
2(A)	WSA Acid Plant	m^2	1 305
2(A)	Effluent Treatment Plant	m^2	155
2(A)	Acid Plant Cooling Water	m^2	1 012
2(A)	Acid Storage Tanks	m^2	1 020
2(A)	Lime Storage Silo	m^2	60
Component 2(A) Total			**4 052**
10	Mobile Containers Storage Site, Offices and Ablution		0
10	Car Park Area	ha	0.43
10	Large Equipment Lay-down & Cable Yard	ha	1
Component (10) Total			**1.43**
14	Footprint of SO_2 Abatement Plant and Large Equipment Lay-down & Cable Yard area	ha	3.24
Component 14 Total			**3.24**

This closure liability estimate considers only the SO_2 Abatement Plant components in their proposed state and assumes that all liability from previous mining activity is included in the Union Section Liability Assessment (SRK, 2016).

6.9 Step 4.6: Identify Closure Costs from Specialist Studies

The closure costing excludes any costs from site-specific specialist studies, and assumes that specialist studies will be undertaken as part of the closure costing for the RPM-US.

6.10 Step 4.7: Calculate Closure Costs

The quantum of the financial liability for closure associated with the proposed SO_2 Abatement Plant and associated infrastructure is presented in Table 6-7 below. The total estimated closure cost is R 3,011,973.46.

Table 6-7
Mortimer Smelter SO_2 Abatement Plant Closure Costs

No.	Main Description	Unit	Quantity	2017 Master rate (ZAR)	Multi-plication Factor	WF1	Amount (ZAR)
1	Dismantling of processing plant and related structures (including overland conveyors and power lines)	m^3		14.48	1	1	0.00
2(A)	Demolition of steel buildings and structures	m^2	4,052.00	201.65	1	1	817,099.17
2(B)	Demolition of reinforced concrete buildings and structures	m^2		297.17	1	1	0.00
3	Rehabilitation of access roads	m^2	20,556.00	36.09	1	1	741,769.99
4(A)	Demolition and rehabilitation of electrified railway lines	m		350.24	1	1	0.00
4(B)	Demolition and rehabilitation of non-electrified railway lines	m		191.04	1	1	0.00
5	Demolition of housing and facilities	m^2		403.31	1	1	0.00
6	Opencast rehabilitation including final voids and ramps	ha		205261.83	1	1	0.00
7	Sealing of shafts, adits and inclines	m^3		108.26	1	1	0.00
8(A)	Rehabilitation of overburden and spoils	ha		140945.04	1	1	0.00
8(B)	Rehabilitation of processing waste deposits and evaporation ponds (basic, salt-producing waste)	ha		175544.50	1	1	0.00
8(C)	Processing waste deposits and evaporation ponds (acid, metal)	ha		509864.45	1	1	0.00
9	Rehabilitation of subsided areas	ha		118020.25	1	1	0.00
10	General surface rehabilitation, including grassing of all denuded areas	ha	3.24	111652.25	1	1	361,753.28
11	River diversions	ha		111652.25	1	1	0.00

No.	Main Description	Unit	Quantity	2017 Master rate (ZAR)	Multi-plication Factor	WF1	Amount (ZAR)
12	Fencing	m		127.36	1	1	0.00
13	Water management (Separating clean and dirty water, managing polluted water and managing the impact on ground water, including treatment when required)	ha		42453.33	1	1	0.00
14	2 to 3 years of maintenance and aftercare	ha	3.24	14858.66	1	1	48,142.07
Subtotal 1		**Weighting Factor 2 = 1.1 (Step 4.4)**					**2,165,640.97**
VAT		14% of Subtotal 1					303,189.74
GRAND TOTAL (Planned closure)		Subtotal 1 plus VAT					**2,468,830.71**
Preliminary and General		12% of subtotal 1 if < R100,000,000.00					259,876.92
Contingencies		10% of subtotal 1					216,564.10
Total 3rd party closure costs		Preliminary and general plus Contingencies					476,441.01
Subtotal 2		Subtotal 1 plus 3rd party closure costs					**2,642,081.98**
VAT		14% of Subtotal 2					369,891.48
GRAND TOTAL (Premature / 3rd party closure)		Subtotal 2 plus VAT					**3,011,973.46**

6.11 Closure Assumptions and Qualifications

Assumptions and qualifications related to the closure cost determinations for the SO_2 Abatement Plant are as follows:

- Although the proposed SO_2 Abatement Plant and related surface infrastructure could have a salvage or resale value at closure, this could not be determined and hence no cost off-sets due to possible salvage values have been considered as part of this costing.
- Once the infrastructure has been removed, the remaining footprint areas will be shaped so that they are free draining to ensure a productive landscape.
- It is assumed that the storage containers, contractor's offices and ablution facilities will be mobile containers which will be removed from the site at closure. The cost of removing the mobile facilities have been excluded.
- Only the access road to the SO_2 Abatement Plant site has been costed for in terms of Closure Component (3). All internal roads within the Plant are costed for in the rehabilitation of the footprint of the plant.
- Allowance has been made for care and maintenance as well as surface and groundwater quality monitoring to be conducted for a minimum period of 2-3 years to ensure and assess success of the implemented rehabilitation and closure measures.
- The cost for dismantling of the fence around the SO_2 abatement plant and the laydown area has been excluded and is assumed to be considered as part of the overall decommissioning cost for the Mortimer Smelter.

- Risks associated with the socio-economic environment during closure are excluded from this closure assessment. It is assumed that socio-economic aspects are addressed in the closure plan of the RPM-US.
- The cost for the demolition of existing infrastructure for the development of the SO_2 Abatement Plant is excluded from this study. It is assumed that this costing is included as part of the capital start-up cost for the Project.
- Potential impacts to surface and groundwater resources from the SO_2 Abatement Plant will be negligible (WSP, 2017). Water management has therefore been excluded from this Closure Plan; however, any residual impacts on groundwater and surface water resulting from mining activities will be accounted for in the RPM-US Closure Plan.
- The Socio-Economic Closure cost have been excluded from this closure assessment for the SO_2 Abatement Plant and will be considered as part of the Union Section Closure Cost.

7 CONCLUSION

The proposed SO_2 Abatement Plant is still in the environmental authorization application phase, therefore no infrastructure has been developed. The closure cost determination has been based on the Final Scoping Report (WSP, 2017), from which the quantities used in the closure cost assessment were extracted. AAP will update the Closure Cost as part of their annual Closure Cost update for the Mortimer Smelter once the plant has been constructed.

8 REFERENCES

Chamber of Mines (CM) (2007) Guideline for the Rehabilitation of Mined Land. Chamber of Mines of South Africa/Coaltech Research.

SRK Consulting (South Africa) (Pty) Ltd (2016) Union Section – Liability Assessment 2016.

WSP | Parsons Brinckerhoff (2017) Proposed Installation of Sulphur Dioxide (SO_2) Abatement Equipment at Anglo American Platinum Limited: Mortimer Smelter – Final Scoping Report.

WSP | Parsons Brinckerhoff (2009) Final Mortimer Smelter Furnace Upgrade EIA/EMP Report.

APPENDIX 1:

Curriculum Vitae of the Specialists

Resumé: Stephan Herb

Qualifications and Courses

Master of Sciences in Environmental Management, University of Johannesburg, 2010
Bachelor of Science Honours Degree in Zoology, University of Stellenbosch, 2006
Bachelor of Science in Natural and Environmental Science, University of Johannesburg, 2005
IRCA Environmental Management Systems (EMS) 14001:2004 Lead Auditor Course, Bureau Veritas, July 2014

Professional Affiliations

- Professional Registration with the South African Council for Natural Scientific Professions (SACNASP) in the field of Environmental Science (Pr.Sci.Nat. member number 400171/14)
- International Association for Impact Assessment (IAIAsa)
- Land Rehabilitation Society of South Africa (LaRSSA)
- Wildlife and Environment Society of South Africa (WESSA)
- Field Guide Association of South Africa (FAGSA) - Level 2 qualified field guide

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Key Experience

Stephan is an Environmental Project Manager with over seven years of environmental consulting experience to the mining, industrial and oil and gas sector. His experience includes, but not limited to, project management, land rehabilitation and closure, Ecology and Land Management, GIS, ESIA coordination, compliance auditing, EMS development and implementation, waste management and due diligence assessments.

The MSA Group: January 2015 - Current **Position:** Environmental Project Manager

- Due Diligence Assessments including IFC and Equator Principal reviews
- Manage exploration and mining and prospecting right applications in terms of the MPRDA and NEMA
- Water Use License Application in terms of the National Water Act
- Environmental/Legal Compliance Audits and Assessments
- Closure plans and Financial Provision updates
- Screening and GIS projects
- Contribute to marketing and sales
- Develop and maintain relationships with key clients

Environmental Resources Management: 2011 - 2014 **Position:** Environmental Advisor

- Prepare Environmental and Social Impact Assessments (ESIA) to IFC performance Standards and local legislation;
- Advise clients on environmental permitting requirements;
- Manage environmental licensing applications e.g. Waste Management License and Water Use License.
- Develop environmental management and monitoring plans;
- Undertake environmental compliance audits;
- Supervise environmental monitoring and field assessments;
- Prepare proposals;
- Undertake contaminated land assessments and propose mitigation measures; and
- Contaminated Land experience

Anglo American Kumba Iron Ore (Pty) Ltd: 2011 - 2012 **Position:** Environmental Coordinator

- Develop and oversee environmental awareness training;
- Develop site specific Environmental Management Procedures and guidelines;
- Develop and maintain an Environmental Management System (EMS);
- Undertake and approve Environmental Risk Assessments;

- Monitor construction activities to ensure compliance with the Environmental Management Programme and other legal requirements;
- Conduct regular environmental compliance audits of the construction site and submit quarterly reports to authorities;
- Act as guide and advisor to the contactors, and Kumba personnel;
- Facilitate and chair environmental performance and coordination meetings;
- Liaise and engage with stakeholders from the private and public sector; and
- Report and present environmental performance to the Kumba Environmental Steering Committee and Executives.

Digby Wells & Associates: 2009 (Part Time) **Position:** Environmental Scientist

- Conduct and manage Environmental Impact Assessments (EIAs) and Basic Assessments to South African legal requirements;
- Facilitate Stakeholder engagement and Public Participation;
- Liaise with clients in both the private and public sectors;
- Compile and assist with project proposals and environmental reports;
- Develop Environmental Management Programmes (EMPs); and
- Conduct environmental monitoring and site investigations

Mills & Otten: 2008 (Part Time) **Position:** Environmental Scientist

- Undertaking and managing of EIAs
- Basic Assessments;
- Stakeholder engagement;
- Contamination assessments;
- Due diligence assessments;
- Data collection and processing; and
- Maintenance and upkeep of all scientific equipment.

Selected Key Project Experience

1. Environmental Authorisation (EIA and EMP) for Sail Minerals, South Africa (2016)
2. Royal Bafokeng Platinum closure liability assessment, South Africa (2015)
3. BCL Due Diligence Assessment and corrective action plan auditing, Botswana (2015)
4. MOGS Pipeline Environmental Screening Assessment, Mozambique (2015)
5. Shell Southern Africa Pty Ltd Phase II Environmental Site Assessment for Telemotors, South Africa (2014)
6. AEMR Environmental and Social Impact Assessment (ESIA) IFC Update, Angola (2013)
7. WCL ESIA, Mining Client, Liberia (2013)
8. AEMR Preparation of conceptual closure plan and closure cost estimate, Angola (2013)
9. Xtrata Coal EMPR Performance Audit, South Africa (2012)
10. COAL of AFRICA exploration guideline document, South Africa (2012)
11. Kumba Projects Development and implementation of EMS, South Africa (2011-2012)
12. Kumba Iron Ore legal permitting toolkit, Kumba Iron Ore Pty Ltd, South Africa (2012)
13. Kumba Environmental Training, Kumba Iron Ore Pty Ltd, South Africa (2012)
14. Valuing sustainability and closure assessment, Anglo American Thermal Coal, South Africa (2012)
15. Sishen West Expansion project, Anglo American Kumba Iron Ore, South Africa (2011-2012)

Resumé: Lisa Otten

Qualifications

BSc (Hons) (Environmental Management), University of Cape Town, 2010
BSc (Environmental Science and Ecology), University of Cape Town, 2009

Key Experience

Lisa Otten is an Environmental Consultant and has experience in the field of environmental management. Her key areas of focus lie in undertaking various environmental permitting processes, including environmental authorisations, water use licence applications and mining right applications. Her role has extended to undertaking stakeholder engagement process, environmental compliance monitoring and due diligences. Lisa is also familiar with the financial sector, in particular the IFC Performance Standards and the World Bank Equator Principles.

Her key strengths include diligence, a keen and growing understanding of South African Environmental legislation while working effectively with multidisciplinary teams.

Relevant Career Experience

The MSA Group: January 2017 - Current **Position:** Environmental Project Manager

Role:

- Due Diligence Assessments including IFC and Equator Principal reviews
- Manage exploration and mining and prospecting right applications in terms of the MPRDA and NEMA
- Water Use License Application in terms of the National Water Act
- Environmental/Legal Compliance Audits and Assessments
- Closure plans and Financial Provision updates
- Screening and GIS projects
- Contribute to marketing and sales
- Develop and maintain relationships with key clients

Environmental Resources Management: 2012 - 2016 **Position:** Environmental Consultant

Role:

- Preparation of Environmental and Social Impact Assessments (ESIA) to IFC performance Standards and local legislative requirements;
- Advise clients on environmental permitting requirements;
- Manage environmental licensing applications e.g. Waste Management License and Water Use License.
- Develop environmental management and monitoring plans; and
- Undertake environmental compliance audits.

Selected Key Project Experience:

1. Environmental Due Diligence for three Wescoal Holdings Coal Mines, Nedbank - Mpumalanga, South Africa 2017
2. Environmental and Social Impact Assessment for the proposed BOST Fuel Terminal and LPG Pipeline – Ghana, 2017
3. Environmental Basic Assessment, Environmental Management Programme and Section 102 Amendment for the Kusipongo Mine, Kangra Coal - South Africa, 2015
4. Environmental Management Programme for the Tunnel Remediation Works for the Gautrain, Bombela Civils Joint Venture, Bombela- South Africa, 2014
5. Environmental Impact Assessment (EIA) for the Proposed Acetylene Production Gas Facility, Air Products (Pty) Ltd - South Africa, 2014
6. Environmental Compliance Monitoring for the Installation of Aboveground Storage Tanks at two Fuel Depots, Chevron South Africa (Pty) Ltd - South Africa, 2014
7. Basic Assessment for the Decommissioning and Remediation of Contaminated Land, Shell Marketing South Africa (Pty) Ltd, - South Africa, 2013
8. Basic Assessment for the Remediation of Contaminated Land, Swinburne, Shell Marketing South Africa (Pty) Ltd - South Africa, 2013
9. Basic Assessment for Decommissioning of Underground Storage Tanks and Associated Infrastructure at Roodepoort, Shell Marketing South Africa (Pty) Ltd - South Africa, 2013

10. Environmental Compliance Monitoring for the demolition and reconstruction of a Service Station, Shell Marketing South Africa (Pty) Ltd - South Africa, 2013
11. EIA for a Section 24G Application for a Waste Effluent Plant, Simba - South Africa, 2013
12. Rail Screening Study for Kassinga Area 1 IFC Update - Liberia, 2013