FINAL

SAMANCOR CHROME FERROMETALS

ENVIRONMENTAL IMPACT ASSESSMENT & ENVIRONMENTAL MANAGEMENT PROGRAMME

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(Decommissioning of the Existing Slimes Disposal Facility)

COMPILED FOR

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Sustainable Environmental Solutions through Integrated Science and Engineering

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1. INTRODUCTION

This Report comprises the **Final EIA Report** compiled in support of the Environmental Impact Assessment (EIA) Process, as legally required for the applications for Environmental Authorisations relevant to Ferrometals – A Business Unit of Samancor Chrome (**Ferrometals**).

Ferrometals is situated in Emalahleni (formerly called Witbank), Mpumalanga, and operates six Charge Chrome Furnaces, (4 open and 2 closed), one Metal Recovery Plant and an Intermediate Carbon Ferrochrome Converter. In addition, a Pelletizing and Sintering Plant converts fine ore and UG2 (Upper Group 2 layer of the Rustenburg Layered Suite) into sintered pellets for use in the furnaces. The plant was established in **1959** with an expected life still in excess of 25 years.

JMA Consulting (Pty) Ltd (**JMA**) was appointed as the Environmental Assessment Practitioner (EAP) by Ferrometals to obtain the necessary environmental authorizations for the **decommissioning and rehabilitation of the current existing Slimes Dam** footprint and the construction of a **new Slimes Dam** footprint from the Regulating Authorities.

An enviro-legal assessment conducted by JMA with the specific purpose of identifying all listed activities contained in the active South African Environmental and related Legislation, pertaining to the abovementioned activities, has indicated the requirement for authorization applications in terms of the following legislation:

- National Environmental Management Act, Act 107 of 1998 - **NEMA**.

(Listed activities in terms of GNR 544 are present and require a basic environmental impact assessment to be done).

- National Environmental Management: Waste Act, Act 59 of 2008 – **NEMWA**.

(The Slimes Disposal at Ferrometals is deemed to represent Hazardous Waste Disposal and as such requires Licensing in terms of the provisions contained in the NEMWA. The disposal of any quantity of hazardous waste requires that a Scoping & EIA process be followed).

- National Water Act, Act 36 of 1998 – **NWA**

(The current Integrated Water Use License will have to be amended in order to adequately address new developments with regards to the decommissioning of the existing and construction of a new Slimes Dam footprint).

Although all of the above does not require the performing of a **Scoping & Environmental Impact Assessment** (**S&EIA**), due to the fact that both Scoping and Basic Assessments are required for the same activities (decommissioning and rehabilitation of the existing slimes dam footprint and the construction of a new slimes dam footprint), the most extensive of the two which is scoping and environmental impact reporting, is deemed applicable.

This application for Ferrometals is therefore an application *inter alia* in terms of section 24 of the NEMA, read with GNR 543 and in particular the application for **Scoping and Environmental Impact Assessment** described in regulations 26 to 35.

Listed activities in GNR 544 will be undertaken in order to give effect to the project and these have been identified and listed in the application that has been submitted to the Nkangala District Office in Emalahleni of the Department of Economic Development, Environment & Tourism (DEDET).

Listed Activities in Category A & B of GNR 718 have been identified and listed in applications made for Waste Licenses which was submitted to the Department of Environmental Affairs (DEA) Head Office in Pretoria.

This document represents the **Final EIA Report** compiled in terms of the NEMA Regulations, and as such was compiled in strict accordance with the Regulations listed below:

EIA Regulations GNR 543 – NEMA (107 of 1998)

31. (1) If a competent authority accepts a scoping report and advises the EAP in terms of regulation 30(1)(a) to proceed with the tasks contemplated in the plan of study for environmental impact assessment, the EAP must proceed with those tasks, including the public participation process for environmental impact assessment referred to in regulation 28(h)(i)-(iv) and prepare an environmental impact assessment report in respect of the proposed activity.

(2) An environmental impact assessment report must contain all information that is necessary for the competent authority to consider the application and to reach a decision contemplated in regulation 35, and must include-

(a) details of-

(i) the EAP who compiled the report; and

(ii) the expertise of the EAP to carry out an environmental impact assessment;

(b) a detailed description of the proposed activity;

(c) a description of the property on which the activity is to be undertaken and the location of the activity on the property, or if it is-

(i) a linear activity, a description of the route of the activity; or

(ii) an ocean-based activity, the coordinates where the activity is to be undertaken;

(d) a description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity;

(e) details of the public participation process conducted in terms of subregulation (1), including-

(i) steps undertaken in accordance with the plan of study;

(ii) a list of persons, organisations and organs of state that were registered as interested and affected parties;

(iii) *a summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; and*

(iv) *copies of any representations and comments received from registered interested and affected parties;*

(f) *a description of the need and desirability of the proposed activity;*

(g) *a description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity;*

(h) *an indication of the methodology used in determining the significance of potential environmental impacts;*

(i) *a description and comparative assessment of all alternatives identified during the environmental impact assessment process;*

(j) *a summary of the findings and recommendations of any specialist report or report on a specialised process;*

(k) *a description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures;*

(l) *an assessment of each identified potentially significant impact, including-*

(i) *cumulative impacts;*

(ii) *the nature of the impact;*

(iii) *the extent and duration of the impact;*

(iv) *the probability of the impact occurring;*

(v) *the degree to which the impact can be reversed;*

(vi) *the degree to which the impact may cause irreplaceable loss of resources; and*

(vii) *the degree to which the impact can be mitigated;*

(m) *a description of any assumptions, uncertainties and gaps in knowledge;*

(n) *a reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;*

(o) *an environmental impact statement which contains-*

(i) *a summary of the key findings of the environmental impact assessment; and*

(ii) *a comparative assessment of the positive and negative implications of the proposed activity and identified alternatives;*

(p) *a draft environmental management programme containing the aspects contemplated in regulation 33;*

(q) *copies of any specialist reports and reports on specialized processes complying with regulation 32;*

(r) *any specific information that may be required by the competent authority; and* *(s) any other matters required in terms of sections 24(4)(a) and (b) of the Act.*

(3) The EAP managing the application must provide the competent authority with detailed, written proof of an investigation as required by section 24(4)(b)(i) of the Act and motivation if no reasonable or feasible alternatives, as contemplated in subregulation 31(2)(g), exist.

In terms of the above, this Environmental Impact Assessment Report contains the following information:

Chapter 1 gives an **Introduction** to the project.

Chapter 2 and 3 give a detailed **Description of the EIA Process** as required by the relevant legislation (NEMA) and also gives **Details of the Environmental Assessment Practitioner (EAP)** and the **Project Team** appointed to undertake the EIA.

Chapter 4 discusses the overall **Project/Activity Description** and gives details on the Project Enviro-Legal Framework, Project Applicant, Project Location and Properties Affected.

Chapter 5 discusses the **Project Resource Attributes** and Chapter 6 addresses the **Need and Desirability** of the proposed project (Project Motivation).

A Synoptic **Project Description** and the **relevant Time Frames** for the Construction Phase, Operational Phase, Decommissioning and Closure Phase, as well as the Post Closure Phase are discussed in Chapter 7.

Chapter 8 deals with the identification and consideration of **Project Alternatives.**

Chapter 9 describes the **Current Environment** that could be impacted on by the proposed activity. The **Manner of Potential Environmental Impacts** on the environment is also summarized in this chapter.

Chapter 10 gives a detailed description of the **Public Participation Process** conducted up to date and Chapter 11 discusses the relevant information and correspondence in terms of the **Application Forms** submitted.

Chapter 12 gives a detailed description of the **Impact Assessment Methodology** applied during the impact assessment phase.

Chapter 13 details the identified **Environmental Aspects and Impact Descriptions as well as the Actual Impact Assessment.**

A description of **any Assumptions, Uncertainties and Gaps in knowledge** has been given in Chapter 14.

The **Professional Opinion of the EAP** with regards to whether the activity should or should not be authorised and any conditions that should be made in respect of that authorisation is given in Chapter 15.

The **Environmental Impact Statement**, which contains a summary of the key findings of the environmental impact assessment as well as a comparative assessment of the positive and negative implications of the proposed activity and identified alternatives, is discussed in Chapter 16.

Chapter 17 comprises a description of the **Draft Environmental Management Programme** that contains the aspects contemplated in regulation 33 of GNR 543 (of 18 June 2010). The proposed **Environmental Monitoring System** and the **Environmental Awareness Plan** is subsequently discussed in Chapter 18 and 19.

Finally, the **Report Identification** is given in Chapter 20.

1.1 ACRONYMS

APPA:	Atmospheric Pollution Prevention Act
BATNEEC:	Best available techniques not entailing excessive costs
CV:	Curriculum Vitae
DEA:	Department of Environmental Affairs
DEAT:	Department of Environmental Affairs and Tourism
DEDET:	Department of Economic Development, Environment and Tourism
DMR:	Department of Mineral Resources
EAP:	Environmental Assessment Practitioner
ECA:	Environment Conservation Act
EIA:.	Environmental Impact Assessment
EIAR:	Environmental Impact Assessment Report
EMP:	Environmental Management Programme
EMPr:	Environmental Management Programme Report
FMT:	Ferrometals
GNR:	Government Notice Regulation
I&AP's:	Interested and Affected Parties
ISO:.	International Organisation for Standardisation
NEMA:	National Environmental Management Act (Act 107 of 1998)
NEMAQA:	National Environmental Management: Air Quality Act (Act 39 of 2004)
NEMWA:	National Environmental Management: Waste Act (Act 59 of 2008)
NWA:	National Water Act (Act 36 of 1998)
PCD:	Pollution Control Dam
ROD:	Record of Decision
RWD:	Return Water Dam

1.2 DEFINITIONS

Activities: means policies, programmes, processes, plans and projects.

Alternatives: in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to-

(a) the property on which or location where it is proposed to undertake the activity;
(b) the type of activity to be undertaken;
(c) the design or layout of the activity;
(d) the technology to be used in the activity;
(e) the operational aspects of the activity; and
(f) the option of not implementing the activity.

Applicant: means a person who has submitted-
(a) or who intends to submit an application for an environmental authorisation: or
(b) an application for an environmental authorisation simultaneously with his or her application for any right or permit in terms of the Mineral and Petroleum Resources Development Act, 2002.

Application: means an application for-
(a) an environmental authorisation
(b) an amendment to an environmental authorisation
(c) an amendment to an environmental management programme; or (c) an exemption from a provision of these Regulations

Aspect: elements of an organisations activity, products or services which can interact with the environment. A significant environmental aspect is an environmental aspect which has, or can have a significant environmental impact.

Assessment: means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to decision-making.

Basic Assessment: means a report contemplated in regulation 22;

22. (1) The EAP managing an application to which this Part applies must prepare a basic assessment report in a format that may be determined by the competent authority.

(2) A basic assessment report must contain all the information that is necessary for the competent authority to consider the application and to reach a decision contemplated in regulation 25, and must include-
(a) details of-
(i) the EAP who prepared the report; and
(ii) the expertise of the EAP to carry out basic assessment procedures;
(b) a description of the proposed activity;
(c) a description and a map of the property on which the activity is to be undertaken and the location of the activity on the property, or, if it is-
(i) a linear activity, a description of the route of the activity; or

(ii) an ocean-based activity, the coordinates within which the activity is to be undertaken;

(d) a description of the environment that may be affected by the proposed activity and the manner in which the geographical, physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity;

(e) an identification of all legislation and guidelines that have been considered in the preparation of the basic assessment report;

(f) details of the public participation process conducted in terms of regulation 21(2)(a) in connection with the application, including-

(i) the steps that were taken to notify potentially interested and affected parties of the proposed application;

(ii) proof that notice boards, advertisements and notices notifying potentially interested and affected parties of the proposed application have been displayed, placed or given;

(iii) a list of all persons, organisations and organs of state that were registered in terms of regulation 55 as interested and affected parties in relation to the application; and

(iv) a summary of the issues raised by interested and affected parties, the date of receipt of and the response of the EAP to those issues;

(g) a description of the need and desirability of the proposed activity;

(h) a description of any identified alternatives to the proposed activity that are feasible and reasonable, including the advantages and disadvantages that the proposed activity or alternatives will have on the environment and on the community that may be affected by the activity;

(i) a description and assessment of the significance of any environmental impacts, including-

(i) cumulative impacts, that may occur as a result of the undertaking of the activity or identified alternatives or as a result of any construction, erection or decommissioning associated with the undertaking of the activity;

(ii) the nature of the impact;

(iii) the extent and duration of the impact;

(iv) the probability of the impact occurring;

(v) the degree to which the impact can be reversed;

(vi) the degree to which the impact may cause irreplaceable loss of resources; and

(vii) the degree to which the impact can be mitigated;

(j) any environmental management and mitigation measures proposed by the EAP;

(k) any inputs and recommendations made by specialists to the extent that may be necessary;

(l) a draft environmental management programme containing the aspects contemplated in regulation 33;

(m) a description of any assumptions, uncertainties and gaps in knowledge;

(n) a reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation

(o) any representations, and comments received in connection with the application or the basic assessment report;

(p) the minutes of any meetings held by the EAP with interested and affected parties and other role players which record the views of the participants;

(q) any responses by the EAP to those representations, comments and views;

(r) any specific information required by the competent authority; and;

(s) any other matters required in terms of sections 24(4)(a) and (b) of the Act.

(3) In addition, a basic assessment report must take into account-

(a) any relevant guidelines; and

(b) any departmental policies, environmental management instruments and other decision making instruments that have been developed or adopted by the competent authority in respect of the kind of activity which is the subject of the application.

(4) The EAP managing the application must provide the competent authority with detailed, written proof of an investigation as required by section 24(4)(b)(i) of the Act and motivation if no reasonable or feasible alternatives, as contemplated in sub regulation 22(2)(h), exist.

Competent Authority: in respect of a listed activity or specified activity, means the organ of state charged by this Act with evaluating the environmental impact of that activity and, where appropriate, with granting or refusing an environmental authorisation in respect of that activity.

Construction: means the building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity but excludes any modification, alteration or expansion of such a facility, structure or infrastructure and excluding the reconstruction of the same facility in the same location, with the same capacity and footprint.

Cumulative Impact: in relation to an activity, means the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

Decommissioning: means to take out of active service permanently or dismantle partly or wholly, or closure of a facility to the extent that it cannot be readily re-commissioned.

Disposal: means the burial, deposit, discharge, abandoning, dumping, placing or release of any waste into, or onto, any land;

EIA Report (EIAR): means a report contemplated in regulation 31;

31. (1) If a competent authority accepts a scoping report and advises the EAP in terms of regulation 30(1)(a) to proceed with the tasks contemplated in the plan of study for environmental impact assessment, the EAP must proceed with those tasks, including the public participation process for environmental impact assessment referred to in regulation 28(h)(i)-(iv) and prepare an environmental impact assessment report in respect of the proposed activity.

(2) An environmental impact assessment report must contain all information that is necessary for the competent authority to consider the application and to reach a decision contemplated in regulation 35, and must include-

(a) details of-

(i) the EAP who compiled the report; and

(ii) the expertise of the EAP to carry out an environmental impact assessment;

(b) a detailed description of the proposed activity;

(c) a description of the property on which the activity is to be undertaken and the location of the activity on the property, or if it is-

(i) a linear activity, a description of the route of the activity; or

(ii) an ocean-based activity, the coordinates where the activity is to be undertaken;

(d) a description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity;

(e) details of the public participation process conducted in terms of subregulation (1), including-

(i) steps undertaken in accordance with the plan of study;

(ii) a list of persons, organisations and organs of state that were registered as interested and affected parties;

(iii) a summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; and

(iv) copies of any representations and comments received from registered interested and affected parties;

(f) a description of the need and desirability of the proposed activity;

(g) a description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity;

(h) an indication of the methodology used in determining the significance of potential environmental impacts;

(i) a description and comparative assessment of all alternatives identified during the environmental impact assessment process;

(j) a summary of the findings and recommendations of any specialist report or report on a specialised process;

(k) a description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures;

(l) an assessment of each identified potentially significant impact, including-

(i) cumulative impacts;

(ii) the nature of the impact;

(iii) the extent and duration of the impact;

(iv) the probability of the impact occurring;

(v) the degree to which the impact can be reversed;

(vi) the degree to which the impact may cause irreplaceable loss of resources; and

(vii) the degree to which the impact can be mitigated;

(m) a description of any assumptions, uncertainties and gaps in knowledge;

(n) a reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;

(o) an environmental impact statement which contains-

(i) a summary of the key findings of the environmental impact assessment; and

(ii) a comparative assessment of the positive and negative implications of the proposed activity and identified alternatives;

(p) a draft environmental management programme containing the aspects contemplated in regulation 33;

(q) copies of any specialist reports and reports on specialized processes complying with regulation 32;

(r) any specific information that may be required by the competent authority; and

(s) any other matters required in terms of sections 24(4)(a) and (b) of the Act.

(3) The EAP managing the application must provide the competent authority with detailed, written proof of an investigation as required by section 24(4)(b)(i) of the Act and motivation if no reasonable or feasible alternatives, as contemplated in subregulation 31(2)(g), exist.

Environmental Assessment Practitioner (EAP): when used in Chapter 5, means the individual responsible for the planning, management and coordination of environmental impact assessments, strategic environmental assessments, environmental management plans or any other appropriate environmental instruments introduced through regulations.

Environmental Awareness Plan: an environmental awareness plan describing the manner in which-

(i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and

(ii) risks must be dealt with in order to avoid pollution or the degradation of the environment

Environmental Authorisation: when used in Chapter 5, means the authorisation by a competent authority of a listed activity or specified activity in terms of this Act, and includes a similar authorisation contemplated in a specific environmental management Act.

Environmental Impact: Change to the Environment. Such a change can be Positive of Negative. Environmental Impacts are caused by Environmental Aspects.

Environmental Impact Assessment (EIA): means a systematic process of identifying, assessing and reporting environmental impacts associated with an activity and includes basic assessment and S&EIR.

Environmental Management Programme (EMP): means a programme required in terms of section 24;

A draft environmental management programme must comply with section 24N of the Act and include -

(a) details of-
  (i) the person who prepared the environmental management programme; and
  (ii) the expertise of that person to prepare an environmental management programme;

(b) information on any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified in a report contemplated by these Regulations, including environmental impacts or objectives in respect of-
  (i) planning and design;
  (ii) pre-construction and construction activities;
  (iii) operation or undertaking of the activity;
  (iv) rehabilitation of the environment; and
  (v) closure, where relevant.

(c) a detailed description of the aspects of the activity that are covered by the draft environmental management programme;

(d) an identification of the persons who will be responsible for the implementation of the measures contemplated in paragraph (b);

(e) proposed mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon;

(f) as far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of any listed 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, including, where appropriate, concurrent or progressive rehabilitation measures;

(g) a description of the manner in which it intends to-
  (i) modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;
  (ii) remedy the cause of pollution or degradation and migration of pollutants;
  (iii) comply with any prescribed environmental management standards or practices;
  (iv) comply with any applicable provisions of the Act regarding closure, where applicable;
  (v) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;

(h) time periods within which the measures contemplated in the environmental management programme must be implemented;

(i) the process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking a listed activity;

(j) an environmental awareness plan describing the manner in which-
  (i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and
  (ii) risks must be dealt with in order to avoid pollution or the degradation of the environment;

(k) where appropriate, closure plans, including closure objectives.

Hazardous Waste: means any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment.

Inter alia*:* among other things.

Listed Activity: when used in Chapter 5, means an activity identified in terms of section 24(2)(a) and (d).

> 24 (2) The Minister, or an MEC with the concurrence of the Minister, may identify-
>
> (a) activities which may not commence without environmental authorisation from the competent authority;
>
> (b) geographical areas based on environmental attributes, and as specified in spatial development tools adopted in the prescribed manner by the environmental authority, in which specified activities may not commence without environmental authorisation from the competent authority;
>
> (c) geographical areas based on environmental attributes, and specified in spatial development tools adopted in the prescribed manner by the environmental authority, in which specified activities may be excluded from authorisation by the competent authority;
>
> (d) activities contemplated in paragraphs (a) and (b) that may commence without an environmental authorisation, but that must comply with prescribed norms or standards.

M.Sc.: Magister Scientiae degree.

Public Participation Process: in relation to the assessment of the environmental impact of any application for an environmental authorisation, means a process by which potential interested and affected parties are given opportunity to comment on, or raise issues relevant to the application.

Registered Interested and Affected Party (I&AP): in relation to an application, means an interested and affected party whose name is recorded in the register opened for that application in terms of regulation 55.

Zoning Status: Zoning schemes form part of land-use management plans as instruments to indicate specific land uses.

2. THE SCOPING AND EIA PROCESS

The Scoping and EIA Process is formally defined in published Regulations promulgated in terms of the NEMA, and represents the formal EIA driver applicable to this project for Ferrometals.

2.1 INTRODUCTION

With effect from 2 August 2010, the Environmental Impact Assessment (EIA) Regulations, 2010 (GNR 543 of 18 June 2010 ("GNR. 543")) and three Listing Notices promulgated in terms of the NEMA and as set out in detail below, commenced (save for those listed activities in respect of prospecting, mining, exploration, production, and reconnaissance which will commence at a date to be published). As a result, the relevant notices promulgated in terms of the NEMA pertaining to identified activities (GNR. 386 and 387 of 21 April 2006) and the Environmental Impact Assessment (EIA) Regulations, 2006 (GNR. 385 of 21 April 2006) have been revoked.

Consequently, the listed activities have been promulgated in three different government notices, namely Government Notice R. 544 of 18 June 2010 ("GNR. 544"), which identifies those activities for which a **basic assessment** must be undertaken in accordance with the procedure set out in regulation 21 to 25 of GN R. 543; Government Notice R. 545 of 18 June 2010 ("GNR. 545"), which identifies those activities for which a **scoping and environmental impact assessment** must be undertaken in accordance with the procedure, set out in regulations 26 to 35 of GNR. 543; and Government Notice R. 546 of 18 June 2010 ("GNR. 546"), which identifies those activities for which a **basic assessment** must be undertaken in accordance with the procedure set out in regulation 21 to 25 of GNR. 543, based on the activities being undertaken in specific identified geographical areas.

The Schedules to GNR. 544, GNR. 545, and GNR. 546 set out those activities that have been identified in terms of section 24(2)(a) of the NEMA which may not commence without environmental authorisation from the competent authority and for which the investigation, assessment and communication of potential impacts of the activities must follow the procedure described in regulation 21 to 25 of the regulations in respect of those activities that require a "basic assessment" or in terms of regulation 26 to 35 of the regulations in respect of those activities that require "scoping and an environmental impact assessment".

This is an application in terms of section 24 of the NEMA referred to above read with GNR 543 of 18 June 2010 and in particular the application for Scoping & Environmental Impact Assessment described in regulations 26 to 35. Listed activities in GNR. 544 of 18 June 2010 will be undertaken in order to give effect to the project and these have been identified and listed in the application that was submitted to DEDET Nkangala District Office in Emalahleni.

Other applications in terms of provisions contained in the NEMWA also require the Scoping & EIA Process to be followed. Section 20 of the NEMWA provides that no person may commence, undertake or conduct a waste management activity except in accordance with *inter alia* a waste management license issued in respect of that activity, if a license is required.

On 3 July 2009 the Minister of Water and Environmental Affairs ("the Minister") published a list of waste management activities which have or are likely to have a detrimental effect on the environment in GN 718 of 3 July 2009 ("GN 718") and which require a waste management license in accordance with section 20 of the NEMWA. Certain of the waste management activities listed in GN 718 are governed by specific thresholds. Where any process or activity involving "***waste***" (as defined) falls below or outside the thresholds stipulated, a waste management license is not required, but such processes or activities will be regulated in terms of the remaining relevant provisions of the NEMWA, for instance those provisions dealing with the storage, transportation etc. of waste.

In addition to the above, section 47 of the NEMWA provides for the procedure for a waste management license application and states that the applicant must take appropriate steps to bring the application to the attention of relevant organs of state, interested parties and the public, including the publication of a notice.

GNR 718 differentiates between Category A and Category B waste management activities. Category A activities pertains to those activities which have a lesser impact on the environmental, whereas Category B activities are perceived to have a significant impact on the environment.

Item 3 of GN 718 states that a person who wishes to commence, undertake or conduct an activity listed under Category A must conduct a basic assessment process as stipulated in the EIA Regulations made under section 24(5) of the National Environmental Management Act 107 of 1998 (NEMA) as part of the waste management licence application. Similarly, item 4 provides that a person who wishes to commence, undertake or conduct an activity listed under Category B must conduct an EIA process as stipulated in the EIA Regulations made under section 24(5) of the NEMA as part of the waste management licence application.

Accordingly, in order to determine the process applicable to a waste management licence application, it must first be determined whether the waste management activity falls within Category A or B. Once this is determined, the application process provided for in the EIA Regulations 2010 must be followed.

2.2. EIA PROCESS FLOW DIAGRAM

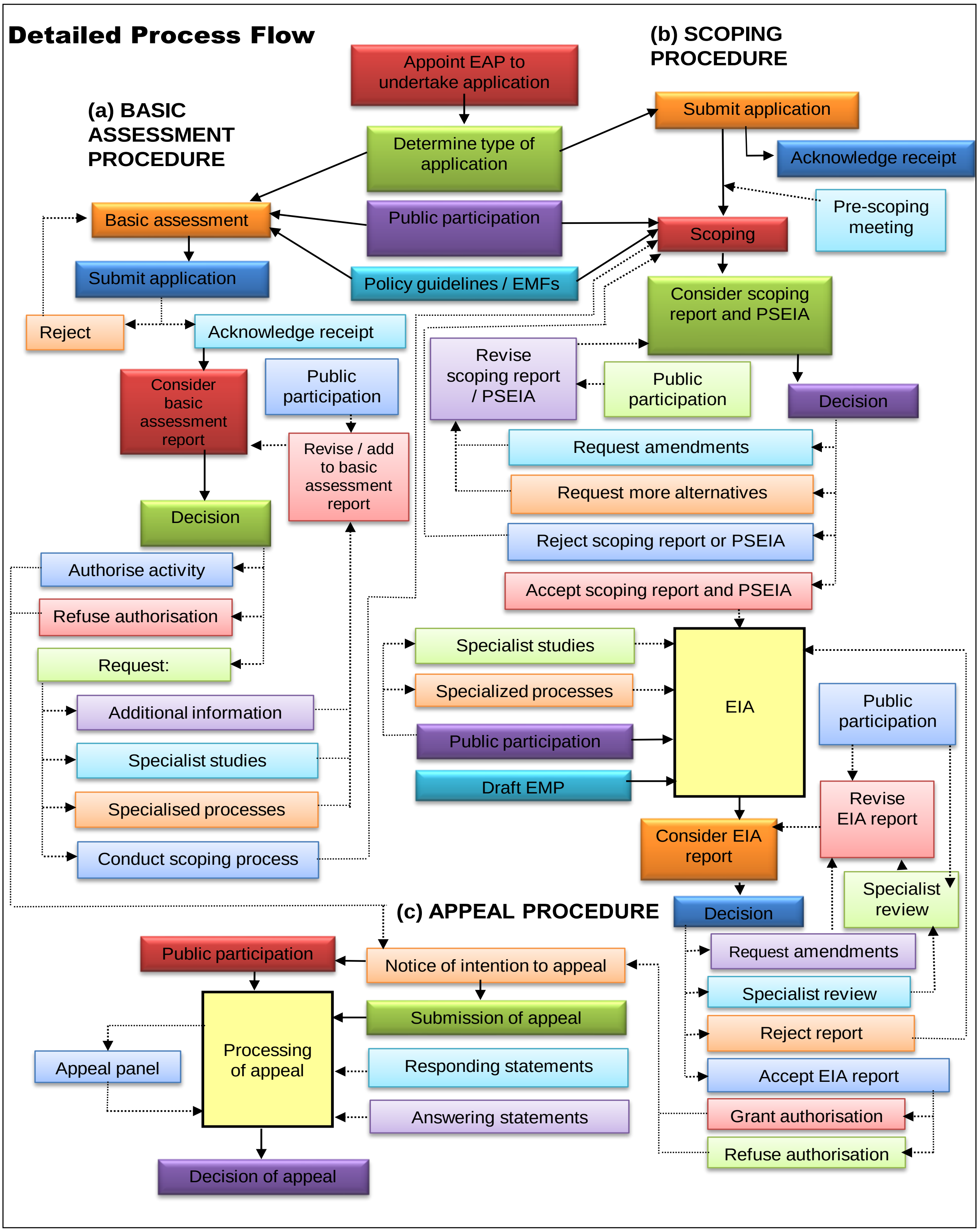


Figure 2.2(a): Process flow Diagram for NEMA EIA Processes

The diagram above in Figure 2.2(a), illustrates the processes for both a Basic Assessment, and a Scoping and Environmental Impact Assessment.

As described in section 2.1, listed activities contained in GNR 544, as well as in Category B of GNR 718, have been identified for the **Ferrometals** and will therefore be incorporated into one **Scoping and Environmental Impact Assessment Process** for this project.

2.2.1 EIA Process and Objectives

Practical implementation of the Scoping and EIA Process comprises five stages:

- Stage 1: Pre-application and Application
- Stage 2: Scoping
- Stage 3: Environmental Impact Assessment
- Stage 4: Consideration and Decision
- Stage 5: Appeal

EIA Stage 1: Pre-Application & Application

- Appointment of EAP by Applicant
- Determination of Type of Application
- Identification of the Competent Authority
- Pre-application Consultation with the Competent Authority
- Identify and Notify Property/Land Owners
- Submit Application to Competent Authority
- Notification of Decision on Application

EIA Stage 2: Scoping

- Initiate and Conduct Public Participation Process
- Compile Notification and Information Documents
- Notify all I&AP's of Project and Meetings (Newspapers, Site Notices, Letters, etc.)
- Written Notification to Relevant Regulating Authorities
- Compilation of Scoping Report and Plan of Study as per Regulations and Guidelines
- Scoping Public Meeting
- Make Scoping Report available for Review
- Capture and Consider Comments from I&AP's and Relevant Authorities
- Finalize and Submit Scoping Report and Plan of Study to I&AP's and Authorities
- Authority Review & Decision
- Notification of Decision on Scoping Report

EIA Stage 3: Environmental Impact Assessment

- Commence to Implement Plan of Study
- Continue Public Participation Process
- Conduct Specialist Studies
- Prepare EIA Report (EIAR comprising EIA, EMPr as per Regulations and Guidelines)
- EIA/EMP Public Meeting
- Make EIAR available for Review
- Capture and Consider Comments from I&AP's and Relevant Authorities
- Finalize and Submit EIAR to I&AP's and Authorities

EIA Stage 4: Consideration and Decision

- Authority Review & Decision
- Notification of Decision on the EIAR
- Granting of Environmental Authorization
- Inform I&AP's of Decision/Approval and of Opportunity to Appeal

EIA Stage 5: Appeal

(NEMA EIA)

- Appellant to give notice of intention to Appeal to Authority and Applicant
- Consultation between Applicant and Appellant to Resolve Issues
- Submission of appeal to Authority and Applicant
- Submission of Responding Statement from Respondent/Applicant to Authority and Appellant
- Submission of Answering Statement by Appellant to Authority and Applicant
- Acknowledgment of all by Authority within 10 days
- Processing of Appeal
- Decision on Appeal
- Notification of Decision on Appeal to Appellant and Respondents by Authority

3. DETAILS OF AND DECLARATION BY THE EAP

The EIA and associated EMP for this project have been compiled by fully qualified and duly registered Professional Scientists and Engineers. Synoptic CV's of all personnel which contributed to the project, are attached in **APPENDIX I** to this report.

The duly appointed **EAP** for the Project is **JMA Consulting (Pty) Ltd**.

Table 3(a): Details of Project EAP Consultancy

Project Consultancy:	JMA Consulting (Pty) Ltd
Company Registration:	2005/039663/07
Professional Affiliations:	South African Council for Natural Scientific Professions (SACNASP)
Contact Person:	Mr Riaan Grobbelaar (Pr.Sci.Nat.)
Physical Address:	15 Vickers Street DELMAS 2210
Postal Address:	P O Box 883 DELMAS 2210
Telephone no:	(013) 665 1788
Fax no:	(013) 665 2364
E-mail:	riaan@jmaconsult.co.za

JMA Consulting sub-contracted the services of the following Professional Consultancies and Certified Laboratories for specialist inputs into the project:

Sub-Consultancies

- Cameron Cross Incorporated (recently joined TABACKS)
- Ecosys Consulting Engineers CC
- Geostratum Groundwater and Geochemistry Consulting
- Scientific Aquatic Services CC
- Airshed Planning Professionals (Pty) Ltd

Laboratories

- Yanka Laboratories

3.1 DETAILS AND EXPERTISE OF THE PRINCIPAL EAP

The principle Environmental Assessment Practitioner on this project is Mr Riaan Grobbelaar (**Pr.Sci.Nat.**).

Riaan Grobbelaar holds a M.Sc. (cum laude) in Geohydrology from the University of the Free State and has been involved in projects related to water supply, aquifer management, groundwater quality investigations, groundwater monitoring, groundwater impact and risk assessments since 1996.

Riaan Grobbelaar (Pr.Sci.Nat.)
(M.Sc. Geohydrology)

Riaan Grobbelaar is responsible for the overall project and specifically for EIA Process and Time Line Management, Project Technical Management (commissioning of specialist studies), and finally all the EIA/EMP Report Compilation including the full integration of all specialist study findings into the EIA/EMP.

3.2 DETAILS AND EXPERTISE OF THE EIA TEAM

The following Scientists and Engineers were directly (specific inputs into this project) and indirectly (inputs incorporated from previous studies) involved with the Environmental Impact Assessment for this project:

Photo	Name Qualification Registration	Consultancy	Responsibility
	**Riaan Grobbelaar M.Sc. Geohydrology Pr.Sci.Nat.**	**JMA Consulting**	**Principal EAP**
	**Jasper Muller M.Sc. Geohydrology Pr.Sci.Nat.**	**JMA Consulting**	**EIA and EMP**
	**René Wolmarans M.Sc. Zoology Pr.Sci.Nat.**	**JMA Consulting**	**EIA Report**
	**Kobus du Plessis B.Sc.Hons. Environmental Sciences Cand.Sci.Nat.**	**JMA Consulting**	**Public Participation**
	**Genevieve Cloete B.Sc.Hons. Environmental Sciences Pr.Sci.Nat.**	**JMA Consulting**	**GIS Topography**
	**Shane Turner B.Sc. Hons. Geology Pr.Sci.Nat.**	**JMA Consulting**	**Geology Groundwater Meteorology**
	**Johan Fourie M.Sc. Geohydrology Pr.Sci.Nat.**	**Geostratum**	**Geochemistry Geochemical Modelling Groundwater Modelling**
	**Nicolette von Reiche (neé Krausse)**	**Airshed Planning Professionals**	**Air Quality**
	**Stephen van Staden Pr.Sci.Nat.**	**Scientific Aquatic Services**	**Wetlands Terrestrial Ecology Aquatic Ecology**

	**Koos Jonck**	**Ecosys Consulting Engineers CC**	**Slimes Dam Designs** **Geotechnical Assessment** **Surface Water Balances** *(Only focussed on the two footprints)*
	**Melissa Grobbelaar**	**Cameron Cross Incorporated** *(recently joined TABACKS)*	**Enviro-Legal**

3.3 DECLARATION BY EAP

I, **Riaan Grobbelaar**, acting as independent Environmental Practitioner on this project, declare that:

- I act as the independent environmental practitioner 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 environmental impact assessments, including knowledge of the National Environmental Management Act (107 of 1998), the Environmental Impact Assessment Regulations of 2010, and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in regulation **8** of the regulations when preparing the application and any report relating to the application;
- 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;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will ensure that the comments of all interested and affected parties are considered and recorded in reports that are submitted to the competent authority in respect of the application, provided that comments that are made by interested and affected parties in respect of a final report that will be submitted to the competent authority may be attached to the report without further amendment to the report;
- I will keep a register of all interested and affected parties that participated in a public participation process; and
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- all the particulars furnished by me in this form are true and correct;
- will perform all other obligations as expected from an environmental assessment practitioner in terms of the Regulations; and
- I realise that a false declaration is an offence in terms of regulation 71 and is punishable in terms of section 24F of the Act.

Disclosure of Vested Interest

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2010.

____

Signature of the environmental practitioner:

JMA CONSULTING (PTY) LTD

Name of company:

____

Date:

____

Signature of the Commissioner of Oaths:

____

Date:

____

Designation:

4. PROJECT/ACTIVITY DESCRIPTION

4.1 PROJECT TITLE

Project Title
FERROMETALS – A BUSINESS UNIT OF SAMANCOR CHROME LIMITED **THE DECOMMISSIONING AND REHABILITATION OF THE EXISTING NORTHERN SLIMES DAM FACILITY AT THE FERROMETALS OPERATION AND THE CONSTRUCTION AND OPERATION OF A NEW SLIMES DAM FACILITY AT FERROMETALS, LOCATED WITHIN THE BOUNDARIES OF THE EMALAHLENI LOCAL MUNICIPALITY IN EMALAHLENI**

4.2 PROJECT ENVIRO-LEGAL FRAMEWORK

4.2.1 Listing of Relevant Acts, Regulations and Technical Guidance

A review of the project components has indicated the following Environmental Acts, Regulations and Technical Guidance to be applicable for the project. An expanded Enviro-Legal framework, as applicable to the project is attached as **APPENDIX II**.

Legislation Considered for Application	
1.	Constitution Act 108 0f 1996
2.	National Environmental Management Act 107 of 1998 (NEMA)
3.	Environment Conservation Act 73 of 1989 (ECA)
4.	National Water Act 36 of 1998 (NWA)
5.	National Heritage Resources Act 25 of 1999 (NHRA)
6.	National Environmental Management Air Quality Act 39 of 2004 (NEMAQA)
7.	Atmospheric Pollution Prevention Act 45 of 1965 (APPA)
8.	National Environmental Management Biodiversity Act 10 of 2004 (NEMBA)
9.	National Environmental Management Waste Act 59 of 2008 (NEMWA)
10.	National Forests Act 84 of 1998 (NFA)
11.	Mineral and Petroleum Resources Development Act 28 of 2002 (MPRDA)
12.	National Environmental Management Integrated Coastal Management Act 24 of 2008 (NEMICMA)
13.	National Building Regulations and Building Standards Act 103 0fof 1997 (NBRBSA)
14.	Conservation of Agricultural Resources Act 43 of 1983 (CARA)

The following regulations published in terms of three of these Acts, have pertinent bearing on inputs into this report:

Considered Regulations	
NEMA	
1.	GNR 543 of 18 June 2010 – EIA Regulations
2.	GNR 544 of 18 June 2010 – Basic Assessment Listed Activities
3.	GNR 545 of 18 June 2010 – Scoping and EIA Listed Activities
4.	GNR 546 of 18 June 2010 – Basic Assessment Listed Activities- Specified Geographical Areas
NWA	
1.	GNR 2274 of 23 October 1981 – Regulations promulgated in terms of section 30(2) of the Water Act 54 of 1956 in respect of subterranean water control areas
2.	GNR 704 of 4 June 1999 – Regulations on use of water for mining and related activities aimed at the protection of water resources

3.	GNR 1160 of 1 October 1999 – Establishment of Water Management Areas
4.	GNR 1352 of 12 November 1999 – Regulations requiring that a water use be registered
5.	GNR 212 of 10 March 2000 – Request to register a water use
6.	GN 398 of 26 March 2004 – General authorizations in terms of Section 39 of the National Water Act
7.	GN 470 of 12 May 2000 – Request to register a water use
8.	GNR 399 of 26 March 2006 – General authorizations in terms of Section 39 of the National Water Act
ECA	
1.	GNR 154 of January 1992 – Noise Control Regulations
NEMAQA	
1.	GNR 248 of 31 March 2010 – List of Emission Activities
NEMWA	
1.	GNR 718 of 3 July 2009 – List of Waste Management Activities

The following regulations published in terms of the above Acts, have pertinent bearing on authorizations related to this project:

Considered Technical Guidelines	
DEA and DEDET	
1.	Integrated Environmental Management, Information Series 0, Overview of Integrated Environmental Management
2.	Integrated Environmental Management, Information Series 1, Screening
3.	Integrated Environmental Management, Information Series 2, Scoping
4.	Integrated Environmental Management, Information Series 3, Stakeholder Engagement
5.	Integrated Environmental Management, Information Series 4, Specialist Studies
6.	Integrated Environmental Management, Information Series 5, Impact Significance
7.	Integrated Environmental Management, Information Series 6, Ecological Risk Assessment
8.	Integrated Environmental Management, Information Series 7, Environmental Resource Economics
9.	Integrated Environmental Management, Information Series 8, Cost Benefit Analyses
10.	Integrated Environmental Management, Information Series 9, Project Alternatives in EIA
11.	Integrated Environmental Management, Information Series 10, Environmental Impact Reporting
12.	Integrated Environmental Management, Information Series 11, Review in EIA
13.	Integrated Environmental Management, Information Series 12, Environmental Management Plans
14.	Integrated Environmental Management, Information Series 13, Environmental Auditing
15.	Integrated Environmental Management, Information Series 14, Life Cycle Assessment
16.	Integrated Environmental Management, Information Series 15, Strategic Environmental Assessment
17.	Integrated Environmental Management, Information Series 16, Cumulative Effects Assessment
18.	Integrated Environmental Management, Information Series 17, Environmental Reporting
19.	Integrated Environmental Management, Information Series 18, Environmental Assessment of Trade Related Agreements and Policies in South Africa
20.	Integrated Environmental Management, Information Series 19, Environmental Assessment of International Agreements
21.	Integrated Environmental Management, Information Series 20, Linking EIA and EMS
22.	Integrated Environmental Management, Information Series 21, Environmental Monitoring Committees
23.	Integrated Environmental Management, Information Series 22, Socio-Economic Impact Assessment
24.	Integrated Environmental Management, Information Series 23, Risk Management
25.	Guideline 3: General Guide to the Environmental Impact Assessment Regulations
26.	Guideline 4: Public Participation
27.	Guideline 5: Assessment of Alternatives and Impacts
28.	Guideline 6: Environmental Management Frameworks
29.	Guideline 7: Detailed Guide to Implementation of the EIA Regulations

Considered Technical Guidelines	
DEA and DEDET	
30.	DWAF, Second Edition, 1998. Waste Management Series. Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste.
31.	DWAF, Second Edition, 1998. Waste Management Series. Minimum Requirements for Waste Disposal by Landfill.
32.	DWAF, Second Edition, 1998. Waste Management Series. Minimum Requirements for Water Monitoring at Waste Management Facilities.
33.	Draft Guideline: Companion Document on the Environmental Impact assessment Regulations 2010.
34.	Draft Guideline: Public Participation in the EIA Process, 2010.
35.	Draft Guideline: Environmental Management Framework Guideline in support of the Environmental Management Framework Regulations, 2010.
36.	White Paper on Integrated Pollution and Waste Management for South Africa.
DWA	
1.	External Guideline: Generic Water Use Authorisation Application Process, 2007
2.	Internal Guideline: Generic Water Use Authorisation Application Process, 2007
3.	External Guideline: Section 21(c) and (i) Water Use Authorisation Application Process (impeding or diverting the flow of water in a watercourse and /or altering the bed, banks, course or characteristics of a watercourse)
4.	Internal Guideline: Section 21(c) and (i) Water Use Authorisation Application Process (impeding or diverting the flow of water in a watercourse and /or altering the bed, banks, course or characteristics of a watercourse)
5.	Internal Guideline: Section 21(e), (f), (g), (h) and (j) Water Use Authorisation Application Process (waste discharge related)
6.	Operational Guideline: IWWMP Technical Document, February 2010
7.	Best Practice Guideline A2 – Water Management for Mine Residue Deposits; 2006
8.	Best Practice Guideline A4 – Pollution Control Dams; 2006
9.	Best Practice Guideline A6 – Water Management for Underground Mines; 2006
10.	Best Practice Guideline G1 – Storm Water Management; 2006
11.	Best Practice Guideline G2 – Water and Salt Balances; 2006
12.	Best Practice Guideline G3 – Water Monitoring Systems; 2006
13.	Best Practice Guideline G4 – Impact Prediction; 2006
14.	Best Practice Guideline H1 – Integrated Mine Water Management; 2006
15.	Best Practice Guideline H2 – Pollution Prevention and Minimization ; 2006
16.	Best Practice Guideline H3 – Water Reuse and Reclamation; 2006
17.	Best Practice Guideline H4 – Water Treatment; 2006

4.2.2 Existing Authorisations

All existing Environmental Authorizations for the Ferrometals Operations are listed below, whilst copies of the relevant ROD’s, Permits and Licences are attached in **APPENDIX III**.

Sequential Number	Existing Environmental Authorizations
1	ECA Section 20 Permit (12/9/11/P106) issued 30 June 2009
2	Air Quality: APPA Certificate (Ref 47) issued 30 March 2010
3	Water Use License (04/B11K/709) issued 2 April 2011
4	Environmental Authorization (Ref: 17/2/3/9(1)N-6) issued 6 December 2011

4.2.3 Environmental Authorisations Required for this Project

Based on the Enviro-Legal framework and having regard to the relevant and specific project attributes, a number of authorizations will be applied for during the course of the Environmental Authorization Phase of this Project.

National Environmental Management Act, Act No. 107 of 1998		
Section 24	**Environmental Authorisation Application**	
GNR 544		
Identification of the competent authority	The competent authority in respect of the activities listed in this part of the schedule is the environmental authority in the province in which the activity is to be undertaken unless it is an application for an activity contemplated in section 24C(2) of the Act, in which case the competent authority is the Minister or an organ of state with delegated powers in terms of section 42(1) of the Act, as amended.	
Activity 27	The decommissioning of existing facilities or infrastructure, for - (i) electricity generation with a threshold of more than 10MW; (ii) electricity transmission and distribution with a threshold of more than 132kV; (iii) (iv) (v) storage, or storage and handling, of dangerous goods of more than 80 cubic metres; but excluding any facilities or infrastructure that commenced under an environmental authorisation issued in terms of the Environmental Impact Assessment Regulations, 2006 made under section 24(5) of the Act and published in Government Notice No. R. 385 of 2006, or Notice No. 543 of 2010.	**Decommissioning of Existing Northern Slimes Dam Facility at the Ferrometals Site**

National Environmental Management: Waste Act, Act No. 59 of 2008		
GNR 718 of 3 July 2009	**Waste License Application**	
CATEGORY A		
20	The decommissioning of activities listed in this Schedule.	**Decommissioning of Existing Slimes Dam Facility at the Ferrometals Site**
CATEGORY B		
9	The disposal of any quantity of hazardous waste to land.	**Disposal at the Current Slimes Dam Facility and New Slimes Dam Footprint at the Ferrometals Site**
11	The construction of facilities for activities listed in Category B of this Schedule (not in isolation to associated activity).	**Construction of New Slimes Dam Footprint at the Ferrometals Site**

National Water Act, Act No. 36 of 1998		
NWA Section 40	**Integrated Water Use License Application (Includes Registrations)**	
Section 21(g)	Disposing of water containing waste in a manner which may detrimentally impact on a water resource.	**Construction/Operation of New Slimes Dam Facility at the Ferrometals Site**
GNR 704	**Exemptions from Requirements of Regulations**	
5	Restrictions on use of material	
GNR 1352	**Water Use Registration**	
	Included in Water Use License Application	

Note that the possible dispensation with the requirement for a Water Use License will be consulted with the DWA. If the DWA is satisfied that the purpose of NWA will be met by the granting of a Waste License or other authorisation under any other law, a Water Use License for the Slimes Dam may not be required. Relevant conditions will be incorporated into the Waste License.

4.3 PROJECT PROPONENT/APPLICANT

Project Applicant:	Ferrometals – a Business Unit of Samancor Chrome Limited
Business Registration No:	1926/008883/06
Contact Person:	Ellie Wheal
Physical Address:	Moses Kotane Drive, Emalahleni (Witbank), Mpumalanga
Postal Address:	Private Bag X7228, Witbank, 1035
Telephone no:	(013) 693 7205
Fax no:	(013) 696 2800
E-mail:	ellie.wheal@samancorcr.com

4.4 PROJECT LOCATION/RELEVANT GOVERNING AUTHORITIES

4.4.1 Regional/Local Setting

Samancor Chrome, Ferrometals Works, (“Ferrometals”) is situated in Emalahleni (formerly called Witbank), Mpumalanga Province, and operates six Charge Chrome Furnaces, (4 open and 2 closed), one Metal Recovery Plant and an Intermediate Carbon Ferrochrome (IC3) Converter. In addition, a Pelletizing and Sintering Plant (PSP) converts fine ore and UG2 (Upper Group 2 layer of the Rustenburg Layered Suite) into sintered pellets for use in the furnaces. The plant was established in 1959 and is currently the largest charge chrome producing operation in the world with an expected life still in excess of 25 years.

Table 4.4.1(a): Locality of Site in relation to nearest Towns/Cities

Town	Distance from Site (km)	Direction from Site
Emalahleni	4 km	East
Lynnville	1.3 km	South East
Ackerville	Directly Adjacent	South
Kwa-Guqa	2.2 km	WSW
Hlalanikahle	4 km	WNW

Figure 4.4.1(a) (below) indicates the regional locality of the Ferrometals Operations.

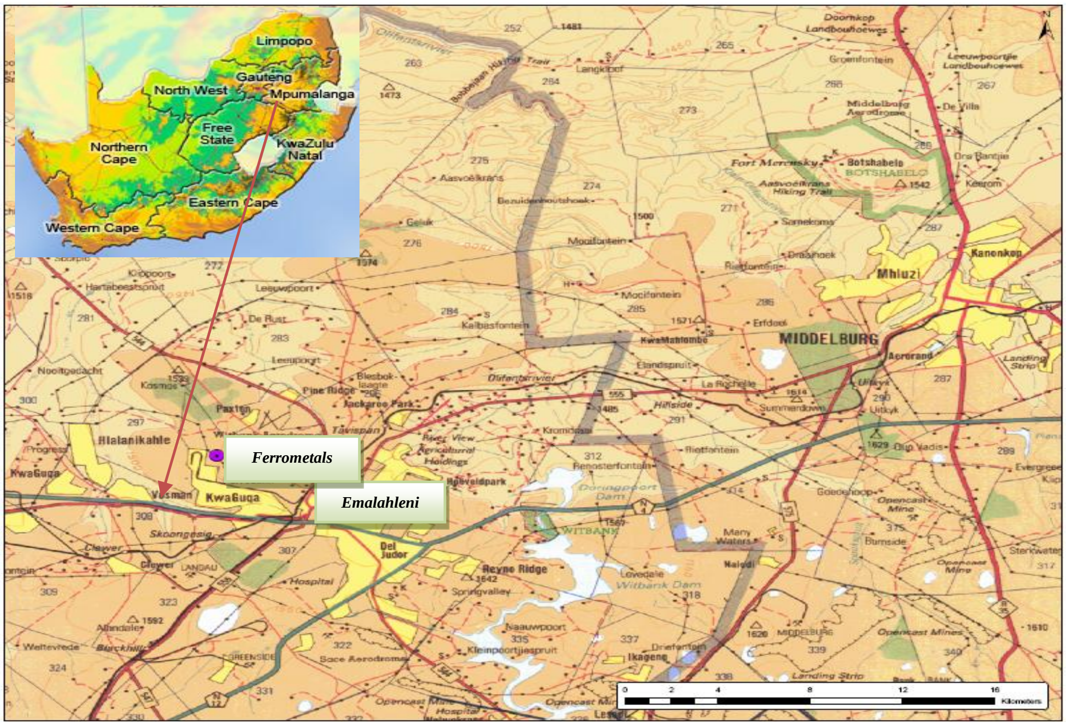


Figure 4.4.1(a): Regional Setting of the Project

The Ferrometals site is located within the Ferrobank industrial area of Emalahleni, as depicted on the Figure 4.4.1(b & c) that follows. The current developed portion of the plant site covers about 195 ha, draining roughly from east to west.

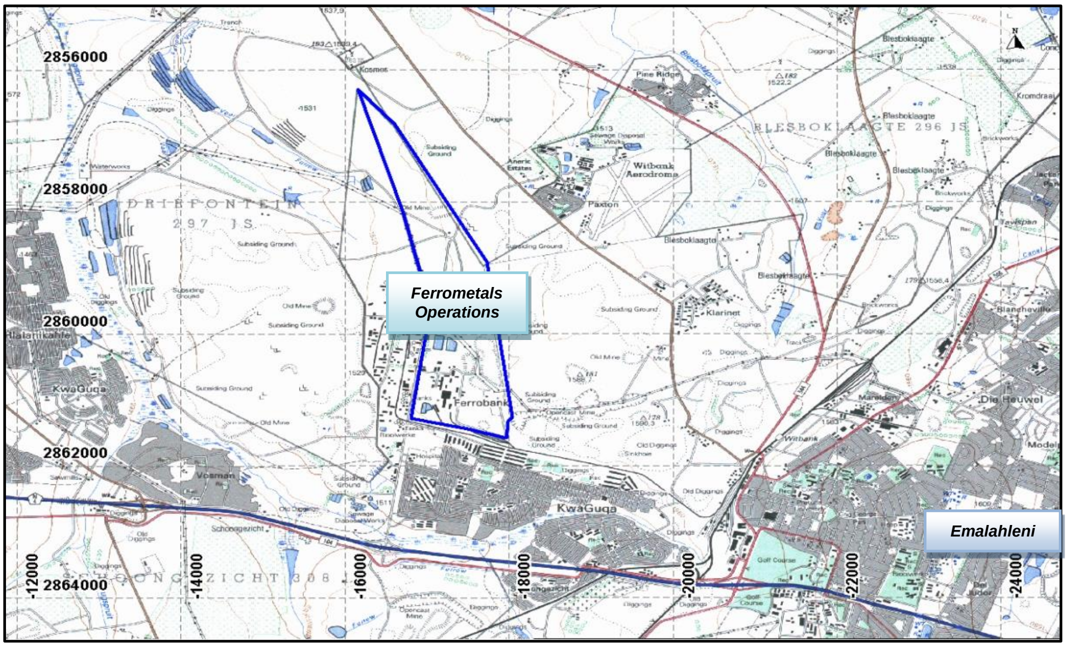


Figure 4.4.1(b): **Ferrometals Operations Local Site Locality Topographical Map 2529CC**

Figure 4.4.1(c): **Ferrometals Operations Locality (Photo 2529CC 9&14)**

4.4.2 Relevant Authorities

The following national, regional and local authorities will be consulted during this Environmental Authorization Project.

4.4.2.1 National Authorities

Department of Environmental Affairs (DEA) – Hazardous Waste

National Department:	Department of Environmental Affairs
Directorate/Designation:	Authorisations and Waste Disposal Management
Contact Person:	Thizwikoni Ramavhona
Postal Address:	Private Bag X447, Pretoria, 0001
Telephone no:	(012) 310 3142
Fax no:	(012) 310 3753
Cellular Phone:	082 307 0747
E-mail:	tramavhona@environment.gov.za

4.4.2.2 Provincial/Regional Authorities

Department of Economic Development Environment & Tourism

Regional Department:	Nkangala District Office
Directorate/Designation:	Environmental Impact Management
Contact Person:	Musa Mondlane
Postal Address:	P.O. Box 7255,Witbank, 1035
Telephone no:	(013) 692 5848
Fax no:	(013) 690 3704
E-mail:	gmmondlane@wit.mpu.gov.za

Department of Water Affairs (Regional Office)

Regional Department:	Bronkhorstspruit Regional Office
Directorate/Designation:	Water Sector Regulation and Use
Contact Person:	Ms M Musekene
Postal Address:	Private Bag X11259, NELSPRUIT, 1200
Telephone no:	(013) 759 7313
Fax no:	086 666 6217
Cellular Phone:	083 492 9690
E-mail:	MusekeneM@dwa.gov.za
Water Management Area	Olifants River Catchment

4.4.2.3 District/Local Authorities

Local Municipality:

Local Authority:	Emalahleni Local Municipality
Designation:	HOD-Environmental and Waste Management
Contact Person:	E. J. Nkabinde
Postal Address:	P.O. Box 3, Witbank, 1035
Telephone no:	(013) 690 6350
Fax no:	(013) 690 6295
Cellular Phone:	082 729 7488
E-mail:	nkabindeej@emalahleni.gov.za

District Municipality:

Directorate/Designation:	Nkangala District Municipality
Contact Person:	Mr M. Mogale
Postal Address:	PO Box 437, Middelburg, 1050
Cellular Phone:	078 007 4995

Ward 12 Councillor:

Local Authority:	Emalahleni Local Municipality
Designation:	Ward Councillor
Contact Person:	Taylor Pookgoadi
Cellular Phone:	083 400 9396
E-mail:	taylorp@vodamail.co.za

4.5 PROPERTY DESCRIPTION/LAND OWNER/ZONING STATUS

A detailed property assessment was performed by specialist Enviro-Legal Attorneys, for the purposes of this project. The full report, titled **Memorandum: Environmental-Legal Considerations in Respect of Certain Properties of Samancor Ltd,** is attached as in **APPENDIX IV**.

The proposed project will be located on the following properties (Please refer to Figure 4.5(a)):

No	Property Name	Deed of Transfer	Owner		Zoning Status	21 Digit Surveyor General ID Number
1.	Driefontein 297 JS (Portion 9)	T 39220/93	Name	Ferrometals – a Business Unit of Samancor Chrome Limited	Industrial 2	T0JS0000000 0029700009
			Contact Person	Brian Gibson		
			Postal Address	Private Bag X7228, Witbank, 1035		
			Telephone	(013) 693 7206		
			Facsimile	(013) 693 7558		
			e-mail	Brian.Gibson@SamancorCr .com		
2.	Driefontein 297 JS (Portion 12)	T 39220/93	Name	Ferrometals – a Business Unit of Samancor Chrome Limited	Industrial 2	T0JS0000000 0029700012
			Contact Person	Brian Gibson		
			Postal Address	Private Bag X7228, Witbank, 1035		
			Telephone	(013) 693 7206		
			Facsimile	(013) 693 7558		
			e-mail	Brian.Gibson@SamancorCr .com		

Figure 4.5(a): Ferrometals Property Delineation

4.5.1 Ferrometals Property Description

4.5.1.1 Remaining Extent of Portion 9 (a portion of portion 2) of the farm Driefontein 297 JS

Description:

Remaining Extent of Portion 9 (a portion of portion 2) of the farm Driefontein 297
Registration Division JS, Transvaal
Measuring 126, 7112 hectares
Held under Deed of Transfer No T 39220/93

Owner:

Samancor Ltd

Relevant Servitudes:

Servitude 1

By Notarial Deed K 443/1963S, the right has been granted to the Town Council of Witbank to convey electricity across the property by means of overhead power lines and together with ancillary right, and subject to the conditions as will more fully appear on reference to the said Notarial Deed.

Servitude 2

By Notarial Deed K 1590/1976S, the right has been granted to the Eskom to convey electricity over the property together with ancillary right, and subject to the conditions as will more fully appear on reference to the said Notarial Deed.

Servitude 3

By Notarial Deed K 3861/2005S, the property is subject to an underground electric power line servitude in favour of Highveld Steel and Vanadium Corporation Limited, together with ancillary rights, as will more fully appear on reference to the said Notarial Deed and diagram S.G No 8031/1999.

This servitude determines that during the construction process, the owner shall not construct any buildings, enclosures or other structures or plant any trees or place any materials on or over the servitude area without Highveld's prior written permission, which permission shall not be unreasonably withheld.

In respect of Mineral Rights the servitude determines that should the cables at any time, in any way at all, interfere with, limit or prevent the exploitation of the underlying or neighbouring mineral reserve, the owner shall give notice in writing to Highveld of such entrance and should Highveld not be in a position to offer an alternative solution which is reasonably acceptable to the owner within 90 days a new route over the property shall be agreed upon between the owner and Highveld.

Servitude 4

By Notarial Deed K 2871/1997S, a perpetual servitude has been granted to convey gas over the property by means of a gas pipeline and works, as will more fully appear on reference to the said Notarial Deed and diagram S.G No 5199/1995.

This servitude determines that the owner shall not construct any buildings, enclosures or other structures or plant any trees or place any materials on or over the servitude area without Gaskor's prior written permission. Furthermore, the top layer of soil may not be removed in the servitude area without prior written permission of Gaskor. The owner may use the land in the servitude area for agricultural purposes provided that the owner does not dig deeper than 0,50 meter and that no damage is caused to the pipeline or works.

In respect of Mineral Rights the servitude determines that should the pipeline at any time, in any way at all, interfere with, limit the exploitation of the underlying mineral reserve (excluding sand, rock or clay), the owner shall give notice in writing to Gaskor of such entrance and should Gaskor not be in a position to offer an alternative solution which is reasonably acceptable to the owner within 90 days a new route over the property shall be agreed upon between the owner and Gaskor.

Servitude 5

By Notarial Deed K 329/1999S, a perpetual servitude has been granted for the installation and erection of the gas pipeline and works over the property in favour of Afrox, as will more fully appear on reference to the said Notarial Deed and diagram S.G No 10706/1997.

This servitude determines that the owner shall not construct any buildings, enclosures or other structures or plant any trees or place any materials on or over the servitude area without Afrox's prior written permission, which permission shall not be unreasonably withheld.

This servitude determines that the owner may use the land in the servitude area for agricultural purposes provided that the owner does not dig deeper than 0,50 meter and that no damage is caused to the pipeline or works, without Afrox's prior written permission.

Zoning Status:

Portion 9 of the farm Driefontein 297 JS is zoned "Industrial 2" as per Zoning Certificate, in terms of the Emalahleni Town Planning Scheme 1991, which was issued on 19 September 2007.

The primary uses for which buildings may be erected and used or purposes for which land may be used are as follows:

- Commercial;
- Industries;
- Noxious Industries;

- Places of refreshment for own employees only; and
- Warehouses.

Development Parameters Applicable:

- Maximum Coverage: Other buildings 75%;
- Maximum FAR: - ;
- Maximum Height: 2 Storeys;

4.5.1.2 Portion 12 (a portion of portion 2 of the Farm Driefontein 297 JS)

Description:

Portion 12 (a portion of portion 2) of the Farm Driefontein 297
Registration Division JS, Transvaal
Measuring 95, 7921 hectares
Held under Deed of Transfer No T 39220/93

Owner:

Samancor Ltd

Relevant Conditions:

Condition 1

The following restrictive condition is placed on the registered owner of the property, in favour of and enforceable by the Transvaal and Delagoa Bay Investment Company Ltd namely that –

- The transferee, its successors in title or assigns shall not be entitled to carry on coal mining operations on or beneath the property.

Servitudes:

Servitude 1

By Notarial Deed K 1307/1986S, the right has been granted to the Eskom to convey electricity over the property and subject to the conditions as will more fully appear on reference to the said Notarial Deed. The route determination of the said servitude fully appears in Notarial Deed K13/1997S.

Servitude 2

By Notarial Deed K 1590/1976S, the right has been granted to the Eskom to convey electricity over the property and to erect a distribution station together with ancillary right, and subject to the conditions as will more fully appear on reference to the said Notarial Deed.

Servitude 3

By Notarial Deed K 3316/2003S, Eskom has been granted a perpetual servitude of electric transmission lines over the property substantially in the servitude area subject to any existing servitude or other real right to convey electricity across the property by means of overhead power lines, as will more fully appear on reference to the said Notarial Deed and Diagram.

Zoning Status:

Portion 12 of the farm Driefontein 297 JS is zoned "Industrial 2" as per Zoning Certificate, in terms of the Emalahleni Town Planning Scheme 1991, which was issued on 19 September 2007 and attached hereto as Annexure G.

The primary uses for which buildings may be erected and used or purposes for which land may be used are as follows:

- Commercial;
- Industries;
- Noxious Industries;
- Places of refreshment for own employees only; and
- Warehouses.

Development Parameters Applicable:

- Maximum Coverage: Other buildings 75%;
- Maximum FAR: -
- Maximum Height:2 Storeys;
- Building lines: Side – 0m (if no services)
- Rear – 0m (if no services)-
- Street – 5m:-
- Parking:1 parking space to 100m^2 floor area.

5. PROJECT RESOURCE ATTRIBUTES

5.1 RAW MATERIALS SUPPLY

All raw materials used at the Ferrometals Plant are sourced locally within South Africa:

- Chrome Ore
- Pellets (made UG2 fine ore material)
- Coal
- Coke
- Char
- Anthracite
- Quartzite
- Dolomite
- Limestone

5.2 PRODUCT BENEFICIATED

Ferrometals, the largest single ferrochrome producer in the western world, is situated just outside of eMalahleni (formerly known as Witbank) in Mpumalanga. The Intermediate Carbon Ferrochrome (IC3) Plant was constructed in 1986 and relies on the furnaces for a supply of charge chrome. The IC3 plant produces intermediate carbon ferrochrome for the foundry and special steel-producing markets. FMT also includes Ferroveld, a joint venture with Elkem.

Samancor Chrome produces three grades of ferrochrome: charge chrome, intermediate carbon ferrochrome and low carbon ferrochrome. Ferrochrome production is essentially a carbothermic reduction operation taking place at high temperatures. The ore – an oxide of chromium and iron – is reduced by coal and coke to form an iron-chromium alloy called ferrochrome.

<u>Charge Chrome</u>

Two decades ago South African chromite was not regarded as suitable for charge chrome production. Since then pioneering achievements have been made in the areas of raw material preparation, furnace design and operation, downstream beneficiation and optimisation. By means of upgrading and redesign, Samancor has grown to be one of the world's largest producers of charge chrome. Charge chrome is used in the stainless steel industry and as an additive in the steel industry. Charge chrome is used for the manufacture of more than 170 different types of stainless steels whose main properties include resistance to most types of wet and dry corrosion. For the manufacture of special steels, chromium imparts special properties to the steel, including an improvement in the tempering quality of steel, particular hardness and resistance to wear, and heat resistance.

To improve total ferrochrome recovery while maintaining a high-quality product, alloy recovery plants are utilised to recover the ferrochrome from the slag produced during the charge chrome process. The slag, which has a metallic content of approximately 4 %, is processed through a series of crushers and broken down to minus 15*mm* material.

It then moves through a jigging plant where the chrome and slag are separated by means of gravity. The slag chips are sold for road building and concrete work.

Intermediate Carbon Ferrochrome

The intermediate carbon ferrochrome plant (IC3) erected at Ferrometals was the first of its kind in the world. With a capacity of 70 000 tons a year, IC3 produces a product range of ferrochrome with a 1,5% to 6% carbon content, supplementing the 6% to 8% carbon ferrochrome produced. The IC3 plant uses the liquid charge chrome from the East Plant at Ferrometals as its basic raw material. The process takes place in a pear-shaped convertor where the liquid charge chrome is bottom blown by oxygen and steam through tuyeres to a specific carbon content. The final product, an intermediate carbon ferrochrome, is produced in granulated form. The tailor-made alloy is used specifically in the foundary industry; as a trimming addition to certain stainless steels – specifically some ferritic grades; in tool steels; and in alloy steels such as beating, spring, high speed and valve steels.

Low Carbon Ferrochrome

Low carbon ferrochromium is produced at Middelburg Ferrochrome by means of a three-stage “dry” process whereby molten and solid ferrosilicon-chromium are added to the lime / chrome ore melt in a two-phase reaction. The typical products produced have chrome contents of between 59% and 61% respectively, with carbon content ranging from 0,02% to 0,1%. The alloy is used for trimming additions in stainless steel production as well as in other specialised applications.

5.3 PRODUCT MARKETS

Ferrochrome (FeCr) is an alloy of chromium and iron containing between 50% and 70% chromium. The ferrochrome is produced by melting of chromite/chromium ore. Most of the world's ferrochrome is produced in South Africa, Kazakhstan and India, which have large domestic chromite resources. Increasing amounts are coming from Russia and China. The production of steel is the largest consumer of ferrochrome, especially the production of stainless steel with chromium content of 10% to 20% is the main application of ferrochrome.

5.4 PRODUCT PRICE

Prices of ferrochrome are often quoted in terms of United States cents (¢) per pound (lb) of chrome contained, although producing companies will generally report production and sales in terms of metric tonnes FeCr sold. In order to calculate the value of a metric tonne of FeCr from a price quoted in US cents, the percentage of chrome within the ferrochrome must be known. In a simple example if 1 metric tonne of FeCr with 55% chrome contained is sold for 100¢ US (per lb of Cr contained) then the value would be: 55% (1 metric ton FeCr) = 550 kg Cr = 1212.54 lb Cr (55%). Multiply 1212.54 lb times 100¢/lb = US$1212.54, then round appropriately.

5.5 PLANNED LIFE OF OPERATIONS

The operations at Ferrometals will continue as long as there is a market for its products. The plant is not dependant on any single mine for its raw materials and can continue with production with raw materials from any source.

6. PROJECT MOTIVATION (NEED AND DESIRABILITY)

6.1 LEGAL STANDING

Samancor Chrome's history goes back as far as 1975, when it was established as a result of a merger between SA Manganese Ltd and Amcor Ltd. SA Manganese was formed in 1926 to mine manganese ore in the Northern Cape. Amcor was established in 1937 to exploit mineral deposits for the steel industry and to process those minerals into ferroalloys.

Samancor was listed on the Johannesburg Stock Exchange until 1998 when the minority shareholders were bought out by the majority shareholders, Billiton and Anglo American. This resulted in the delisting of the company and shareholding of 60% African Metals Ltd (a BHPB Company) and 40% Anglo South Africa Capital (Proprietary) Ltd (an Anglo American company).

Samancor then consisted of chrome and manganese operations and stainless steel investments with marketing and distribution arrangements via structures held wholly and indirectly by BHPB and Anglo American. Towards the end of 2004, bids were invited for the purchase of Samancor Chrome. The successful bidder, the Kermas Group, effectively took over the operations from 1 June 2005. In November 2009 International Mineral Resources (IMR) became the majority shareholder in Samancor Chrome Limited with a 70% direct shareholding in the holding company, Samancor Chrome Holdings (Pty) Limited.

6.2 NEED FOR PRODUCT

Over 80% of the world's ferrochrome is utilised in the production of stainless steel. In 2006 28 Mt of stainless steel were produced. Stainless steel depends on chromium for its appearance and its resistance to corrosion. The average chrome content in stainless steel is approximately 18%. It is also used when it is desired to add chromium to carbon steel. FeCr from Southern Africa, known as 'charge chrome' and produced from a Cr containing ore with a low Cr content, is most commonly used in stainless steel production.

Alternatively, high carbon FeCr produced from high grade ore found in Kazakhstan (among other places) is more commonly used in specialist applications such as engineering steels where a high Cr to Fe ratio and minimum levels of other elements such as sulfur, phosphorus and titanium are important and production of finished metals takes place in small electric arc furnaces compared to large scale blast furnaces.

6.3 STRATEGIC IMPORTANCE OF THE RESOURCE/PRODUCT

Ferrochrome is a corrosion-resistant alloy of chrome and iron containing between 50% and 55% chrome. Over 80% of the world's ferrochrome is utilized in the production of stainless steel. The average chrome content in stainless steel is approximately 18%. Chrome alloys are used in stainless and special steels. In stainless steels, the chromium is chiefly responsible for improved corrosion resistance. In special steels, chromium imparts properties like heat resistance, hardness, and wear resistance.

6.4 SOCIO-ECONOMIC BENEFITS

Corporate Social Investment (CSI) is an integral part of Samancor Chrome, as they believe that every upliftment project implemented by the company contributes to creating a more prosperous country. With this in mind, they continuously strive to strengthen their commitment to sustainable development by building mutually beneficial relations with their stakeholders and contributing to the communities within which they operate.

Their Corporate Social Investment efforts are governed by the Samancor Chrome Foundation, which ensures that their contributions add value — now, and in the future. They are constantly working to better the execution and implementation of their corporate social and economic plans for the greater good of the communities surrounding their our business units.

The Samancor Chrome Foundation's CSI initiatives span over a number of categories, including education, health, small business development and community infrastructure. Education is the primary focus area of their CSI initiatives as they believe in providing the leaders of tomorrow with every possible advantage. The majority of their projects therefore invest in the education of their communities, enabling them to create a brighter future for themselves while boosting the country's economic growth.

They are able to achieve these sustainable outcomes by consulting narrowly with a diverse range of stakeholders, ranging from unions, community agencies and NGOs to local government. These partnerships, forged for the benefit of the communities, enable them to have a greater understanding of the local social and environmental needs, giving them the opportunity to determine how they can make an effective and much needed contribution.

Uplifting the communities within which they operate gives them the ability to truly empower themselves. Projects, like providing necessary infrastructure, go a long way towards making a sustainable difference – something Samancor Chrome will remain committed to.

Chrome Foundation

Samancor Chrome's Corporate Social Investment efforts are governed by the Samancor Chrome Foundation. This foundation approves the CSI projects that are thereafter implemented, coordinated and managed by the different business units. The community relations professionals and their supporting CSI committees who coordinate the CSI efforts on the business units are part of the local communities. This means that they have a greater understanding of the local social and environmental needs, and are thus best-placed to determine how the company can make an effective contribution at this level.

All projects undertaken by the Samancor Chrome Foundation are consistent with their business strategy and subscribe to the following set of operating principles:

- Adhering to the key pillars of the Mining Charter
- Aligned with the Community Relations Plan
- Subject to regular audits
- Achieving sustainable development
- Fostering community involvement
- Applying project management principles
- Sound corporate governance
- These principles ensure that all funds and projects committed to by the business units fall within the mission statement of the Samancor Chrome Foundation, which is "to improve the quality of life of people in communities around Samancor Chrome operations".

7. PROJECT BACKGROUND AND DETAILS

7.1 PROJECT BACKGROUND INFORMATION

Ferrometals is a brown fields site and has been in operation since 1959. **The authorizations sought in this application for which this EIA process is conducted, stem from the fact that Ferrometals requires a new Slimes Disposal Facility to be operational in 2014 in order to continue with the Production Process**.

The Decommissioning and Rehabilitation of the existing Slimes Dam Facility as well as the Construction and Operation of the new Slimes Dam Facility will require an **EIA Record of Decision in terms of the provisions of the NEMA** as well as a **Waste License in terms of the provisions of the NEM:WA** and an **Integrated Water Use License in terms of the provisions of the NWA**.

7.1.1 Ferrometals Process Description

Ferrometals, situated on the outskirts of Emalahleni, is a division of Samancor Chrome, which is a global producer and marketer of chrome ores and alloys. This plant dates back to 1959 when African Metals Corporation Limited (Amcor) purchased a ten-year old two-furnace ferrosilicon producing plant. In November 2009 International Mineral Resources (IMR) became the majority shareholder with a 70% direct shareholding in Samancor Chrome Holdings (Pty) Limited. Through the years more furnaces were added and the plant currently consists of four (4) open and two (2) closed furnaces.

In addition Ferrometals operates one metal recovery plant and an Intermediate Carbon Ferrochrome (IC3) converter. With technological progress in specialised steel production, the need for intermediate carbon ferrochrome gave rise to the development of a new concept at Ferrometals. In 1986, the commissioning of IC3 took place. This plant concentrated on altering the chemical composition of the metal extracted by the furnaces. The resultant product of this plant is intermediate carbon ferrochrome. IC3 has a capacity of 70 000 tons per annum.

Figure 7.1.1(a) illustrates the general process flow at Ferrometals. All raw materials used at Ferrometals are sourced locally within South Africa. The existing pelletizing plant produce, pre-reduced pellets (utilising Outokumpu technology) for use in the furnaces as replacement for primarily concentrate as well as Lumpy Ores. The final product is conveyed to the Furnaces Raw Material storage. From here it is loaded together with the other furnace ores.

The use of pellets holds several advantages for Ferrochrome production as a whole. It improves specific energy consumption through much improved chrome recovery, thereby increasing daily production for the same raw material throughput in the furnaces. Furthermore it causes an inherent lowering in dust generation. Less slag is also generated, reducing dust generation due to slag handling to an absolute minimum. Very little dust is generated by handling of the pellets when loading or transporting due to its very high abrasion resistance. This is a direct result of the use of Bentonite, a high temperature binder used in the pelletizing process.

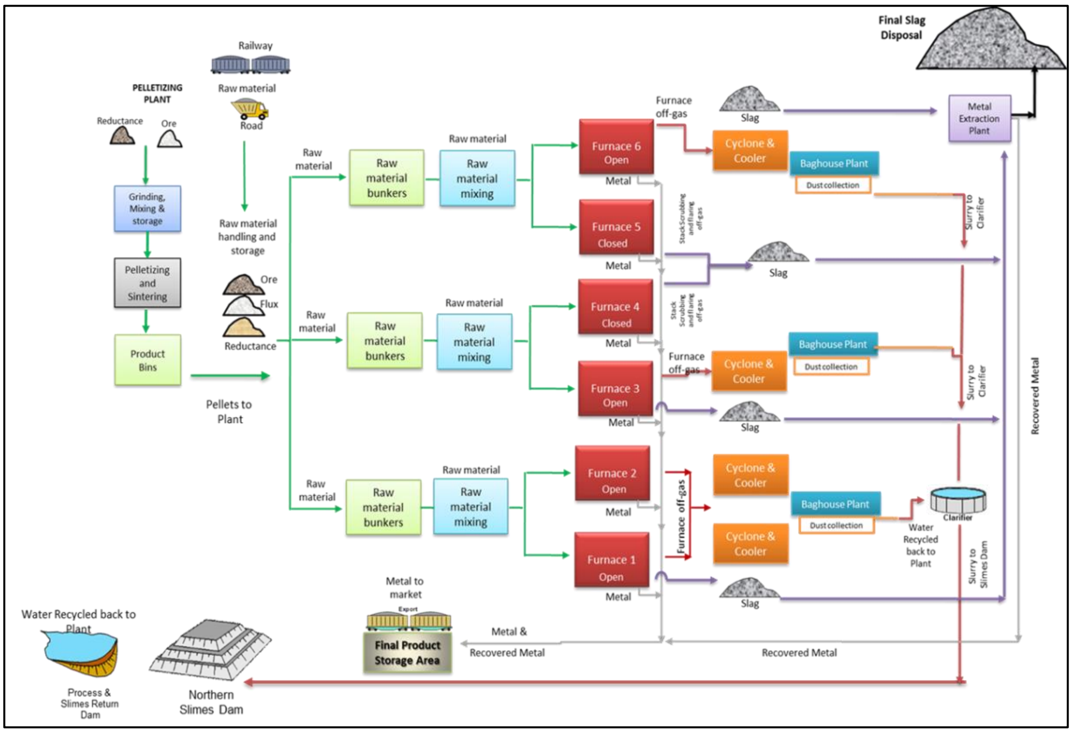


Figure 7.1.1(a): Ferrometals Process Flow Diagram

Each of the 6 Furnaces is charged by means of an automated raw material handling system. Electrical energy is fed to the Furnace by means of electrodes. Metal and slag are tapped concurrently from the Furnace into a separation point, utilizing a separator block and skimmer plate. The metal flows to the chill pans, while slag overflows to the slag pit, where it is withdrawn and further processed to extract trapped metal through the Chrome Recovery Plant. This process delivers clean slag suitable for concrete or road building applications. The Slag is then stored on the final Slag Dump from where it is sold for downstream use.

The liquid ferrochrome is cast into ingots or granulated in water or transferred to the IC3 Plant where it is converted into medium carbon ferrochrome. Once the metal has solidified, the metal ingots are removed, taken to mechanical break floors. The final products are stockpiles in final product storage area where is loaded and exported.

Gas Cleaning

All four of the open furnaces have a dedicated gas/air cleaning plant consisting of trombone coolers, dust cyclones and a high capacity bag filter plant (see Figure 7.1.1(b).

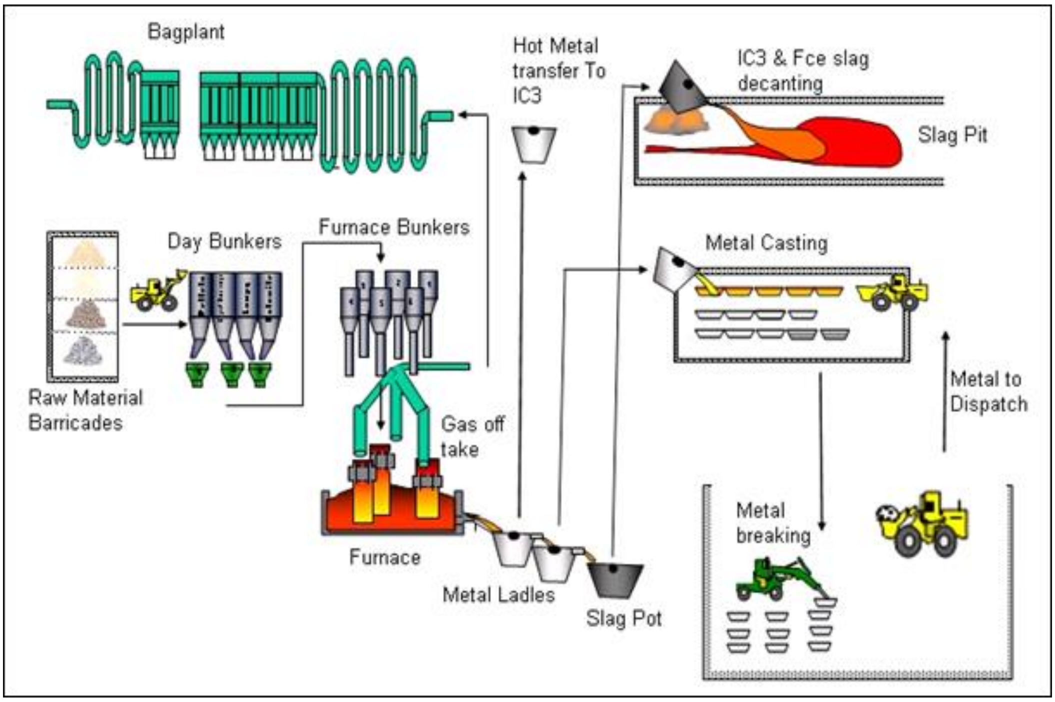


Figure 7.1.1 (b): Open Furnace Gas Cleaning Process Flow Diagram

The solid product from the air filtration operation is classified into two categories according to particle size. The coarse particulate dust is separated from the main off-gas stream by high efficiency cyclones. This material is recycled to the furnaces.

The stacks of the closed furnaces are scrubbed to clean and trap dust from the stack (Figure 7.1.1(c)).

The finer particulate matter is separated from the off-gas stream in a large bag filter complex. This material is then slurried to enable easy transport and minimize possible environmental impacts. The slurry is pumped to the ETP and the underflow from the ETP is pumped to the **Current Existing Slimes Dam** where deposition of the fine waste takes place. This equipment has been installed to ensure safe operation of the furnace and conformance to air pollution standards.

Water is returned from the Process and Slimes Return Water Dam to slurry the solid particulates, collected in the furnace off-gas system and also to be used for cleaning and dust suppression.

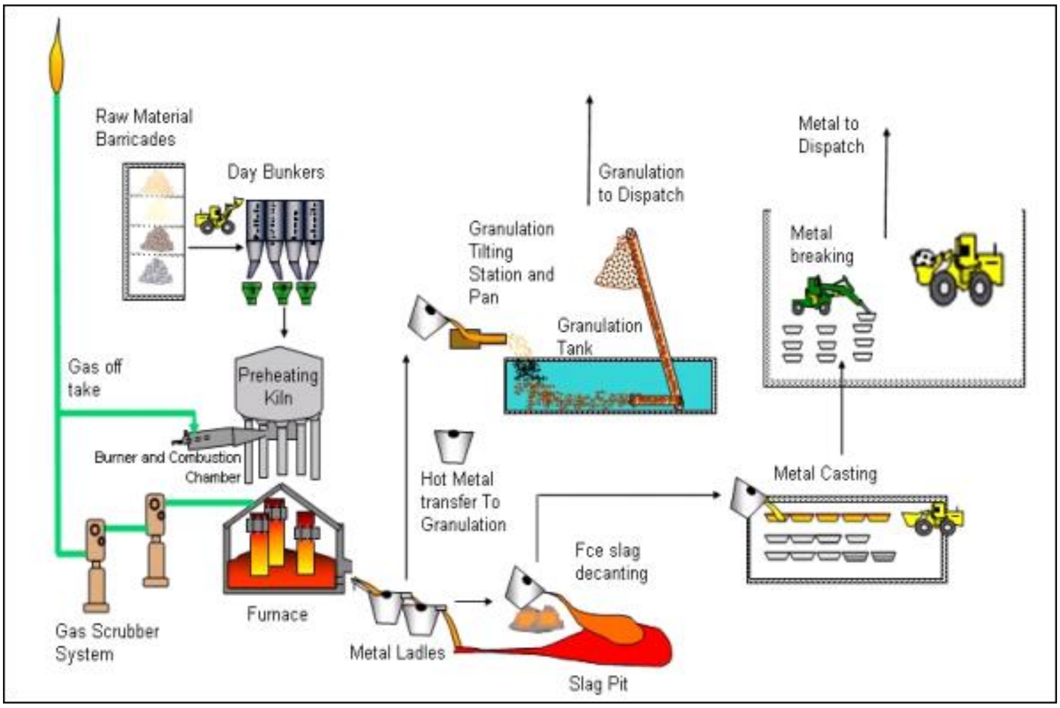


Figure 7.1.1(c): Closed Furnace Gas Cleaning Process Flow Diagram

7.1.2 Ferrometals Site Inventory

As stated above, Ferrometals operates six Charge Chrome Furnaces, (4 open and 2 closed), one Metal Recovery Plant and an Intermediate Carbon Ferrochrome Converter (IC3). In addition, a Pellet and Sintering Plant converts fine ore and UG2 (Upper Group 2 layer of the Rustenburg Layered Suite) into sintered pellets for use in the furnaces.

The following lists the activities/infrastructure at Ferrometals. Also refer to Figure 7.1.2 (a) below.

- Raw Material Storage
- Pelletizing Plant
- Furnace Plant Area
- Final Product Storage Area
- ETP
- Northern Slimes Dam and P&RWD
- Slag Dump
- Current Slag arising Stockpile
- Storm Water Channel & Process Water Dam
- IC3
- Elkem Ferroveld Plant
- Admin Buildings and HT yard
- Chrome Recovery Plant
- Security
- Parking
- Stores
- Workshops
- Office Buildings
- Security Fence
- Internal Roads
- Railway Lines
- Power Lines
- Change Houses
- Contractors Yard
- Electrical Substations
- Southern Historical Slimes Dam
- Eastern Historical Slimes Dam
- Small Historical Slimes Dam at the Stores

Figure 7.1.2(a): Ferrometals Infrastructure Layout Plan

7.2 CONSTRUCTION OF THE NEW SLIMES DAM FACILITY

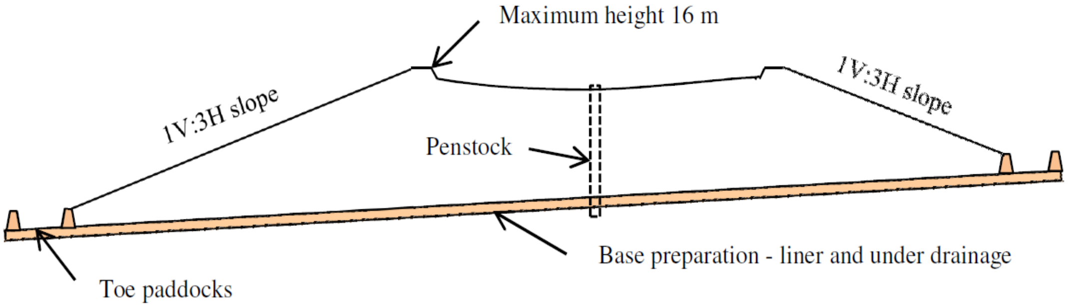
7.2.1 Design Capacity for the Proposed New Slimes Dam

The Northern Slimes Dam at Ferrometals will reach the end of its life by mid-2014. The current slimes production at Ferrometals is in the order of 3 033 m^3 per month. At an average slimes production rate of 3 100 m^3/month, the minimum design capacity required for a new Slimes Disposal Facility is therefore 558 000 m^3, which is equivalent to a total volume of 741 000 tonnes over a 15 year period.

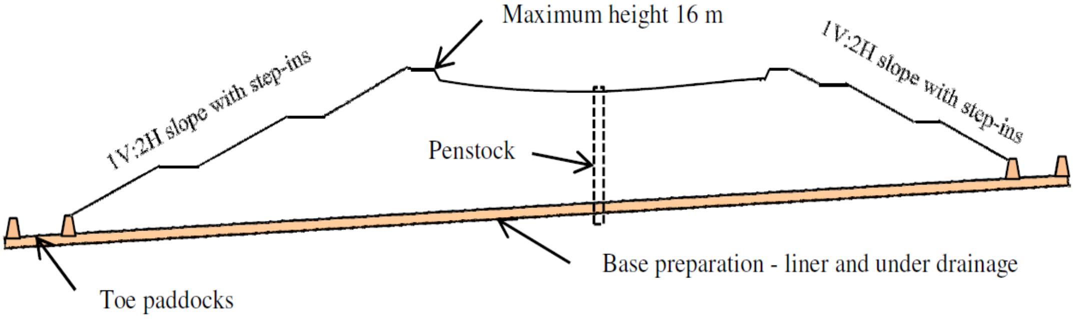
7.2.2 Footprint Size, Side Slope and Final Height

Based on the production volumes for a 15 year design life, the characteristics of the slimes and the design parameters, it is calculated that a footprint area of about 7.85 ha will be required for the new facility. With the side slopes at an average slope of 1V:3H the proposed new Slimes Dam will reach a maximum height of about 16 m at the end of its 15 year life time.

The proposed new Slimes Dam can be constructed at either a constant side slope of 1V:3H or at a slope of 1V:2H with intermediate step-ins to maintain an average slope of 1V:3H. The two possible cross sections of the proposed new Slimes Dam are shown in the Figures below.



Option A: Typical Section through New Slimes Dam
Option A: Slope without step-in



Option B: Typical Section through New Slimes Dam
Option B: Slope with step-in

Either Option A or Option B is acceptable from an environmental, economic and stability point of view. However, the final selection will depend on operational issues that will be finalised before the final design phase.

7.2.3 Slimes Dam Liner Requirements

Due to the poor water quality in the slurry mix the footprint area of the proposed new Slimes Dam will be covered with an engineered hazardous waste lagoon liner consisting of the following layers in sequence from the top to the bottom as shown in Figure 7.2.3(a) below:

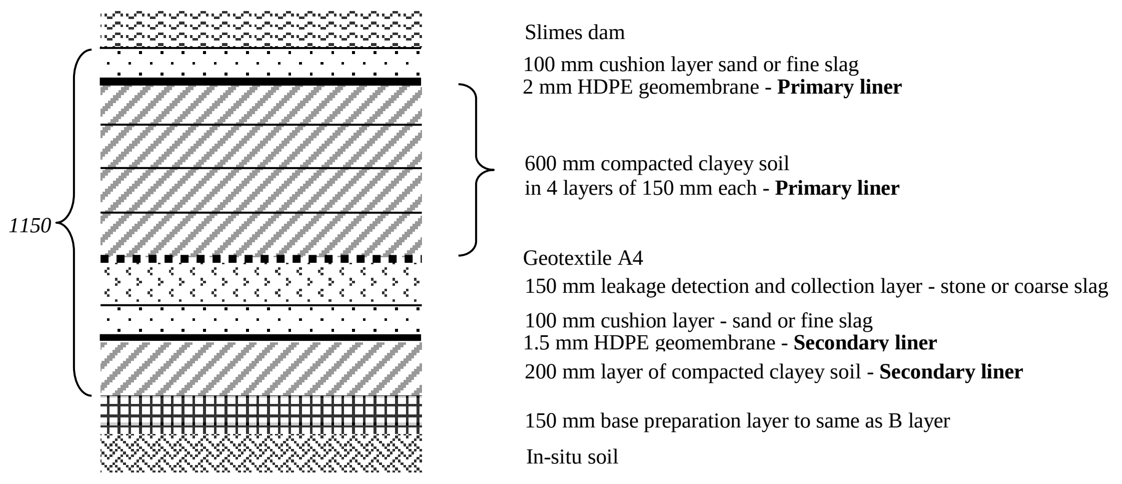


Figure 7.2.3(a): Proposed Lining System for New Slimes Dam

Over and above the engineered lining and seepage detection, an under drainage system consisting of a toe drain along the perimeter of the day wall and a series of parallel collector drains across the width of the slimes dam will be installed. These drains will feed into a main collector drain, with manholes at appropriate intervals, on the lower western side of the slimes dam as shown in Figure above. The main collector drain will then discharge into the collection/return water system to reticulate water back to the process.

The Final Design for the New Slimes Dam was presented to DWA on 15 May 2014 and the comments received in this respect is attached in **APPENDIX IX** (see the Issues and Response Register on page 5-6 and Appendix 6.2.14(A)). Refer to **APPENDIX XI** for the New Slimes Dam Final Design Report.

7.3 CLOSURE OF THE EXISTING SLIMES DAM FACILITY

The current operational Slimes Dam will be operated as per the operational procedures and standards until the new Slimes Dam facility has been constructed, after which the intention is to decommission and close the existing facility. The current indication is that this facility will run out of disposal by mid-2014.

The closure vision is to rehabilitate the current Slimes Dam in such a way that a sustainable post-closure land use is obtained through the application of BATNEEC principles. The objectives of rehabilitation and closure of the current Slimes Dam are to ensure that the site is:

- In a condition consistent with the post-closure land use objectives;
- Neither a danger to public health and safety nor animal health and safety;
- Not a source of on-going pollution of the environment;
- In an ecological and geophysical stable state;
- Aesthetically acceptable;
- Rehabilitated to the legal requirements and commitments stated in the EMP and
- Sustainable in the long term, with minimum post-closure intervention in the form of monitoring and remedial works.

7.3.1 Preliminary Design Criteria for Closure of the Current Slimes Dam

The following design criteria are applicable to the rehabilitation and capping of the existing Slimes Dam:

- The final footprint area after shaping and contouring of the dam must not impede existing buildings or infrastructure still in use – the final footprint area must thus be minimised to allow for other activities around the slimes dam to continue;
- Contouring and shaping of the slimes dam must be such that no ponding occurs;
- The capping/cover material must be able to prevent ingress of surface water and must be sufficiently erosion resistant against surface water run-off and wind;
- The side slopes of the slimes dam must have a Factor of Safety (FOS) of at least 1.50 against sliding and must not be steeper than 1V:3H;
- Storm water run-off resulting from the 1:100 year 24 hour storm duration must be accommodated through sufficient drains, canals, berms and chutes and discharged into the natural environment;
- Leachates through the foundation into the groundwater must be continuously reduced and if required, a seepage trench at the toe of the slimes dam must be provided and;
- A suitable monitoring system must be provided to check the groundwater quality around the slimes dam over a period of at least 30 years.

7.3.2 Design Elements for Closure of the Current Slimes Dam

The Northern Slimes Dam has been investigated and inspected and the following requirements for successful closure were identified:

- The side slopes need to be shaped and flattened for long term slope stability and erosion control;
- The top surface need to be filled with suitable material and contoured to prevent ponding of surface water;
- The penstocks need to be sealed off;
- A suitable capping liner needs to be installed to cover the whole slimes dam and footprint area;
- Storm water control measures i.e. drains, channels and down chutes need to be provided to accommodate the design rainfall event;
- Storm water channels need to be provided to discharge storm water into the receiving clean water drainage system;
- A seepage cut-off trench at the western toe of the slimes dam may be required to reduce groundwater contamination through leachates;
- The existing solution trench needs to be modified to maintain the discharge of internal seepage water into the dirty water sump at the south-western corner;
- A suitable grass cover needs to be provided to minimise surface water erosion and dust blow-off;
- A maintenance system need to be implemented until grassing is established and
- A monitoring and control system needs to be implemented to verify improvement of groundwater quality and cover integrity.

7.3.3 Proposed Capping of the Current Slimes Dam

In terms of the H:H requirement the following capping as shown in Figure 7.3.3(a) is proposed:

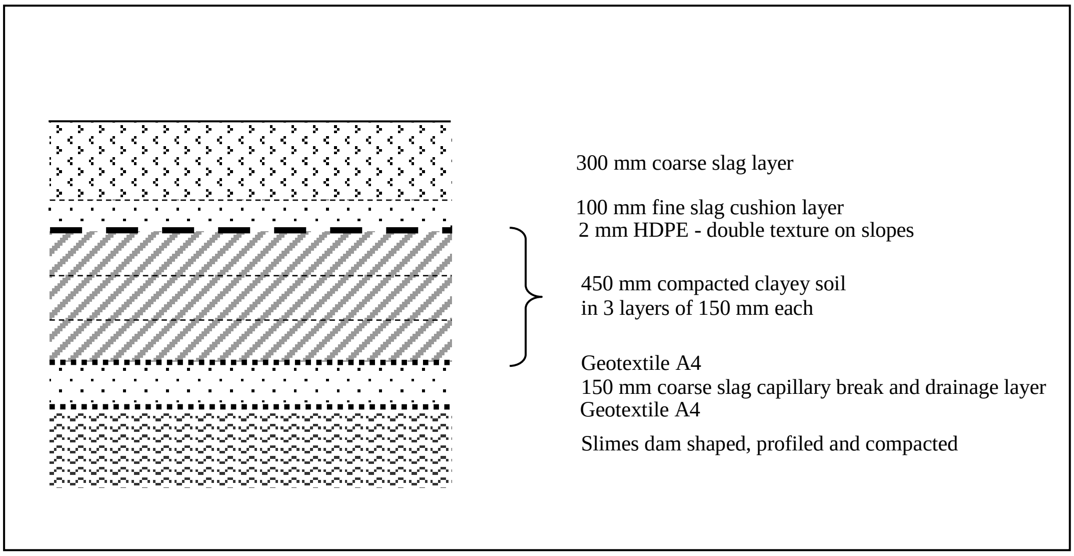


Figure 7.3.3 (a): Proposed Capping for Current Slimes Dam

The specification of the various layers is as follows:

- **U layer**: A 200 mm thick layer of topsoil planted with local grasses and shrubs. The layer must be lightly compacted after spreading.
- **V layer**: A compacted 150 mm soil cap layer. The soil used in the V layer must have a Plasticity Index of between 5 and 15 and a maximum particle size of 25 mm. This layer must be compacted to the maximum density reasonably attainable under the circumstances to ensure the required impermeability. The compaction must not be less than 85% of Proctor maximum dry density at a water content of Proctor optimum to Proctor optimum +2%. The saturated steady state infiltration rate into a compacted soil V layer must not exceed 0,5m/y, as measured by means of an in situ double ring infiltrometer test. The surface of every V layer must be graded initially at a minimum of 3% to shed precipitation.
- **W layer**: Shaped and compacted upper surface of the Slimes Dam.

7.3.4 Slope Stability

Due to the relatively steep side slopes of between 1:1.7 and 1:1.6 on the sides of the current slimes dam it is necessary to flatten the slopes and shape the dam to a suitable side slope of between 1V:3H and 1V:5H as per the minimum requirements and in order to control surface water run-off and erosion of the capping cover material.

At concept/preliminary stage it is proposed that the sides are worked off to a 1V:4H slope for easy construction access, erosion control and stability reasons, subject to the acceptability of the extended footprint area. The Factor of Safety against slope failure for the proposed profile with a 1V:4H slope is 1.99 which is higher than the required 1.50 for long term stability.

7.3.5 Surface Water Drainage Control

In the conceptual/preliminary phase two possible options (A and B) were considered for the capping and closure of the current Slimes Dam (see Figures 7.3.5(a) and 7.3.5(b).

In **Option A** the surface of the Slimes Dam is profiled and contoured at a slope of 1V:50H towards the penstock in order to utilise the penstock system to drain surface water from the top of the slimes dam to the external drainage system. The side slopes are profiled at a slope of 1V:4H and at the highest part of the slimes dam an intermediate bench is provided to reduce the flow path of surface water run-off along the side slopes. Storm water is collected in a channel along the bench and discharged via chutes to the storm water drain at the toe of the current Slimes Dam.

In **Option B** the surface of the Slimes Dam is filled up with imported material and contoured to have a rounded surface with slopes not exceeding 1V:50H. The penstock is to be sealed off and all surface water run-off is routed down the 1V:4H side slopes into a collection channel and then into the external drainage system. At the highest part of the slimes dam a bench is provided to intercept storm water run-off and discharge it via chutes to the storm water drain at the toe of the slimes dam.

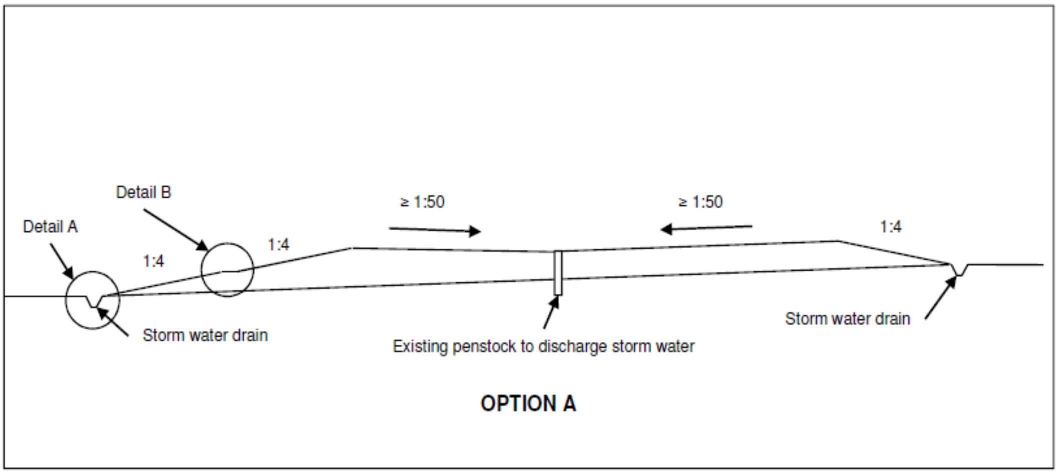


Figure 7.3.5(a): Option A – Discharge through Existing Penstock System

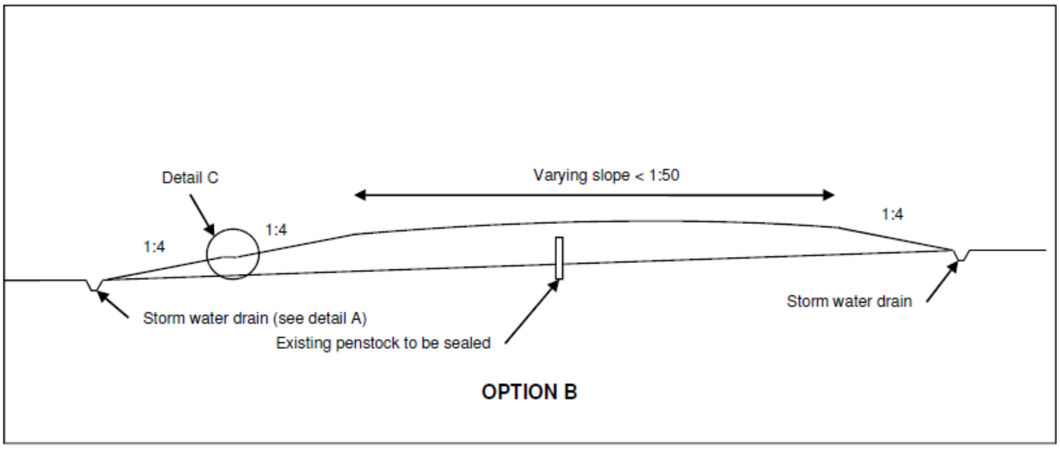


Figure 7.3.5(b): Option B – Discharge along Slopes of Rehabilitated Slimes Dam

The details of the storm water drain and the bench with storm water collection channel and chutes will be determined in the final design phase.

From initial discussions held with the authorities it is evident that Option B is the preferred option as for Option A there is always the risk of blockages of the penstock, resulting in ponding and recharge of the slimes dam and an increase in leachates and seepage into the groundwater system in the long term.

The Final Closure Plan for the Northern Slimes Dam was presented to DWA on 15 May 2014 and the comments received in this respect is attached in **APPENDIX IX** (see the Issues and Response Register on page 5-6 and Appendix 6.2.14(A)). Refer to **APPENDIX XII** for the Final Closure Plan and Design Report.

7.4 PROJECT PHASES AND TIME LINES

The activity descriptions and project phase time lines for the two projects for which application is made, will now be discussed.

7.4.1 Construction of the New Slimes Dam Facility

Four life cycle phases are relevant namely the Construction Phase, the Operational Phase, the Decommissioning and Closure Phase and finally the Post Closure Phase.

7.4.1.1 Construction Phase Activities and Time Lines

Before the new Slimes Dam can be put into operation all the pre-deposition works need to be constructed.

- Site clear and grub which comprises the removal of vegetation
- Stripping and stockpiling of topsoil
- Site levelling (cut and fill operations or the import of external founding materials e.g. crushed stone aggregate)
- Construction of the hazardous waste lagoon liner
- Construction of the seepage detection system
- Construction of the internal drainage system
- Construction of the paddock walls at the toe of the slimes dam
- Construction of the penstocks with catwalk and decant system
- Construction of the starter walls for the slurry deposition and
- Re-routing of the existing slurry pipelines to the south-western end of the new Slimes Dam.

Construction of the new Slimes Dam is expected to take 6 months.

7.4.1.2 Operational Phase Activities and Time Lines

During the operation of the new Slimes Dam Facility the following activities will take place:

- Pumping of slimes slurry from the closed Furnaces via the slurry pipe lines onto the Slimes Dam footprint.
- Beaching and drying out of the slurry next to the starter walls
- Dried out slimes will be used to construct the day wall from the outer edge at the design slope in order to maintain the required freeboard and design geometry of the slimes dam
- As the level of the slimes dam raises pre-cast concrete rings will be placed on the penstock in order to control the pool depth on top of the dam
- Slurry will be deposited from three or four discharge points situated initially on top of the western starter wall
- Supernatant water will be decanted from the Slimes Dam via a penstock system into the Slimes Dam RWD.
- Water infiltrating through the Slimes Dam Facility will feed into a main collector drain which will then discharge into the collection/return water system (RWD).

- Water from the RWD will be recirculated back to the sliming process via the slimes return water pipe lines.

The proposed new Slimes Dam is designed for a life time of 15 years.

7.4.1.3 Decommissioning Phase Activities and Time Lines

- The new slimes dam will be rehabilitated by filling up the paddocks at the toe of the dam with a suitable inert waste rock or discard material
- The material will be placed in layers not exceeding 500 mm at an external slope of 1V:3.5H against the slopes of the slimes dams as shown in Figure 7.4.2.3(a)

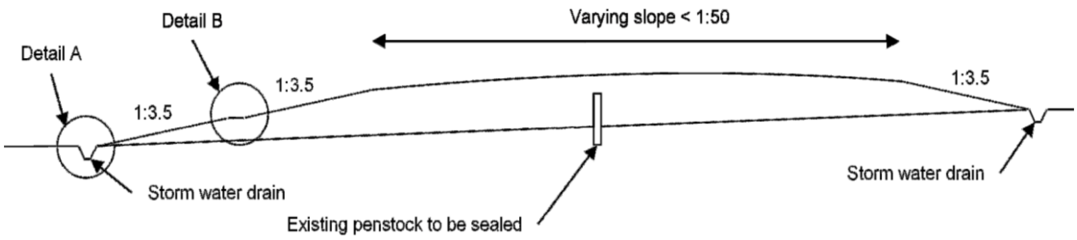


Figure 7.4.1.3(a): Details of Rehabilitation and Closure of the new Slimes Dam

- Construct a toe drain and benches and berms as shown in Details A & B respectively at pre-determined levels in order to prevent erosion or instability problems
- The outside surface of the fill material will be covered with a 450 mm layer of clayey soil, a further 200 mm layer of topsoil and then covered with a suitable grass
- The area at the toes of the slimes dam will be contoured to prevent ponding and ensure proper run-off
- All surface water from the slopes and toe area will be routed via a storm water drain as shown in Detail A to the clean water canal from where it can be discharged into the natural environment.
- A suitable grass cover will be provided to minimise surface water erosion and dust blow-off;
- A maintenance system will be implemented until grassing is established, and
- A monitoring and control system will be implemented to verify improvement of groundwater quality and cover integrity.

Decommissioning and Closure of the new Slimes Dam is expected to take 6 months.

7.4.1.4 Post Closure Phase Activities and Time Lines

Indications at present (low level of operational phase impacts suggest very low level of residual post closure impacts) are that the post closure land use for the Ferrometals site, could resort back to industrial, recreational, business and even residential use.

Apart from some modifications to the topography (such as the rehabilitated Slimes Dams), and despite a slightly impaired agricultural potential and some slight impacts on groundwater quality, the influence of the post closure environmental impact profile on post closure land use, is predicted to be low.

However, potential post closure issues could arise from the following aspects:

- Ineffective Vegetation Cover
- Ineffective Capping System
- Ineffective Seepage Drainage and Collection System
- Ineffective Storm Water Drainage System

The above must be monitored to confirm their sustainable efficiency post closure.

7.4.2 Closure of the Existing Slimes Dam Facility

The construction and operational phase activity descriptions and time lines for the Closure of the Existing Slimes Dam are not relevant to its closure and will therefore not be discussed.

7.4.2.1 Decommissioning Phase Activities and Time Lines

- The side slopes will be shaped and flattened for long term slope stability and erosion control;
- The top surface will be filled with suitable material and contoured to prevent ponding of surface water;
- The penstocks will be sealed off;
- A suitable capping liner will be installed to cover the whole slimes dam and footprint area;
- Storm water control measures i.e. drains, channels and down chutes will be provided to accommodate the design rainfall event;
- Storm water channels will be provided to discharge storm water into the receiving clean water drainage system;
- A seepage cut-off trench at the western toe of the slimes dam may be required to reduce groundwater contamination through leachates;
- The existing solution trench will be modified to maintain the discharge of internal seepage water into the dirty water sump at the south-western corner;
- A suitable grass cover will be provided to minimise surface water erosion and dust blow-off;
- A maintenance system will be implemented until grassing is established;
- A monitoring and control system will be implemented to verify improvement of groundwater quality and cover integrity.

The capping project of the existing Slimes Dam is expected to take 6 months and the overall Decommissioning and Closure of the existing Slimes Dam will require approximately 2 years to complete which is necessary for the dam to dry out.

7.4.2.2 Post Closure Phase Activities and Time Lines

Indications at present (low level of operational phase impacts suggest very low level of residual post closure impacts) are that the post closure land use for the Ferrometals site, could resort back to industrial, recreational, business and even residential use. Apart from some modifications to the topography (such as the rehabilitated Slimes Dams), and despite a slightly impaired agricultural potential and some slight impacts on groundwater quality, the influence of the post closure environmental impact profile on post closure land use, is predicted to be low.

However, potential post closure issues could arise from the following aspects:

- Ineffective Vegetation Cover
- Ineffective Capping System
- Ineffective Seepage Drainage and Collection System
- Ineffective Storm Water Drainage System

The above must be monitored to confirm their sustainable efficiency post closure.

8. PROJECT ALTERNATIVES

Alternatives considered for this project relate to the two activities that require environmental authorisations at the Ferrometals site, namely the decommissioning and closure of the current slimes dam facility as well as all the life-cycle phases of the proposed new slimes dam facility.

As far as the different alternatives to be considered, reference is made to the definition for "**alternatives**" as contained in the Environmental Impact Assessment Regulations – GNR 543 of 18 June 2010.

"**alternative**", in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to –

(a) the property on which or location where it is proposed to undertake the activity;
(b) the type of activity to be undertaken;
(c) the design or layout of the activity;
(d) the technology to be used in the activity;
(e) the operational aspects of the activity;
(f) the option of not implementing the activity.

The DMR Guideline for the Compilation of a Scoping and EIA Report, lists four alternatives to be considered:

- alternative land uses
- alternative land developments
- alternative operational aspects
- consequences of the no-go option

In order to support the DMR Guideline, as well as to include all defined alternatives, the following defined alternatives will be dealt with under "alternative operational aspects" in this report:

- the location where it is proposed to undertake the activity;
- the design or layout of the activity;
- the technology to be used in the activity;
- the operational aspects of the activity;

The option of not implementing the activity will be dealt with under the heading of "consequences of the no-go option".

8.1 ALTERNATIVE LAND USES (property on which activity is undertaken)

The surrounding land use is predominantly industrial and residential. eMalahleni is a coal mining area with 22 Collieries in an area no more than 40 km in any direction. There are also a number of power stations and a steel mill (Highveld Steel and Vanadium Corporation) nearby. The KwaQuqa residential areas are situated to the south and west of Ferrometals (approximately 6 km away). The village of Clewer is approximately 10 km to the south west of Ferrometals.

All the existing and new activities of the Ferrometals operations which form the material content for the applications in support of which this Scoping and EIA process is conducted, occur on land that has been formally proclaimed as industrial land and also on which mining and ferro-chrome smelting have both been authorized to operate.

The assessment of alternative land uses is therefore not relevant to this application as the current land use will not be compromised by any of the existing or new activities associated with the current application process.

8.2 ALTERNATIVE LAND DEVELOPMENTS (type of activity undertaken)

As already stated above, the surrounding land use is predominantly industrial and residential and the Ferrometals operations are all located on formally proclaimed industrial land. Therefore, all the existing and new activities which form the material content for the applications in support of which this Scoping and EIA process is conducted, occur on land on which mining and ferro-chrome smelting are both presently being conducted. The assessment of alternative land developments is therefore also not deemed relevant to this application.

8.3 ALTERNATIVE OPERATIONAL ASPECTS

8.3.1 Location where it is Proposed to Undertake the Activity

The Ferrometals site represents a brown fields situation, therefore no alternative could be considered in terms of the location of the current slimes disposal facility. A fatal flaw assessment was however conducted for the Ferrometals site and its immediate surrounds. It should be noted that the legal requirement for such an assessment did not exist when the site was first established in 1959.

The outcome of this assessment, although belated in the sense that existing facilities may not be able to be moved (e.g. existing slimes dam), would benefit the project in the sense that it could influence design considerations for activities if they were found to compromise any fatal flaw criteria.

The fatal flaw assessment was performed subject to guidance contained in the "Minimum Requirements for Waste Disposal by Landfill". The assessment was performed by highlighting any potential fatal flaw from the list below, which was known to occur within the Ferrometals operational and immediate surrounding area, thereby ending up with a map that shows areas void of any fatal flaws.

In a green fields situation the map would be used to site activities within these fatal flaw free zones. In a brown fields situation the map would be used to identify activities for which the design criteria should be adapted to engineer for possible fatal flaw related complications.

The fatal flaw assessment for Ferrometals will be discussed with reference to the information shown on the map in Figure 8.3.1(a) below. This map was compiled based on information generated during the previous base line studies conducted for Ferrometals.

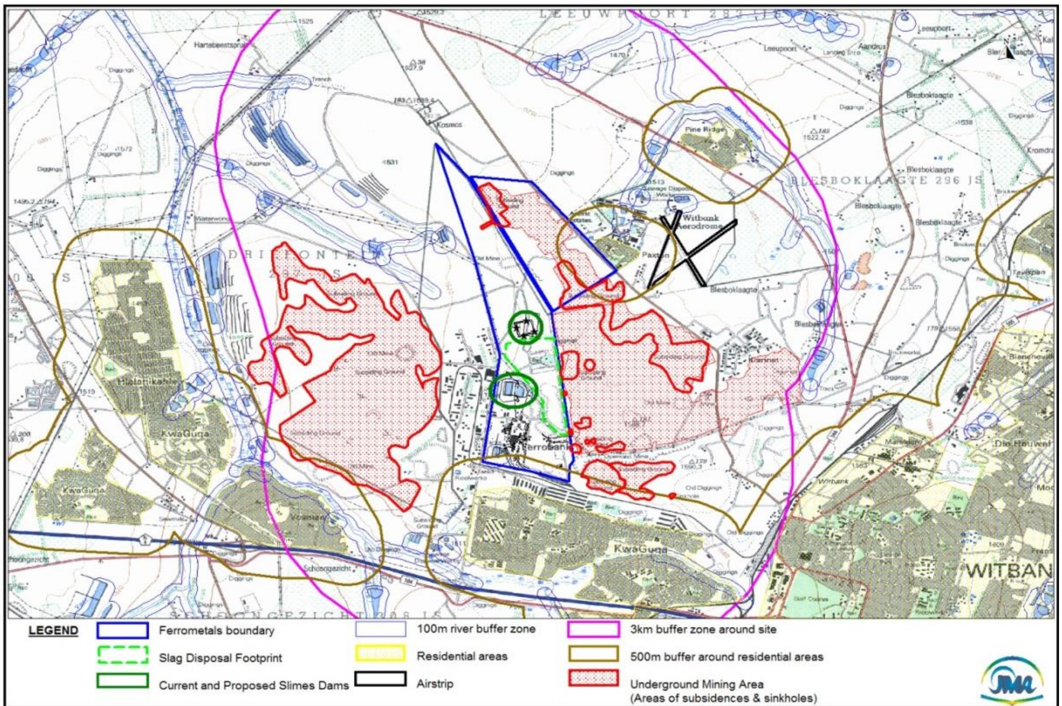


Figure 8.3.1(a): Fatal Flaw Assessment Map for Ferrometals and Immediate Surrounds

The following aspects representing potential fatal flaws were considered for Ferrometals:

- **3000 *m* from the end of any airport runway or landing strip in the direct line of the flight path and within 500 *m* of an airport or airfield boundary.** This is because certain activities could attract birds, creating the danger of aircraft striking birds.

  Local Airfield is located some 3.94 km south-east from the site. The airfield is indicated with a green delineation on Figure 8.3.1(a). The site is not located in the direct line of approaching or departing aircraft.

- **Areas below the 1 in 50 year flood line.** This eliminates wetlands, vleis, pans and flood plains, where water pollution could result from certain activities.

  Buffer zones were drawn along all the surface streams in the area and are shown as blue lines on Figure 8.3.1(a). No areas of concern exist.

- **Areas in close proximity to significant surface water bodies, e.g. water courses or dams.**

  The Ferrometals site is located in quaternary sub-catchment B11K. No surface water tributaries exist in the immediate surroundings of the Ferrometals site.

- **Unstable areas. These could include fault zones, seismic zones and dolomitic or karst areas where sinkholes and subsidence are likely.**

  The site does not have any natural unstable conditions related to geology or seismicity. However, extensive underground mining operations do occur along, and to the east of the Ferrometals site boundary. The underground mining areas are shown as red highlighted zones on Figure 8.3.1(a). Underground mining does not represent a fatal flaw per se and provided that the relevant mining safety factor analyses is considered during the design phase.

- **Sensitive ecological and/or historical areas. These include nature reserves and areas of ecological and cultural or historical significance.**

  No sensitive ecological areas, or sites of cultural or historical significance are present at Ferrometals. This has been confirmed during the various base line studies conducted in the past.

- **Catchment areas for important water resources. Although all sites ultimately fall within a catchment area, the size and sensitivity of the catchment may represent a Fatal Flaw, especially if it feeds a water resource.**

  The Ferrometals site is located in quaternary sub-catchment B11K. The catchment feed into the Loskop Dam, a surface water reservoir located some 55 km downstream from Ferrometals. Although the catchment does feed into a surface water resource, the Ferrometals site being located here is not deemed as presenting a fatal flaw.

- **Areas characterized by flat gradients, shallow or emergent groundwater, e.g. vleis, pans and springs, where a sufficient unsaturated zone separating the waste body and the groundwater would not be possible.**

  No areas with shallow or emergent groundwater exist in the study area. Groundwater levels in the area vary between 5 m and 12 m below surface with an average depth to the groundwater table of about 5.5 m.

- **Areas characterized by steep gradients, where stability of slopes could be problematic.**

  No such areas are present at Ferrometals.

- **Areas of groundwater recharges on account of topography and/or highly permeable soils.**

  Groundwater recharge over the entire Ferrometals area is expected to be fairly uniform, except for areas in the plant where paving, concrete or tar surfaces have been put down. No special groundwater recharge areas exist at Ferrometals.

- **Areas overlying or adjacent to important or potentially important aquifers.**

  The groundwater aquifers at Ferrometals can in general be classified as minor aquifer systems. However, areas with preferential groundwater occurrence and flow could be associated with the contact zones of dykes and faults. These features have therefore all been highlighted on the map in Figure 8.3.1(a). None of the mapped features appear to extend underneath the Ferrometals site.

- **Areas characterized by shallow bedrock with little soil cover. These are frequently also associated with steep slopes, which may be unsuitable.**

  The entire Ferrometals site has an adequate soil cover which varies in thickness between 1m and 2m. No natural bedrock outcrops occur on site.

- **Areas in close proximity to land-uses which are incompatible with landfilling. Land-uses which are incompatible with landfilling would attract community resistance and would include residential areas, nature reserves and cemeteries.**

  Residential areas have been delineated in yellow on the map in Figure 8.3.1(a). Although located within an industrial area, the Ferrometals site is surrounded by residential areas, the closest of which is some 230 m south of the site. The abundance of residential areas around Ferrometals, and proximity of the site to these areas, should be taken into consideration in the design of the EMP for the existing, as well as proposed new developments at Ferrometals.

- **Areas where adequate buffer zones are not possible.**

  The buffer zone around the Ferrometals site is limited, especially towards the west, and south. The proximity of the residential and industrial/business areas should be recognized and provided for in the EMP for the various activities at Ferrometals.

- **Areas which, because of title deeds and other constraints, can never be rezoned to permit a waste disposal facility.**

  The current zonings at Ferrometals are Industrial 2.

- **Areas immediately upwind of a residential area in the prevailing wind direction(s).**

  Predominant wind directions for the study area appear to be northerly, westerly, east- and east-south-easterly.

- **Areas over which servitudes are held that would prevent the establishment of a waste disposal facility; e.g. ESKOM or Road Department servitudes.**

  All servitudes have been duly recorded as based on a detailed property base line assessment.

- **Any area characterized by any factor that would prohibit the development of a landfill except at prohibitive cost.**

  This would be areas with specific engineering challenges. None identified.

- **Areas in conflict with the Local Development Objectives (LDO) process and the Regional Waste Strategy.**

  Assumed that none would exist within the proclaimed municipal industrial area in which Ferrometals is located.

Fatal Flaw Assessment Conclusion

Three major aspects which should be considered based on the outcome of the fatal flaw assessment are:

- Adequate buffer zones around the Ferrometals site, with respect to residential land use, appear to be a concern. Being an existing facility, special care should therefore be taken to design the EMP to cater for this consideration.
- Zoning for areas where hazardous waste is currently deposited, might require rezoning.
- The civil engineering design for surface located features must take possible undermining into consideration.
- Based on the fatal flaw assessment a best proposed alternative footprint was identified directly north of the existing Slag Disposal Area (see below Figure 8.3.1 (b) and (c)). This footprint is proposed for the construction of the new Slimes Disposal Facility (*the footprint needs to be designed for a life of 15 years*).

Figure 8.3.1(b): Best Alternative Footprint (new Slimes Dam) and Existing Slimes Dam Footprint

The following figure illustrates the two footprints (current slimes disposal to be closed and the new proposed Slimes Disposal Footprint area) on a photograph for visual orientation.

Figure 8.3.1(c): Best Alternative Footprint (new Slimes Dam) and Existing Slimes Dam Footprint

8.3.2 Design or Layout of the Activity

Design and layout for both facilities (old and new) is dictated by site geometry, disposal method, and DWA and DEA requirements for waste disposal by landfill.

The capping and lining systems for the old and new slimes dam facility respectively, were designed following the National Environmental Management Waste Act regulations GNR 634 (Waste Classification and Management Regulations), GNR 635 (National norms and standards for the assessment of waste for landfill disposal) and GNR 636 (National norms and standards for disposal of waste to landfill).

8.3.3 Technology to be Used in the Activity

The technology used for slimes disposal, represent current best practice. It complies with DWA and DEA requirements for waste disposal by landfill.

8.3.4 Operational Aspects of the Activity

The Slimes Dam at Ferrometals is currently, and will in future, be operated according to acceptable environmental, engineering and safety standards, all of which are aligned with DWA and DEA requirements for waste disposal by landfill.

8.4 CONSEQUENCES OF THE NO-GO OPTION

Ferrometals has been in operation since 1959 and contributes significantly to the socio-economic well-being of the area. The products produced are of strategic importance and contributes significantly towards foreign earnings for South Africa.

The activities related to this process for Ferrometals, and which are applied for in this application, are all designed to improve Environmental Management of the Site and to ensure continued operations. Should the Ferrometals not be allowed to commission the new Slimes Disposal Facility (no-go), they will not be able to comply with its enviro-legal obligations and will also be required to close the operations as a Slimes Disposal Facility is an integral aspect of the overall process components.

The proposed new Slimes Disposal will contribute towards sustainable continuous growth for not only Ferrometals, but indeed also for Samancor Chrome as a whole, and as such also for the community at large. The no-go consequences for this project will seriously limit Ferrometals ability to implement continually improved technologies in support of sustainable growth and improved environmental management.

9. DESCRIPTION OF ENVIRONMENT

The following section describes the Environment encountered at the Ferrometals site. The environmental components considered and discussed were Climate, Topography, Air Quality, Soil, Land Use and Capability, Geology, Groundwater, Surface Water, Ecology and Heritage and Paleontological resources. It was not deemed necessary to investigate the Noise and Visuals Aspects of the environment, due to the location of the project area.

The Project is located in an already heavily developed industrial area; hence the new activities would not have a significant impact on the baseline environment. No significant increase in the ambient sound/noise level is expected from the new Ferrometals activities when compared to the already existing noise levels generated from the surrounding activities in the area.

In addition, the visual impact would also not be of great significance as the landscape morphology would not be considerably different from the current landscape. There would also not be a significant alteration in terms of the visual intrusion caused by the new activities.

9.1 CLIMATE

9.1.1 Regional Climate

The climate of the region is typical of the Eastern Highveld. During the summer the day time temperatures are in the upper twenties but cool down during the evening. In winter day time temperatures are in the upper teens dropping to near zero during the night. Frost occurrence during winter is common. The rainfall occurs mostly in summer – some 80% of the annual being recorded during this period. Although there is a distinct seasonal variation the evaporation is much more evenly spread during the year than the rainfall.

9.1.2 Rainfall and Evaporation

Ferrometals is located within the B11K quaternary sub-catchment, which has a Mean Annual Precipitation (MAP) of 684 mm and a Mean Annual Evaporation (MAE) of 1700 mm resulting in the site having a negative precipitation balance.

The site is located in a moderate rainfall region with a Mean Annual Runoff (MAR) of about 60 mm, which equates to a runoff of approximately 9 % of the MAP.

There is a considerable variation in MAP for rainfall stations in the catchment area, mainly due to different record lengths. However, the two nearest rainfall stations, Witbank Mag (0515382 - 58 years) and Witbank Mun (0515412 - 47 years), have a difference in MAP of only 18 mm or 2.5 %.

9.2 TOPOGRAPHY

The site falls within the Mpumalanga Highveld region. The average elevation is 1,500 meters above mean sea level (mamsl). The topography is defined as moderately undulating plains, and the landscape consists of gently rolling hills with scattered trees and grassland.

9.3 AIR QUALITY

A baseline air quality impact assessment (refer to **APPENDIX V** for the comprehensive Specialist Report) has been undertaken for Ferrometals and Ferroveld in Mpumalanga. Nuisance dust, as well as PM10, SO_2, NO, NO_2, CO, Cr^{6+}, Benzene and PAH health impacts for current operations were assessed in order to identify all possible detrimental impacts on the surrounding environment and sensitive receptors. The main findings of the study are as follows:

9.3.1 Emissions Inventory

Ferrometals Emissions

- Total TSP emissions were estimated to be 5110 tpa. Vehicle entrained dust from unpaved roads was estimated to be the main contributor to total TSP emissions, contributing ~38%, followed by emissions as a result of wind erosion at ~27%.
- Operations at FMT were estimated to result in 1820 tpa PM10 emissions. PM10 emissions as a result of vehicle entrainment of dust from unpaved roads were estimate to account for ~36% of the total PM10 emissions followed by emissions as a result of wind erosion and furnace fugitives at ~20% and 16% respectively.
- Total SO_2 emissions were estimated to be ~101 tpa with emissions from baghouse vents accounting for ~88% of the total.
- NO emissions were estimated to be 519 tpa. Baghouse vent emissions were estimated to contribute ~98% to the total.
- NO_2 emissions were estimated to 9.65 tpa. Baghouse vent emissions were estimated to contribute 81% to total NO2 emissions.
- Operations at FMT were estimated to result in 227 tpa CO emissions with emissions from the baghouse vents accounting for ~99% of the total.
- Inhalable Cr^{6+} emissions were estimated to be 0.59 tpa. Baghouse vent emissions and furnace fugitives were estimated to contribute ~48% and ~37% to total Cr^{6+} emissions respectively.

Ferroveld Emissions

- Total TSP emissions as a result of FVD operations were estimated to be 228 tpa.
- Stacks emissions were estimated to contribute ~95% to total TSP emissions.
- Operations at FVD were estimated to result in 99.7 tpa PM10 emissions. Stack emissions were estimated to contribute ~94% to total PM10 emissions.
- FVD stack emissions were estimated to result in total SO_2 emissions of 0.53 tpa.
- FVD stack emissions were estimated to result in total NO emissions of 0.9 tpa.
- FVD stack emissions were estimated to result in NO_2 emissions of 0.46 tpa.
- FVD stack emissions were estimated to result in total CO emissions of 4.35 tpa.
- Organic emissions were estimated at 1.57 tpa Benzene and 0.36 tpa semi-volatile organic compounds (SVOC's, used in the estimation of PAH impacts)

Cumulative Emissions

- Cumulative TSP emissions as a result of FMT and FVD operations were estimated to be 5340 tpa. FMT emissions were estimated to account for 96% of cumulative TSP emissions.
- Cumulative PM10 emissions as a result of FMT and FVD operations were estimated to be 1920 tpa. FMT emissions were estimated to account for 95% of cumulative PM10 emissions.
- Cumulative SO_2 emissions as a result of FMT and FVD operations were estimated to be 102 tpa. FMT emissions were estimated to account for 99% of cumulative SO_2 emissions.
- Cumulative NO emissions as a result of FMT and FVD operations were estimated to be 520 tpa. FMT emissions were estimated to account for ~100% of cumulative NO emissions.
- Cumulative NO_2 emissions as a result of FMT and FVD operations were estimated to be 10.1 tpa. FMT emissions were estimated to account for 95% of cumulative NO_2 emissions.
- Cumulative CO emissions as a result of FMT and FVD operations were estimated to be 227 tpa. FMT emissions were estimated to account for 98% of cumulative NO_2 emissions.
- Cr^{6+} emissions were only quantified for FMT.
- Organic emissions were only quantified for FVD.

9.3.2 Ferrometals Contribution to Ambient Air Quality Profile

- The maximum annual average and highest daily average PM10 concentrations predicted to occur at KwaQuqa were 281 µg/m³ and 1350 µg/m³ respectively. Exceedences of the current and proposed South African annual average standards of respectively were predicted to occur only at KwaQuqa South. Exceedences of the current and proposed South African daily average PM10 were predicted at KwaQuqa South, Hlanikahle (116 µg/m) and KwaQuqa West (156 µg/m). Emissions from FMT were predicted to result in 231 days of Exceedence of the EC daily average PM10 standard of 50 µg/m³.
- The maximum annual, highest daily and highest hourly average SO_2 concentrations predicted to occur at KwaQuqa were 0.59 µg/m³, 4.4 µg/m³ and 37.9 µg/m³ respectively. No exceedences of the current SO_2 standards for any of the averaging periods were predicted at any of the sensitive receptors.
- The maximum annual, highest daily and highest hourly average NO concentrations predicted to occur at KwaQuqa were 3.05 µg/m³, 23.6 µg/m³ and 206 µg/m³ respectively. No exceedences of the current NO standards for any of the averaging periods were predicted at any of the sensitive receptors.
- The maximum annual, highest daily and highest hourly average NO_2 concentrations predicted to occur at KwaQuqa were 5.6 µg/m³, 33.8 µg/m³ and 30.8 µg/m³ respectively. No exceedences of the current NO_2 standards for any of the averaging periods were predicted at any of the sensitive receptors.
- The maximum highest hourly average CO concentration predicted to occur at KwaQuqa was 97.2 µg/m³. No exceedences of the current CO standard were predicted at any of the sensitive receptors.

- The maximum annual average Cr^{6+} concentration predicted to occur at was 0.02 µg/m³. No exceedences of the US EPA's reference concentration for particulate Cr^{6+}
- µg/m³) were predicted at any of the sensitive receptor sites. The cancer risk predicted at KwaQuqa South ranged from 1 in 4650 (moderate risk) to 1 in 400 (high risk).
- The average daily and maximum daily dustfall levels predicted to occur at KwaQuqa were 616 mg/m^2/day ("heavy") and 1860 mg/m^2/day ("very heavy") respectively. The maximum daily dustfall level predicted at KwaQuqa was in the SANS "Action" dustfall band and requires investigation and remediation if two sequential months lie in this band, or more than three occur in a year. Dustfall levels as a result of FMT emissions at all other sensitive receptors were in accord with the "Residential" band, permissible for residential and light commercial areas.

9.3.3 Ferroveld Contribution to Ambient Air Quality Profile

- The maximum annual average and highest daily average PM10 concentrations predicted to occur at were 7.02 µg/m³ and 44.1 µg/m³ respectively. No exceedences of the current or proposed South African annual or daily average PM10 standards were predicted at any of the various sensitive receptors. Emissions from FVD were predicted to result in 1 day of Exceedence of the EC daily average PM10 standard of 50 µg/m³.
- The maximum annual, highest daily and highest hourly average SO_2 concentrations predicted to occur at KwaQuqa were 0.04 µg/m³, 0.32 µg/m³ and 1.94 µg/m³ respectively. No exceedences of the current SO_2 standards for any of the averaging periods were predicted at any of the sensitive receptors.
- The maximum annual, highest daily and highest hourly average NO concentrations predicted to occur at KwaQuqa were 0.08 µg/m³, 0.66 µg/m³ and 4.11 µg/m³ respectively. No exceedences of the current NO standards for any of the averaging periods were predicted at any of the sensitive receptors.
- The maximum annual, highest daily and highest hourly average NO_2 concentrations predicted to occur at KwaQuqa were 0.13 µg/m³, 1.06 µg/m³ and 0.78 µg/m³ respectively. No exceedences of the current NO_2 standards for any of the averaging periods were predicted at any of the sensitive receptors.
- The maximum highest hourly average CO concentration predicted to occur at KwaQuqa was 38.6 µg/m³. No exceedences of the current CO standard were predicted at any of the sensitive receptors.
- The maximum annual average Benzene concentration predicted to occur at KwaQuqa was 0.015 µg/m³. No exceedences of any of the international guidelines and standards for Benzene (Section 2.4.6) were predicted at any of the sensitive receptor sites. The cancer risk as a result of Benzene emissions predicted at KwaQuqa South ranged from 1 in 31 million to 1 in 2 million (very low risk).
- The maximum annual average PAH concentration predicted to occur at KwaQuqa was 2.79x10-6 µg/m3. The cancer risk as a result of PAH emissions predicted at KwaQuqa South ranged from 1 in 300 million to 1 in 5 million (very low risk).

- The average daily and maximum daily dustfall levels predicted to occur at KwaQuqa were 37.7 mg/m2/day and 81.3 mg/m2/day (“slight”) respectively. The maximum daily dustfall levels as a result of FVD emissions at all the sensitive receptors were in accord with the “Residential” band, permissible for residential and light commercial areas.

9.4 SOILS

Both the old and new slimes dam sites are blanketed by brownish-maroon silty and clayey sand of various origins overlying residual soils derived from the in situ decomposition of shale and subordinate sandstone and coal measures of the Vryheid Formation, Ecca Group, Karoo Sequence. Percussion drilled monitor boreholes around the current slimes dam site provide the deep sedimentary section beyond that observed during the test pitting phase (< 3m) and the DPSH penetration tests.

The borehole data also provided the underlying geology which provided the basis for DPSH refusal – which was accepted to be hard sedimentary bedrock of either Vryheid shale or sandstone. The average soil and bedrock profile as estimated from the test pitting, penetration tests and monitor borehole data is given in the Table 9.4 below.

Table 9.4: Average Soil and Bedrock Profile.

Soil/Bedrock Profile	Origin	Ave. Thickness (m)	Depth Range from – to (m)
Loose to very loose brown-maroon recent soil	Silty/clayey sand of Various Origins	4	Surface to 4
Stiff brown-maroon clayey residuum grading into hard light beige-ivory sandy residuum	Derived from in situ decomposed shale	6	4 - 10
Beige shale intercalated with ivory coloured medium to course sandstone	Sediments of the Vryheid Formation	5	10 - 15
No. 2 Coal Seam,	Coal measures of the Witbank Coal Field	5	15 - 20
Beige to brown medium grained sandstone with grey shale lenses	Vryheid Formation sediments	5	20 - 25
No. 1 Coal Seam	Coal measures of the Witbank Coal Field	1	25 - 26
Beige – ivory sandstone	Vryheid Formation	4	26 - 30

9.5 LAND CAPABILITY AND LAND USE

A detailed property assessment was performed by specialist Enviro-Legal Attorneys, for the purposes of this project. The full report, titled Memorandum: Environmental-Legal Considerations in Respect of Certain Properties of Samancor Ltd, will be attached as **APPENDIX IV** to this report.

The surrounding land use is predominantly industrial and residential. eMalahleni is a coal mining area with 22 Collieries in an area no more than 40 km in any direction. There are also a number of power stations, a steel mill (Highveld Steel) and Vanadium Corporation nearby. The KwaQuqa residential areas are situated to the south and west of Ferrometals (approximately 6 km away). The village of Clewer is approximately 10 km to the south west of Ferrometals.

9.6 GEOLOGY

9.6.1 Regional Geology

The regional geology is depicted on Figure 9.6.1(a). Ferrometals Plant falls within the Springs-Witbank Coalfield. A vast array of inoperative mines is situated around the Ferrometals Plant. The sediments of the coal bearing Ecca group of the Karoo sequence were deposited on an undulating pre-Karoo floor. This had a significant influence on the nature, distribution and thickness of many of the sedimentary formations, including the coal seams.

Ferrometals is close to the basement contact between rocks of the Bushveld Igneous Complex and sediments (sandstones, conglomerate) of the Waterberg Group. The basement rocks at Ferrobank are overlain by Karoo sediments of glacial origin (Dwyka Formation) which are themselves overlain by coal-bearing Ecca Group sediments. The so-called “No 1” and “No 2” coal seams occur throughout the vicinity.

The area around Ferrometals has been extensively mined for coal in the past and Ferrometals Plant is bounded by defunct coal mines. Middelbult Steam Coal Colliery lies just east of Ferrometals’ eastern boundary while the T&DB Colliery is located approximately 1 km west of the western boundary of Ferrometals (Figure 9.6.1(b)).

It is important to note that portions of the Ferrometals site have been undermined (Figure 9.6.1(b)). From coal seam floor elevations presented in JMA (2004), the workings are 15 m to 20 m below surface.

According to JMA (2004), dolerite intrusions such as dykes, are not common in this part of the Witbank Coalfield and no known faults cross the Ferrometals site. Near the surface, the Ecca sedimentary rocks have been weathered to soil and clay (average thickness about 5 m, range 0 m to 16 m). The average depth of weathering is reportedly about 13 m (range 0 m to 28 m). Thick clay layers to a depth of 15 m below surface have been reported, especially in the south-west of the site.

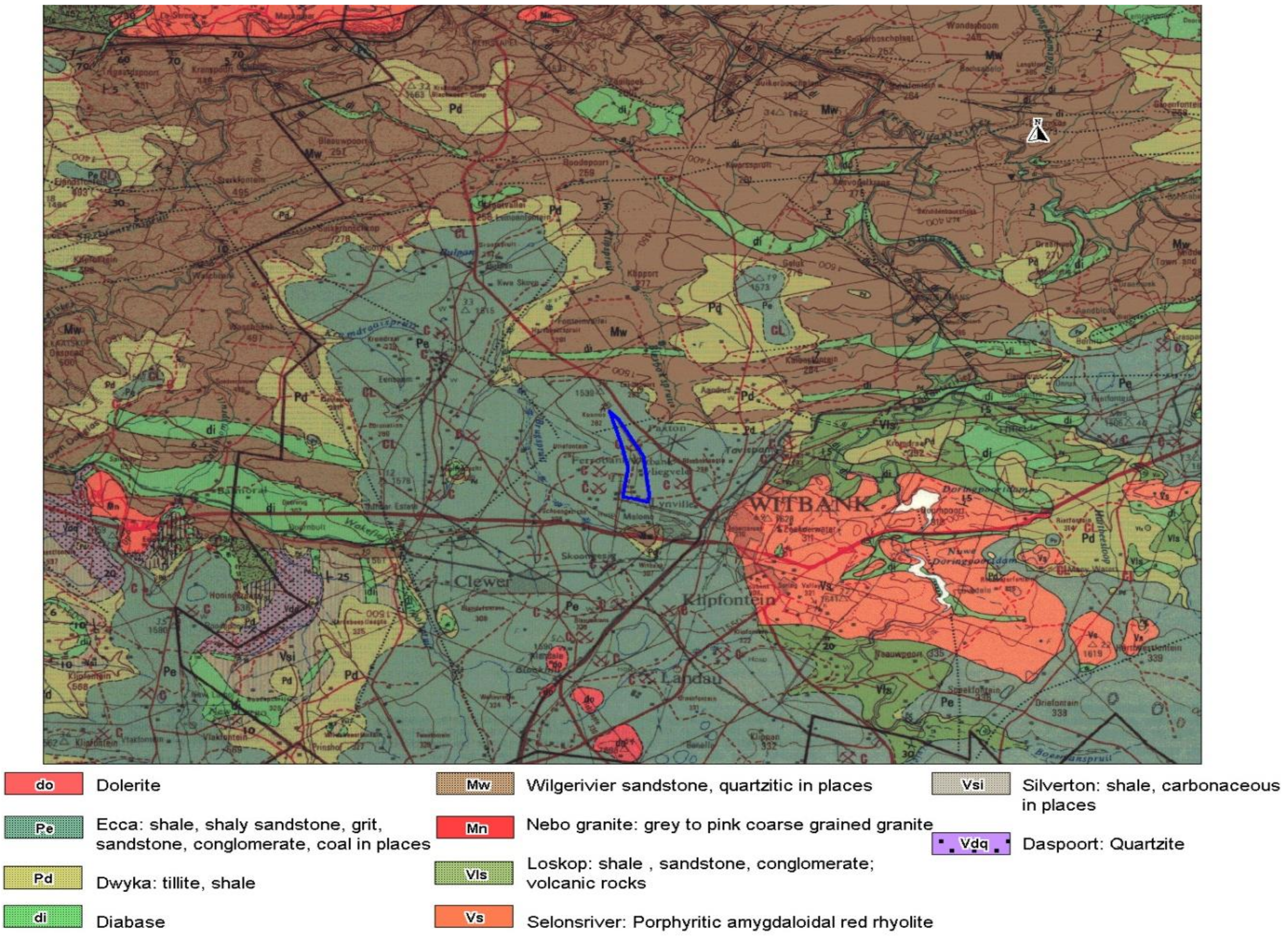


Figure 9.6.1(a): Regional Geological Map (1:250 000 Geological Map (2528 Pretoria)).

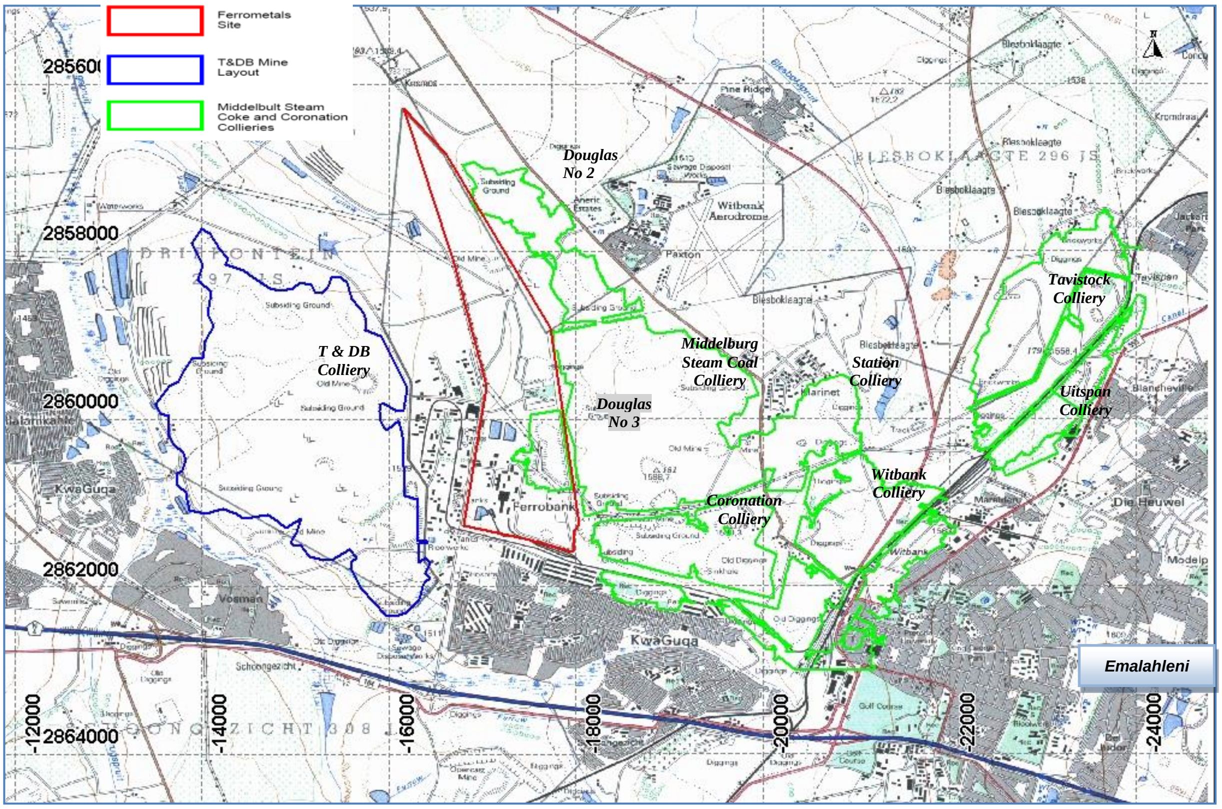


Figure 9.6.1(b): Historic defunct Underground Coal Mines Layout Map

9.6.2 Local Geology

The discussion of the local geology of the area is based on a wealth of quantitative geological information. A number of studies have been conducted in the area over the years, of which the following serve as reference to the current geological description at the Ferrometals Plant:

- Department of Water Affairs, Directorate of Pollution Control, Report No. E B100/00/0290, Olifants River Catchment, Ferrobank, Report on Water Pollution Mitigation and Rehabilitation at T & DB Collieries, Report No. 1383/350/1/W, June 1990.
- Department of Water Affairs and Forestry, WQM/01/00, 2000, Blesbokspruit Catchment - Geohydrological Report for Acid Mine Drainage Collection and Conveyance System for Abandoned Mines.
- JMA, October 1997: Geohydrological Impact Assessment Ferrometals, Reference no. 10124.
- JMA, January 2004: Groundwater Baseline at Ferrometals (JMA/10243).
- Golder Associates, April 2006: Groundwater Situation Assessment at Ferrometals (8036/8305/1/G).
- Golder Associates, November 2007: Phase II Groundwater Investigation at Ferrometals (8807/10801/1/G).

The Ferrometals Plant lies on the lower coal bearing layers of the Vryheid Formation that were deposited on the irregularly eroded northern margin of the Karoo Basin. Erosion has stripped off the upper Karoo rocks so that only the lower part of the Vryheid Formation is exposed at surface. Two major coal seams, namely the No.1 and No.2 Coal Seam are developed in the area. The geological setting as illustrated in the geological cross-sections, indicates the Ferrometals Plant to lie on a basal high between two depositional valleys and the interconnecting coal seams to pinch out.

Mining activities on the No.1 and No.2 coal seams in the Blesbokspruit and Brugspruit catchments, started some 100 years ago. Ferrometals is flanked to the west by the old Transvaal and Delgoa Bay Mine (T. & DB Colliery), is further partially underlain by the old Douglas No.3 Colliery and flanked to the east by the old Douglas No.1, and 2, Middelbult Steam, Coke and Coronation Collieries (Figure 9.6.2(a)).

Although underground mining ceased in the late 1940's and early 1950's, some mining activities of fringe coal took place between the mid-1970's and mid-1990's. Some mining activities are also currently taking place. The No.2 coal seam floor elevations for the greater Ferrometals area slopes from a northwest-southeast orientated ridge (1534 -1552 mamsl) along the central Middelbult Steam & Coke and Coronation Collieries, westwards in the direction of the old Transvaal and Delgoa Bay Mine (T. & D.B.), towards elevations ranging between 1467 and 1487 mamsl along the western bounds of this mine before eventually outcropping along the downslope to the Blesbokspruit.

This is clearly illustrated in the west-east orientated cross-sections that follow – Figure 9.6.2(b– e).

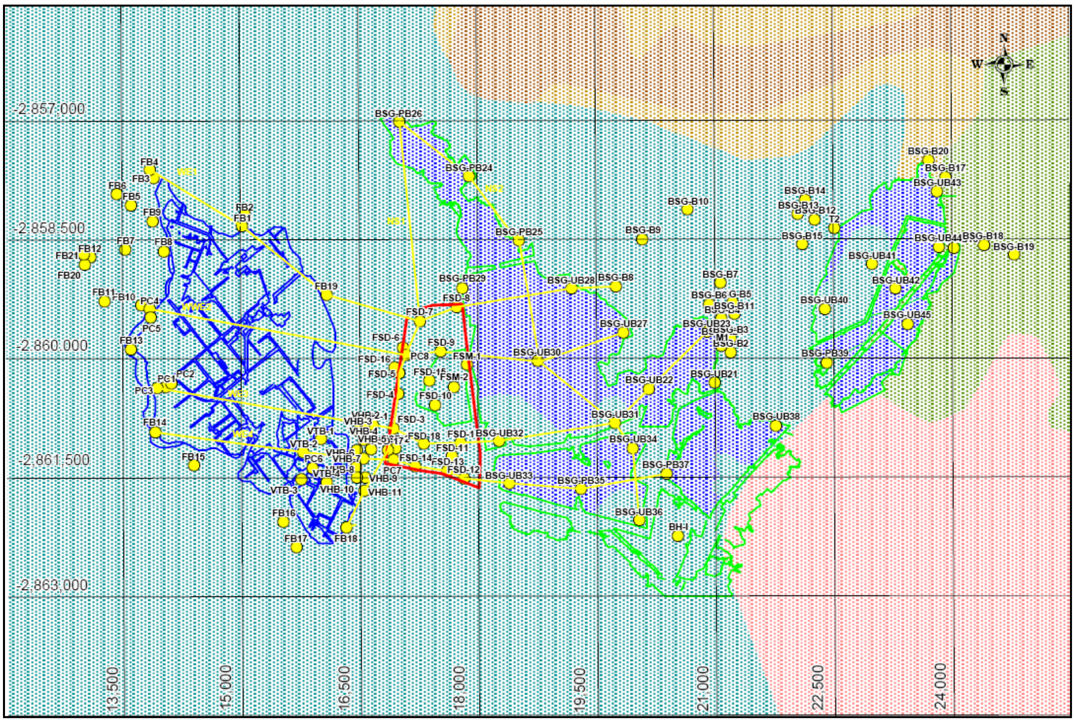


Figure 9.6.2(a): Local geology and east west cross-section line indication.

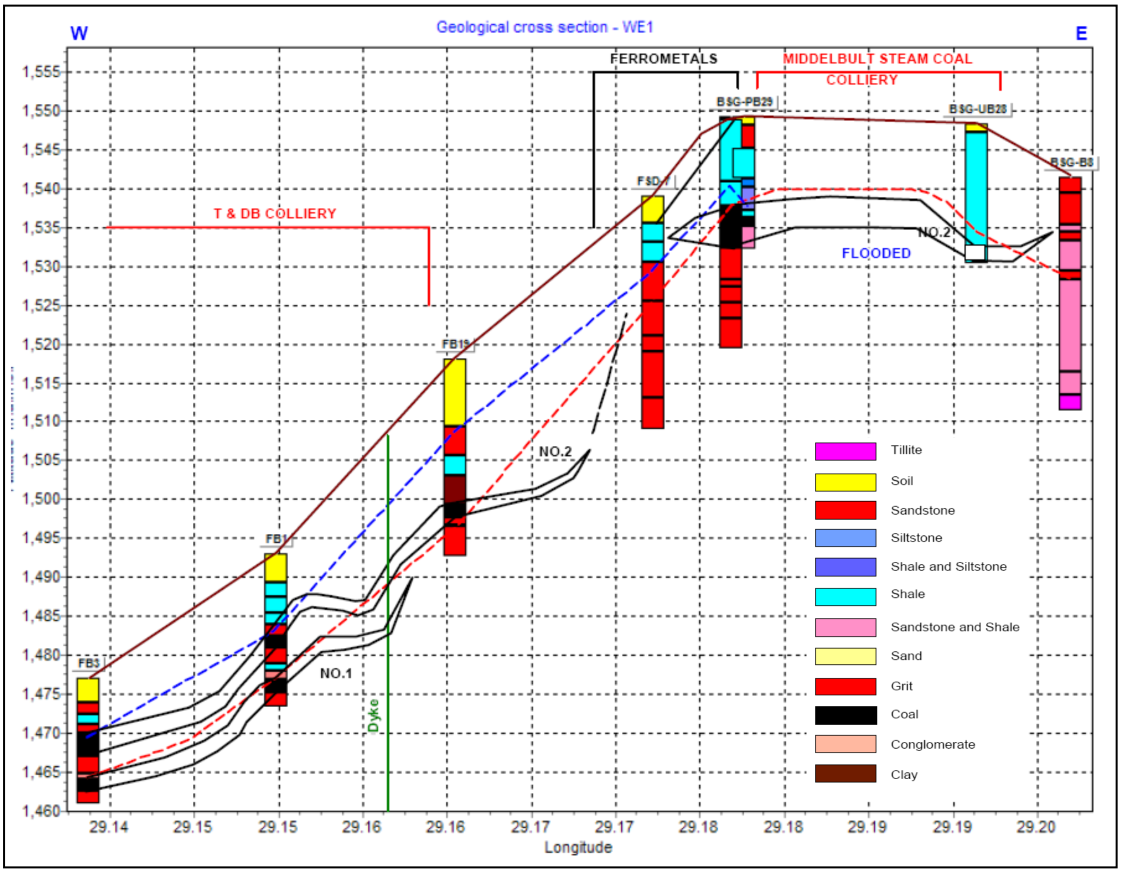


Figure 9.6.2(b): Cross Section West East – 1.

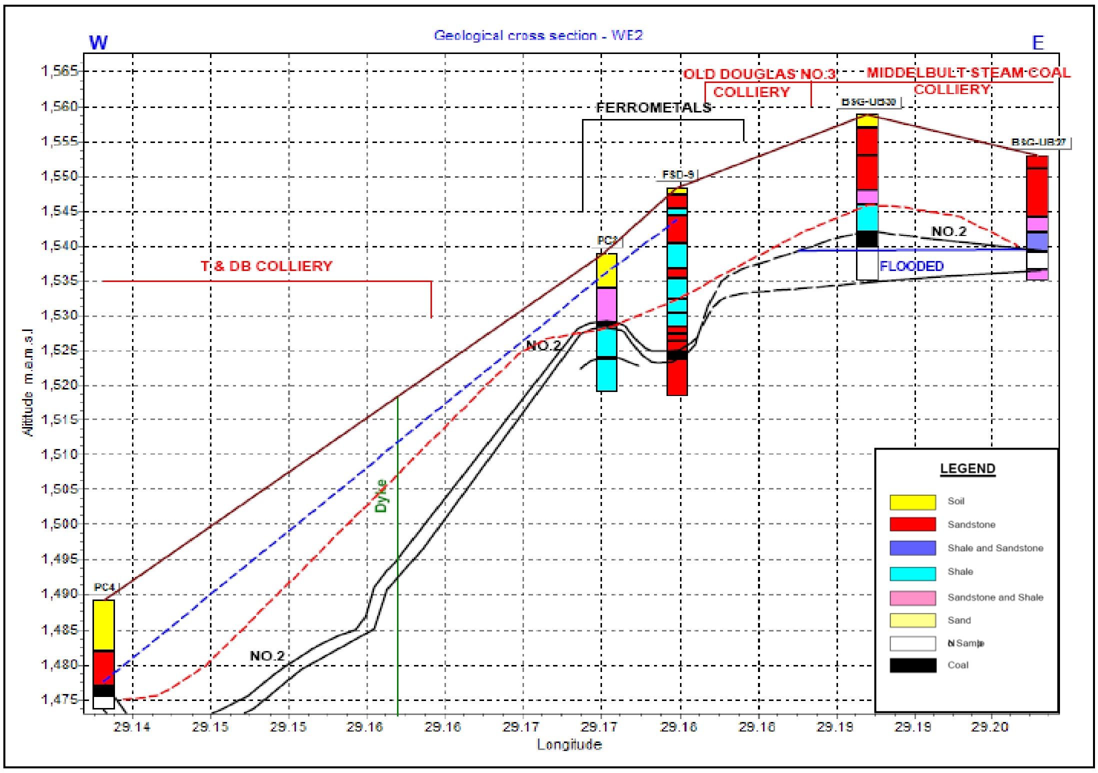


Figure 9.6.2(c): Cross Section West East – 2.

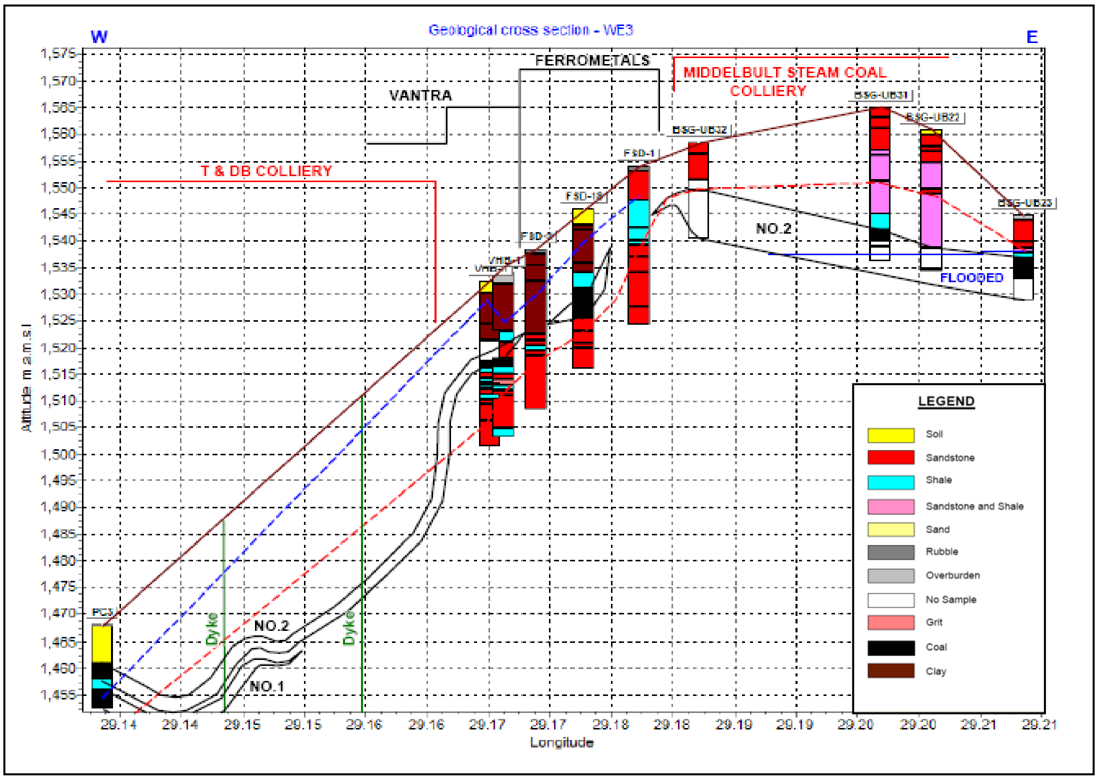


Figure 9.6.2(d): Cross Section West East – 3.

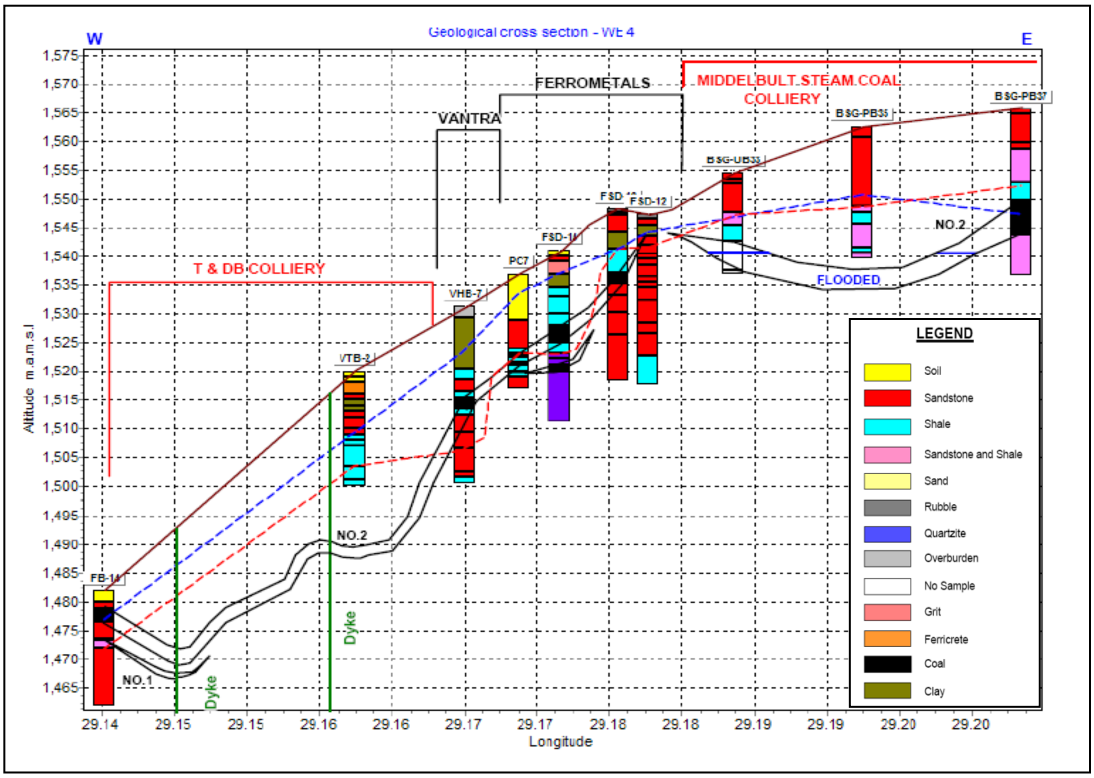


Figure 9.6.2(e): Cross Section West East – 4.

The geology underlying the Ferrometals Plant consists mainly of shales and sandstones belonging to the Ecca Group (Karoo Sequence). Underlying these are tillites / diamictites of the Dwyka Group, which represent the base of the Karoo sequence.

It is important to note that the coal seams were deposited right at the fringe of the Karoo basin. Being located right at the edge of the Karoo basin, dolerite intrusions are not as common as in the remainder of the Witbank Coal fields. No known faults occur in the area. A summary of the soil and clay profiles, based on the assessment conducted is given below:

	Profile Depth (m)		
	West of Site	**East of Site**	**Underneath Site**
Soil	4-16 Avg. 9,4	0,5-16 Avg. 6,72	0,5-15 Avg. 5,16
		Thick Clay: 2-16 Thins to the East: 1.13m	Thick Clay: 0,5-15
Weathering	3-22 Avg.11,91	5,5-21 Avg. 13,42	5,5-20 Avg. 12,86

9.7 GROUNDWATER

9.7.1 Regional Geohydrology

The regional aquifer host rock comprises primarily sediments (argillaceous and arenaceous) of the coal bearing Ecca group of the Karoo sequence that were deposited on an undulating pre-Karoo floor. The regional geological setting of the area indicates the possible existence of mainly two aquifer types in the study area:

- Shallow perched aquifer(s).
- Shallow weathered zone type aquifers.

The Department of Water Affairs' "Groundwater Resources of the Republic of South Africa, Sheets 1 & 2" indicates the following regional groundwater aspects for the area under investigation:

- The probability of drilling a successful borehole (yielding more than 0,1 l/s) is 40 - 60 %.
- The probability of drilling a borehole yielding more than 2 l/s is 10 – 20 %.
- The mean depth to groundwater level is 10 m - 20 m.
- The storage coefficient for the area is < 0,002, and from 0,001 to 0,01, as is typical for compact sedimentary rocks, excluding dolomite and limestone.
- The mean annual recharge is indicated as 50 mm to 75 mm (7 - 10 % of the mean annual precipitation).
- The background groundwater quality in terms of TDS is < 300 mg/l.
- Based on Piper and Durov diagrams, the hydro-chemical type is indicated as Ca, Mg (HCO3), with Ca and or Mg as the dominant cations and HCO_3 as the dominant anion.
- DWAF's, 1:500 000 "Hydro-geological Map Series of the Republic of South Africa", 1999,

Sheet 2526 is indicative of the following regional groundwater aspects for the area under investigation:

- The mean annual precipitation is 600 mm - 800 mm per annum.
- The background groundwater quality is 0 - 70 mS/m.
- The borehole yield (excluding dry boreholes) is approximately 0,5 l/s - 2 l/s.

The aquifer(s) pertaining to the regional study area can be classified in accordance with "A South African Aquifer System Management Classification, Roger Parsons, December 1995. Further with reference to the "Aquifer Classification Map of South Africa" and "Definitions of Aquifer System Management Classes" the aquifers pertaining to the regional study area are classified as minor aquifer systems, the definition of a minor aquifer system being:

"These can be fractured or potentially fractured rocks which do not have a high primary permeability, or other formations of variable permeability. Aquifer extent may be limited and water quality variable. Although these aquifers seldom produce large quantities of water, they are important for local supplies and in supplying base flow for rivers."

A map of the Aquifer Classification System (Parsons, 1995) with the site plotted on it, can be seen below (Figure 9.7.1(a)):

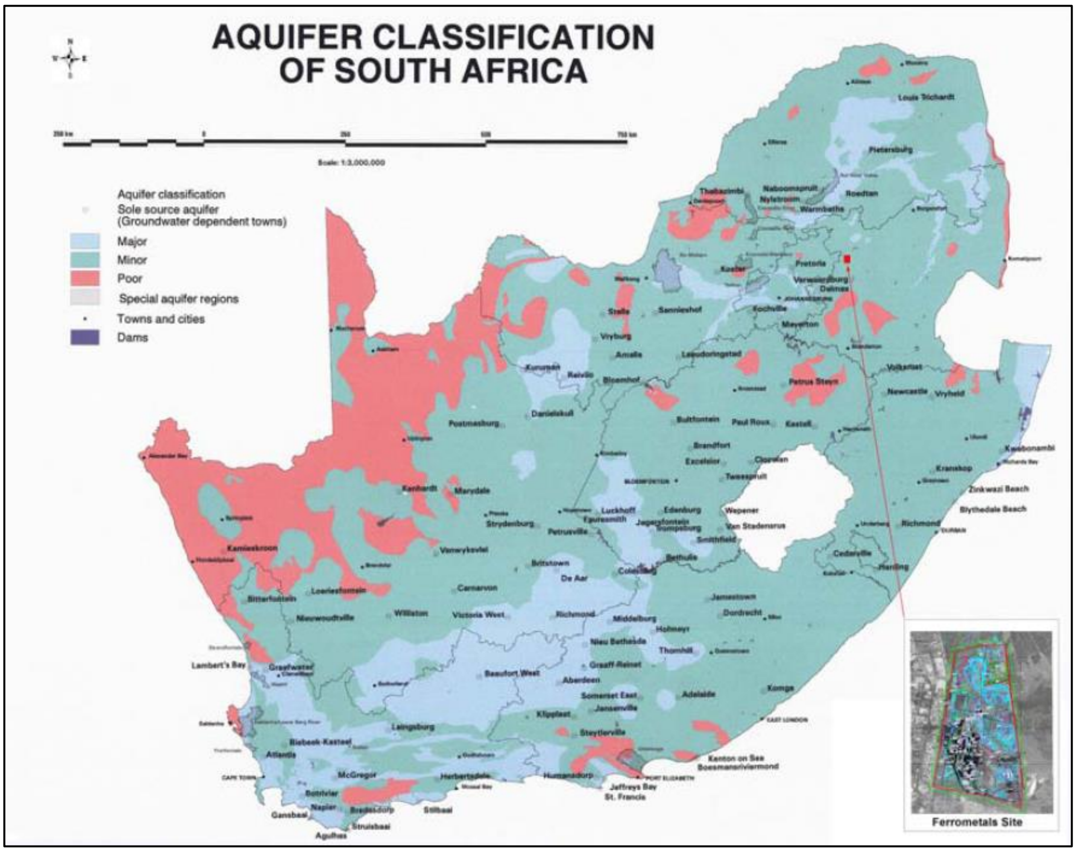


Figure 9.7.1(a): Aquifer Classification of South Africa

The **vulnerability**, or the tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer, is classified as **moderate**.

Aquifer **susceptibility**, a qualitative measure of the relative ease with which a groundwater body can be potentially contaminated by anthropogenic activities, which includes both aquifer vulnerability and the relative importance of the aquifer in terms of its classification, is classified as **medium**.

9.7.2 Local Geohydrology

The geohydrological discussion for the Ferrometals Plant is based on information generated during the drilling of the 37 monitoring boreholes (17 - Perched Aquifer, 18- Shallow Weathered Aquifer and 2 boreholes drilled into the underground mine workings underlying the site), sited, site or source specific, optimally to generate data pertaining to specific aquifer attributes. The site status has a historic component due to existing pollution from the surrounding mining area.

A total of 91 boreholes with geohydrological information surrounding the Ferrometals site, vary in depth (10.3 m – 42 m deep) with variable water strike, yield and permeability information were taken into account for the receiving environment description. The purpose of these boreholes is to generate geohydrological data, pertaining not only to the determination of local aquifer characteristics, but also to investigate/confirm the presence of any possible preferential flow zones as well as any sources that could have an impact on the groundwater. The onsite disposal and storage facilities were used as guidance for the selection of borehole localities.

The interpretation of the geohydrological attributes of the perched water table aquifer(s) can be quantified at the hand of the information generated during the installation of 17 Perched Aquifer(s) monitoring boreholes, drilled to depths of 5 m, in close vicinity (less than 5 m) of the Shallow Weathered Aquifer monitoring boreholes (30 m).

Figure 9.7.2(a): Shallow Perched Aquifer Borehole Localities

The interpretation of the geohydrological attributes of the Shallow Weathered Aquifer can be quantified at the hand of the information generated during the installation of 26 Shallow Weathered Aquifer Monitoring Boreholes, drilled to depths of 30.

Figure 9.7.2(b): Shallow Weathered Aquifer Borehole Localities

Composition and Physical Attributes of the Aquifer(s)

Two aquifer zones exist underneath the Ferrometals site:

(1) Perched Aquifer(s) Zone: The perched water table aquifer(s) present exist within the soft overburden zone and can therefore be described at the hand of the soil profiles observed during the drilling of the Perched Aquifer(s) monitoring boreholes (5 m) and the deeper Shallow Weathered Aquifer monitoring boreholes (30 m).The soil profile underlying the Ferrometals Plant ranges between 0,5 m - 15 m and has an average thickness of approximately 5,16 m, comprises a thick clay layer ranging in depth between 0,5 m and 15 m. When a low permeability layer forms the base of the soft overburden this horizon represents the perched aquifer zone. The clay layer is not common over the entire Ferrometals site.

(2) Shallow Weathered Zone Aquifer: The shallow weathered zone aquifers present in the study area, comprise of the following geological formations: At depths 0,5 m and 15 m the aquifer consists mainly of a clay layer, including silt and shale layers, which forms the main aquifer and overlays the number 2 coal seam. A sandstone layer underlies the coal seam.

In summary therefore, the shallow weathered zone aquifer comprises of overburden material and highly weathered, weathered, fractured to fresh shale, coal and sandstone. The average weathering thickness observed in boreholes in the area, calculates to 12.45 m. These aquifers are hydraulically highly heterogeneous, as the varying degree of weathering of the different lithological units, result in a large variety of physical and hydraulic end products e.g. sand, clay and fractured shale etc. The old mine workings area also adds to the heterogeneity of flow in the aquifer.

Aquifer Hydraulic Types

The geological setting of the area, supplemented with the generated physical information, indicate the potential existence of two hydraulic aquifer types:

- Unconfined Aquifers, comprising of the Shallow Perched Aquifer(s).
- Semi-Unconfined Aquifers comprising of the Shallow Weathered Zone.

Lateral Aquifer Boundaries

Two types of lateral aquifer boundaries are anticipated to exist within the Ferrometals Plant property's zone of influence:

- Physical aquifer boundaries, such as impermeable dolerite/diabase dykes and sills, or other geological discontinuities, for example where layers pinch out or outcrop.
- Hydraulic aquifer boundaries, such as surface infiltration sources which usually represent constant head influx boundaries, streams which act as either groundwater discharge boundaries (normal and low flow conditions) or as groundwater infiltration boundaries (high flow and flood conditions), and groundwater divides which act as no-flow boundaries.

Subject to all the aforementioned, the following observations pertaining to the delineation of lateral aquifer boundaries for the Ferrometals Plant property zone of influence are important:

- All surface water dams/ponds will most probably act as constant infiltration boundaries with groundwater flow away from them within both the perched and shallow weathered zone aquifers. These boundaries are superimposed onto the regional groundwater flow directions.
- The maximum lateral extent of the hydraulic influence radius associated with the Ferrometals Plant property and surrounding potential pollution sources, via their interaction with the perched and weathered zone aquifers, is delineated by the aquifer boundaries.

The Ferrometals Plant lies west of a watershed, where recharge from rainfall occurs in-between the Plant and this boundary. This does not form a no-flow boundary as the undermined area causes flow past the watershed towards the east in certain areas. A discharge aquifer boundary to the northwest is the unnamed tributary flowing into the Brugspruit. A non-perrenial part of the Brugspruit form the southern boundary. The western boundary (discharge boundary) is the non-perrenial Brugspruit. Towards the east the Blesbokspruit form the eastern boundary in the northern part, but since the area is undermined and a lot of subsidence and flooded areas occur in the southern part of the river, non-Ferrometals related pollution there have moved past the Blesbokspruit to the east.

Aquifer Thickness, Depth to Water Table, Groundwater Level Fluctuations

The depths of the boreholes in the surrounding mining area are almost all drilled into the shallow weathered zone aquifer, ranging in depths from 10,3 m to 42 m. Water level information exists for the area east of the Ferrometals site (Blesbokspruit), as well as west of the Ferrometals site. At the time of the field survey, the depth to water table in the existing monitoring boreholes, ranged between 0 m and 24,11 m, averaging at 6,13 m below ground level.

Perched Aquifer(s) Zone:

The perched water table aquifer can be defined as representing one or more saturated zones perched within the soil profile, e.g. perched on pedogenic soils or at the contact between transported and residual soils, etc. or when a low permeability layer forms the base of the soft overburden, this horizon represents the perched aquifer zone.

The depth to the water table in the perched aquifer(s) zone, taking the holes considered to be basically dry out of the equation, ranged between 2,15 m and 5,00 m, averaging at 3,31 m below ground level. The perched aquifer water table may be attributed to recent rainfall and may not be observed during dry periods. The depths to the perched water table, as observed in the shallow boreholes in the area, are shown on Figure 9.7.2(c).

Figure 9.7.2(c) below shows the water level data gathered for 2012, measured in the FSS monitoring boreholes. Values indicated in red represent the measurements taken during the **February 2012** sampling run; the values in blue represent the measurements taken during the **May 2012** sampling run; values in green represent measurements for the **August 2012** sampling run and values in black represent measurements for the **November 2012** sampling run.

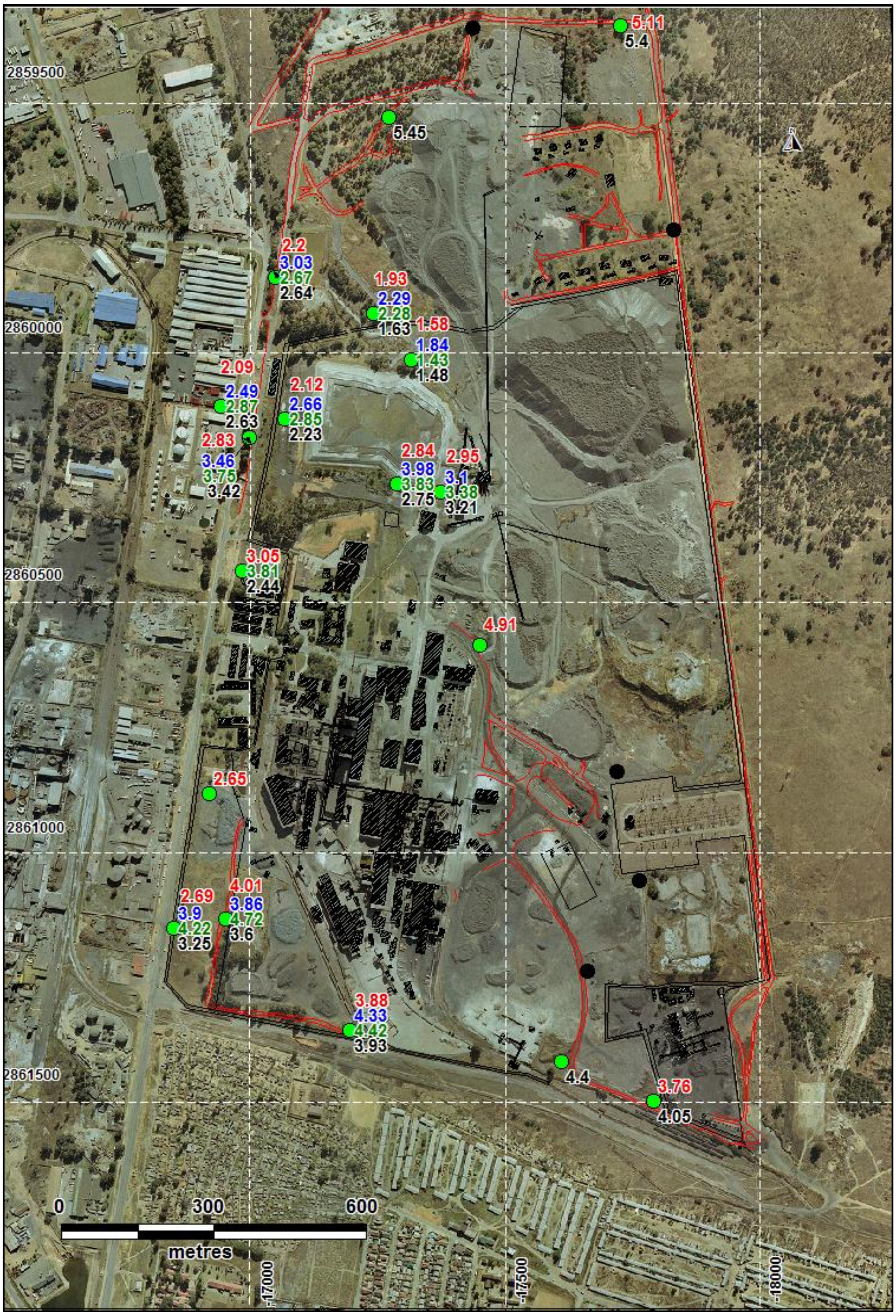


Figure 9.7.2(c): Groundwater Level Data for 2012 – FSS Monitoring Boreholes

Shallow Weathered Zone Aquifers:

The top of the unsaturated zone is defined by the original ground surface, while the bottom is defined by the water table, which represents a non-fixed boundary. The depths to water table for the weathered zone aquifers as observed in the boreholes on the Ferrometals site are shown on Figure 9.7.2(d). Depth to water table in all the newly drilled monitoring boreholes in the shallow weathered zone, ranged between 2,25 m and 11,75 m, averaging at 6,32 m below ground level.

The thickness of the saturated zone is defined by the water table at the top, and the depth of weathering at the bottom. Based on available information, the average depth of weathering is 12,45 m. The saturated zone of the aquifer underlying the pollution sources at Ferrometals therefore varies between 2 m and 12 m. The thickness of the saturated zone is therefore taken as 10 m on average.

Figure 9.7.2(d) below shows the water level data gathered for the FSD monitoring boreholes (Values indicated in red represent the measurements taken during the **February 2012** sampling run; the values in blue represent the measurements taken during the **May 2012** sampling run; values in green represent measurements for the **August 2012** sampling run and values in black represent measurements for the **November 2012** sampling run).

Aquifer Yielding Capacity

Twenty six out of sixty three boreholes on the Vantra industrial site and Blesbokspruit mining area yielded water ranging between 0,01 l/s and 25,5 l/s, the average yield being 2,14 l/s.

Water intersections ranged in depth between 2,5 m and 23 m, the average depth being 12,91 m. Nine of the thirty-seven boreholes drilled on the Ferrometals Plant property yielded water ranging between 0,13 l/s and 5 l/s, the average yield being 1,351 l/s.

Water intersections pertaining to these nine boreholes ranged in depth between 6 m and 27 m, the average depth being 13,5 m. The higher yields observed and recorded in boreholes FSD-6 and FSM-2, can mostly be associated with the pond being situated next to borehole FSD-6, and in the case of FSM-2, with the borehole being situated in the abandoned mine workings area, which is mostly filled up with water.

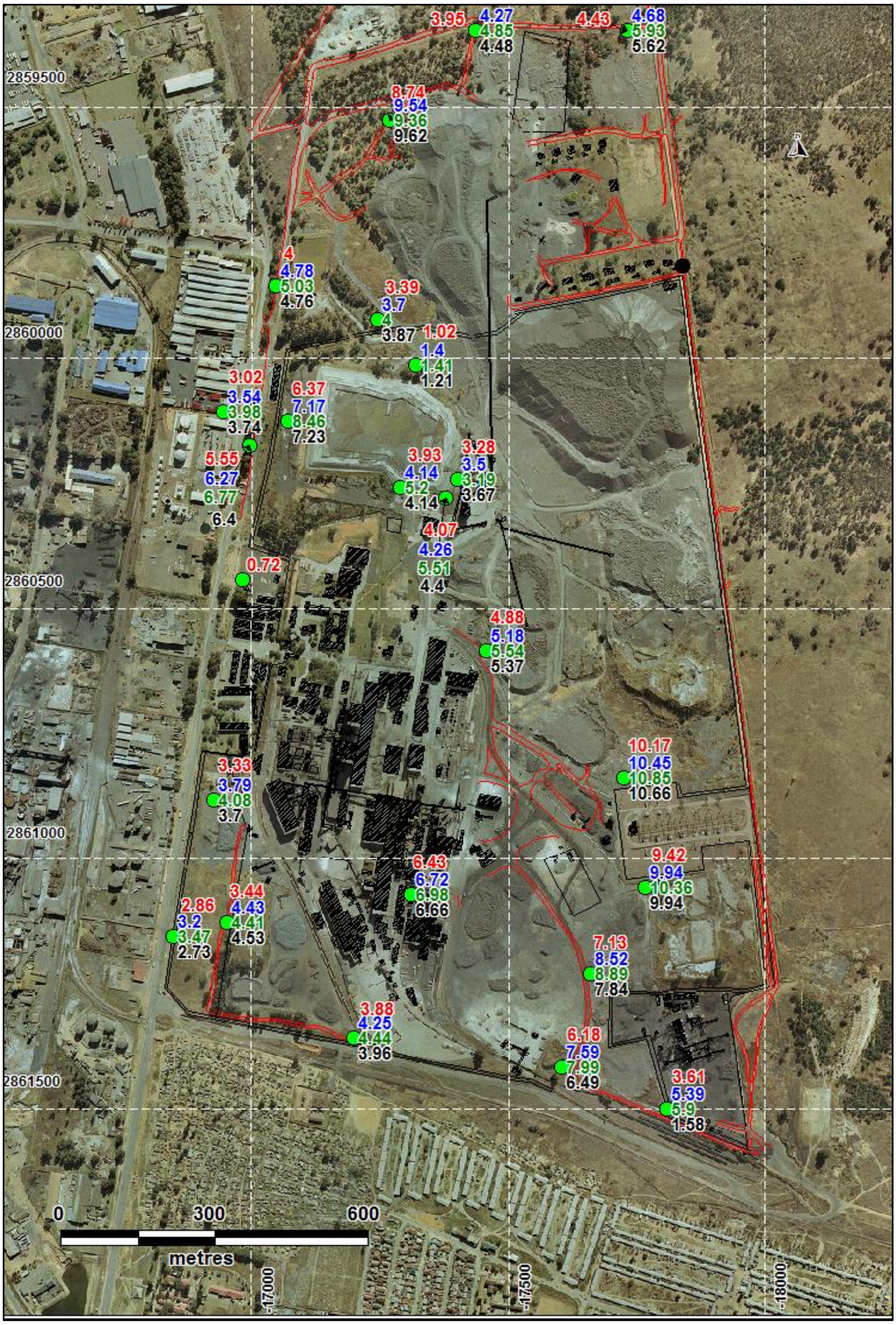


Figure 9.7.2(d): Groundwater Level Data for 2012 – FSD Monitoring Boreholes

Groundwater Quality Fluctuations

Figure 9.7.2(e & f) below shows the ground water quality data gathered for the FSS and FSD monitoring boreholes (Values indicated in red represent the measurements taken during the **February 2012** sampling run; the values in blue represent the measurements taken during the **May 2012** sampling run;

values in green represent measurements for the **August 2012** sampling run and values in black represent measurements for the **November 2012** sampling run).

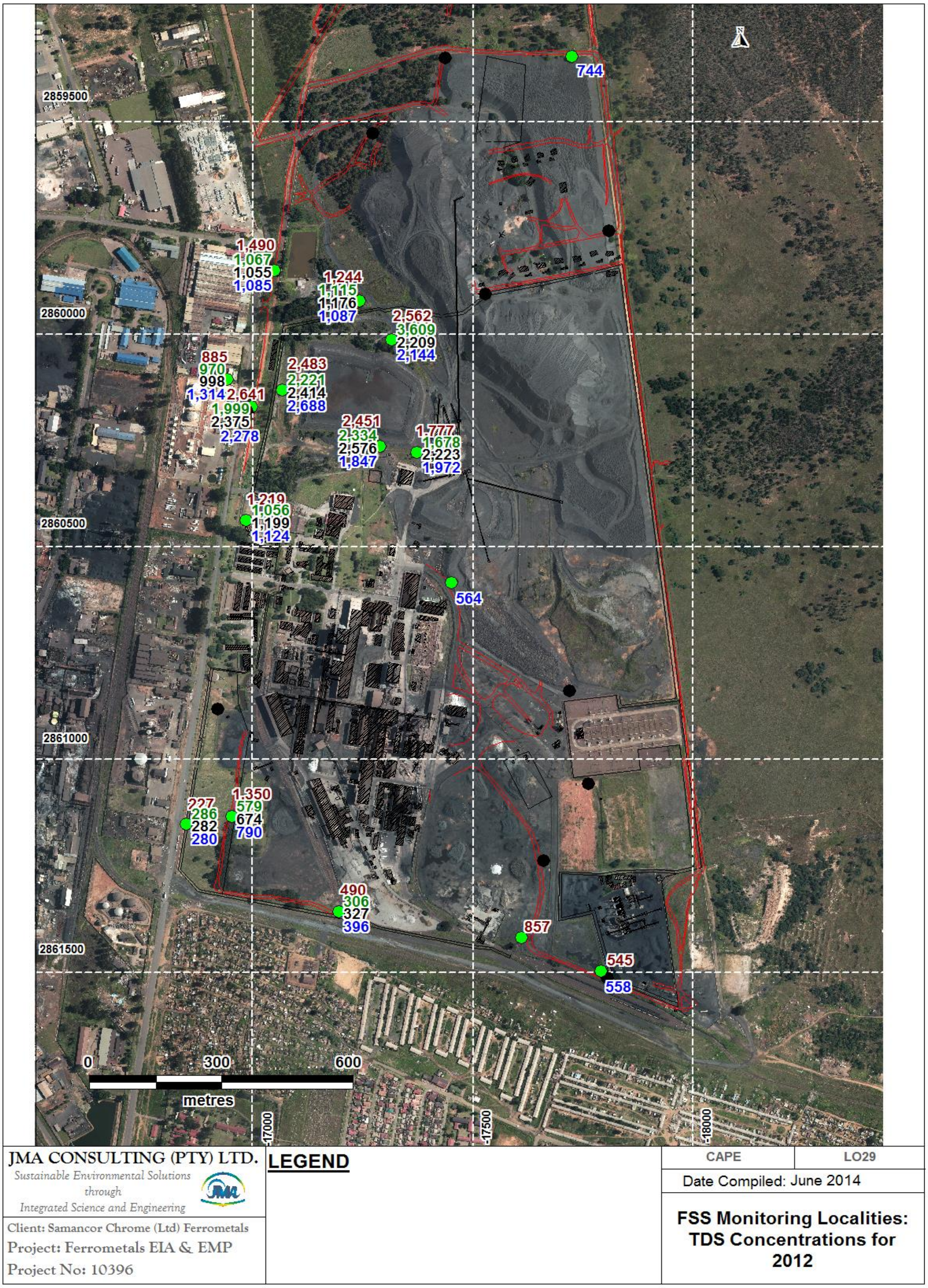
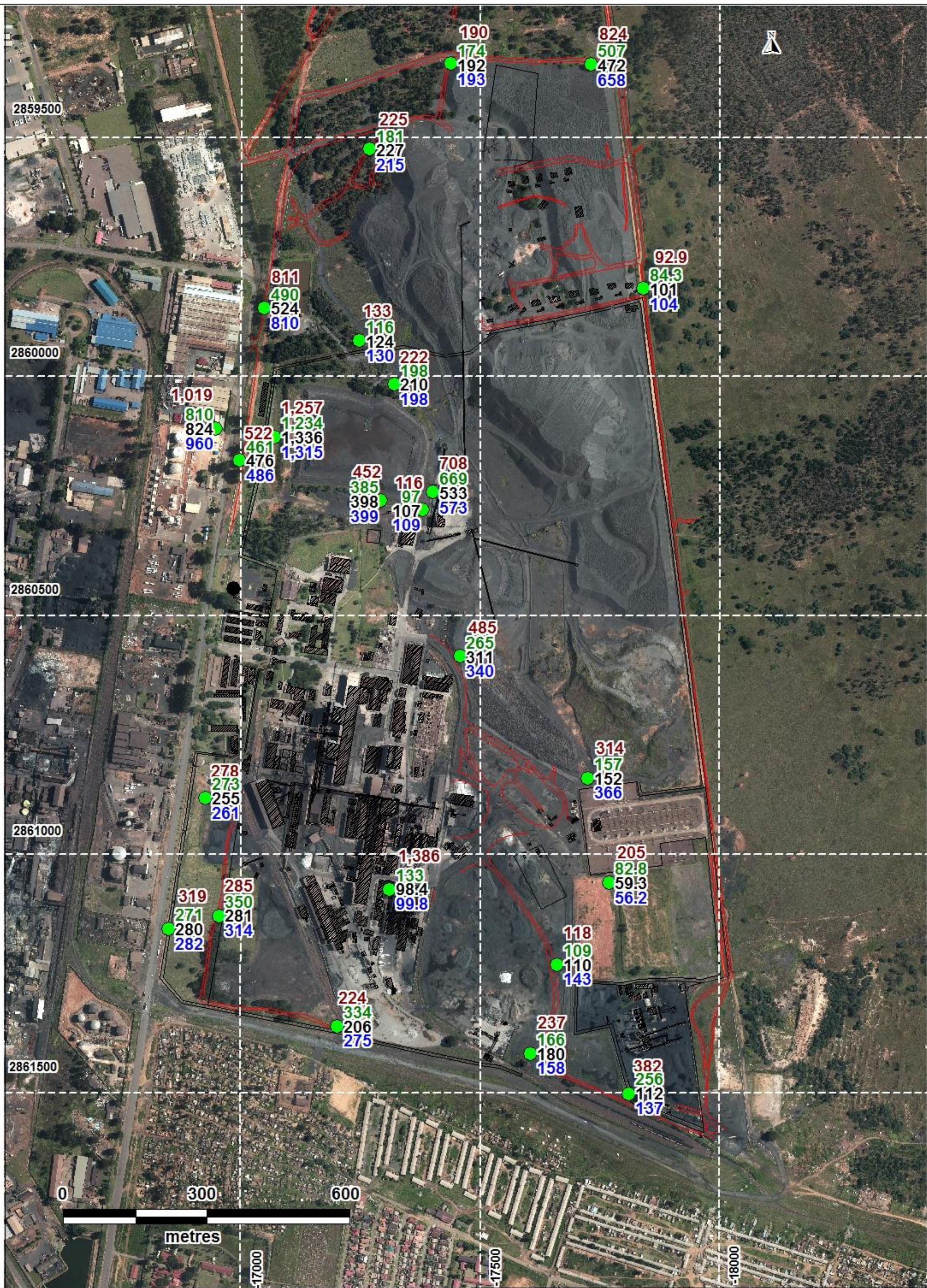


Figure 9.7.2(e): **Groundwater Quality (TDS (mg/l)) for 2012 – FSS Monitoring Boreholes.**



JMA CONSULTING (PTY) LTD.
Sustainable Environmental Solutions through Integrated Science and Engineering

Client: Samancor Chrome (Ltd) Ferrometals
Project: Ferrometals EIA & EMP
Project No: 10396

LEGEND

CAPE	LO29
Date Compiled: June 2014	

FSD Monitoring Localities: TDS Concentrations for 2012

Figure 9.7.2(f): Groundwater Quality (TDS (mg/l)) for 2012 – FSD Monitoring Boreholes.

Groundwater monitoring has resulted in a database of hydro-chemical information which has been assessed to identify sources which have the most significant impact on groundwater quality. Based on the above quality maps, the aquifer has been contaminated over the years by the operation of the Northern Slimes Dam facility. Based on its significant groundwater level impact, which has resulted in an impact within the perched aquifer beneath the facility towards the western side of the Northern Slimes Dam, the impact on groundwater quality is clear from the above figures. Evident from Figure 9.7.2(e) is the impact on the perched aquifer whilst elevated concentration observed in the shallow weathered zone aquifer.

9.7.3 Seepage and Groundwater Flow Model

A seepage model was performed in order to determine the seepage volume of the old and the new slimes dams. In addition, the objective of the groundwater flow model was to calibrate the amount of recharge, to calibrate the steady state groundwater flow, to depict the potential (future) impact on the aquifer after installations of the liner as well as to determine the dilution factor required for the Tier II waste classification.

Refer to **APPENDIX VI** for the comprehensive report on the quantification of seepage and classification of waste. Extracts in terms of the model outputs are given below.

The following comments relate to the seepage calculations:

- The natural groundwater recharge was calculated through the unsaturated zone varying at about 0.5 - 2% of MAP depending on the grass cover, the topographical slope and distance to boundary (e.g. streams). The recharge was actually first calibrated in the steady-state groundwater flow model with the un-impacted groundwater levels. The recharge was then used in HELP to calibrate the average surface run-off;
- The seepage from the old slimes dam (Northern Slimes Dam) was determined by placing slimes of 16 m directly on the in-situ soil/rock modelled above. The old slimes dam was then capped with a 450 mm soil layer and 200 mm topsoil. The seepage decreased from 3.1 to 1.2 % of MAP for the two scenarios with either no or a 25% slope;
- New slimes dam: The seepage during the operational phase was calculated by specifying a 16 m slurry water head on top of the lagoon liner. The post-closure seepage was calculated after no phreatic level was present in the slimes dam. During the operational phase the seepage through the H:H lagoon will be 0.076 % of MAP which will decrease to 0.016 % of MAP after closure. The seepage will always be small through a H:H liner but it may significantly become higher than calculated in this report if the HDPE liner is poorly installed (e.g. incomplete welding between sheets, no compaction before liner instalment, no cushion layer etc.).

The comments below relate to the groundwater flow model:

- In the steady state good overall calibration with the measured groundwater level was found. The recharge was calibrated to 0.5 - 2% of MAP and the hydraulic conductivity in Layer 1 to 0.2 – 6.0 m/d over the model domain.

Groundwater flow is from the southeast towards the west similar to the topographical gradient;

- The groundwater plume below the limes dams will develop in a western direction, similar to the groundwater flow direction;
- Groundwater flow below the old and new slimes dams will be 2 071 and 2 354 m3/a respectively. The average and maximum seepages from these sites will be 485 – 1252 m3/a and 9 – 41 m3/a respectively. This implies that a minimum dilution of 2 - 5 and 59 - 268 times will occur in the underlying aquifer. This is summarized in Table 9.7.3(a) below;

Table 9.7.3(a): Estimated seepage and dilution below new and old slimes dam

Parameter	Seep Model A New slimes dam with H:H lining		Seep Model B Slimes dam north with soil capping	
Dam status	Operational dam with 16 m head	Post-closure Slimes Unsaturated	Post-closure No Slope	Post-closure 25% slope
Rainfall (mm/a)	684	684	684	684
Seepage (%MAP)	0.076	0.016	3.100	1.200
Seepage (mm/a)	0.519	0.112	21.204	8.208
Seepage (m/a)	5.19E-04	1.12E-04	2.12E-02	8.21E-03
Area (m^2)	78 750	78 750	59 050	59 050
Seepage (m^3/a)	40.9	8.8	1252.1	484.7
Groundwater flow (m^3/a)	2353.8	2353.8	2071.2	2071.2
Minimum Dilution	58.6	268.1	1.8	5.0
Time before minimum dilution*	28 908	134 045	338	1 713

** Minimum dilution is reached after all groundwater in the aquifer is replaced.*

- The above dilution is evident from the model results. The maximum seepage volumes were assigned to the two facilities and the minimum dilution should therefore be 2 and 59 times respectively. The concentration of the plume directly below the old and new slimes dams were at a maximum of 30% and 0.5% of the seepage concentration after 100 years – that is a dilution of 3 and 200 times respectively. It is less than the minimum dilution (2 and 59) calculated because the minimum dilution will only be reached after about 350 and 30 000 years for the two facilities respectively.

9.8 SURFACE WATER

9.8.1 Regional Catchment Setting

Ferrometals is located within the B11K quaternary sub-catchment, which has a Mean Annual Precipitation (MAP) of 684 mm and a Mean Annual Evaporation (MAE) of 1 700 mm. The site is thus located in a moderate rainfall region with a Mean Annual Runoff (MAR) of about 60 mm, which equates to a runoff of approximately 9 % of the MAP.

9.8.2 Storm Rainfall

Several rain gauges are located within the catchment area. The rain gauge situated at Witbank Municipality (0515412) covers the longest period and was used as a primary source of rainfall data. The recorded rainfall data indicates that the site is not prone to high rainfall intensities. Over the 47 years of daily rainfall analysed, the 1:50 year 24 hour storm rainfall event of 113 mm was exceeded on only three occasions, whereas the 100-year 24 hour storm rainfall event of 127 mm has never been exceeded.

9.8.3 Local Sub-Catchment Setting

The site is located within the Brugspruit sub-catchment but is buffered from the Brugspruit by the defunct Transvaal and Delegoa Bay (T&DB) Colliery. A local watershed between the Brugspruit and the adjacent Blesbokspruit is located just east of the eastern boundary of the Ferrometals plant site.

The Brugspruit mainly originates to the south of Ferrobank within the Highveld Steel, Clever agricultural holdings and Landau Colliery areas. One branch of the Brugspruit also originates from the KwaGuqa area, a suburb of Witbank just south of Ferrobank, next to the N4 highway. The Brugspruit flows northwards until its confluence with the Klipspruit. The Klipspruit flows in a north-easterly direction until its confluence with the Blesbokspruit, from where it flows into the Wilge River, upstream of Loskop Dam.

Detailed descriptions of the sub-catchments impacted by Ferrometals and Local Surface Water/Storm Water Characterisation at Ferrometals will be presented in the EIA reports.

9.8.4 Water Management Area

Ferrometals is located within the Olifants Water Management Area (WMA) and, more specifically, in the Upper Olifants River catchment also known the Loskop Dam catchment (Figure 9.8.4(a)). The Upper Olifants River catchment comprises the large urban centres of Witbank and Middelburg, as well as several smaller towns associated with localised steel industries, coal fired power stations and coal mines.

The catchment comprises the drainage areas of the Olifants, Klein Olifants and Wilge rivers with tributaries down to the Loskop Dam. The headwaters of these rivers are located along the Highveld Ridge in the Secunda-Bethal area and the rivers then flow in a northerly direction towards Loskop Dam.

The total catchment area is approximately 12 285 km^2, sub-divided into the drainage basins as summarised in Table 9.8.4(a).

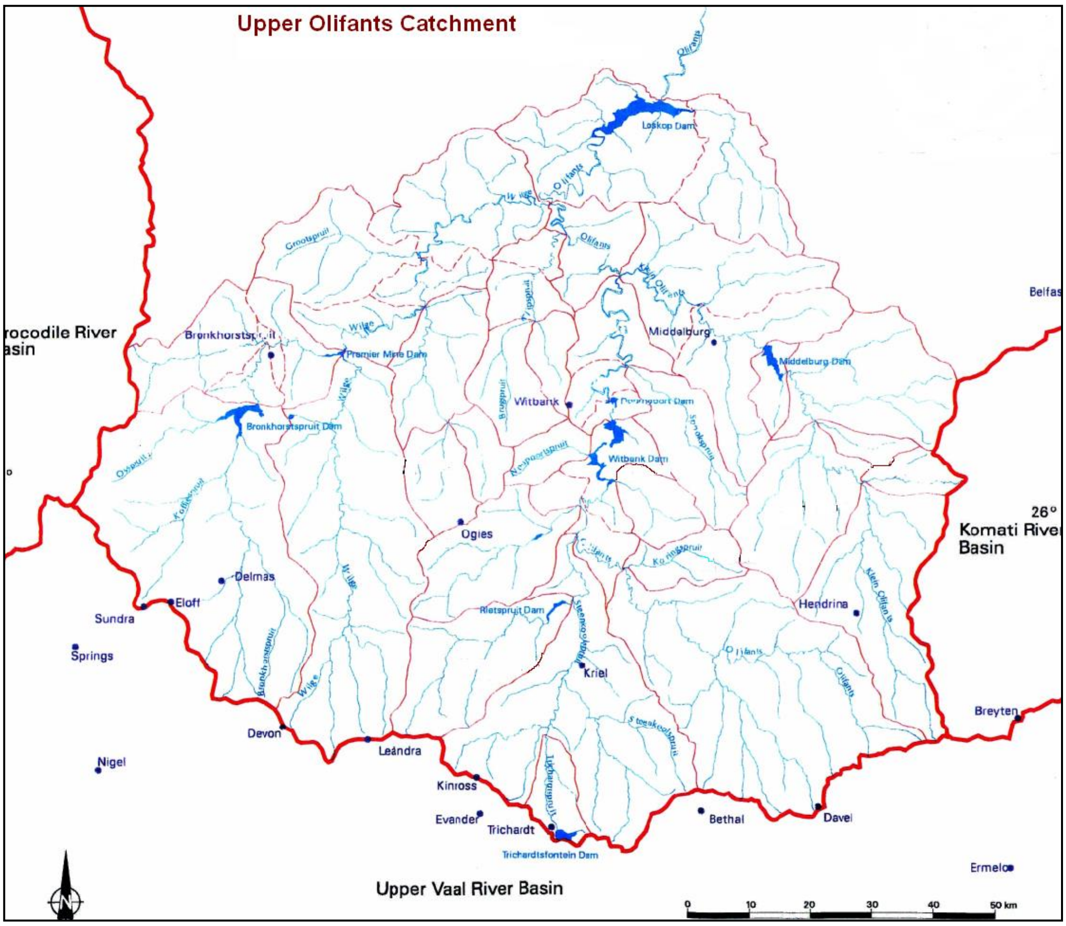


Figure 9.8.4 (a): Delineation of the Upper Olifants River catchment.

Table 9.8.4(a): Catchment Areas and Runoff from Drainage Basins Upstream of Loskop Dam

Drainage basin	Catchment Area (km^2)	Naturalised Mean Annual Runoff (million m^3/annum)
Olifants River, upstream of Witbank Dam	3 256	125.1
Olifants River, downstream of Witbank Dam and Middelburg Dam	2 905	180.4
Klein Olifants River, upstream of Middelburg Dam	1 401	43.8
Klipspruit	376	11.2
Wilge River	4 347	130.4
TOTAL	**12 285**	**490.9**

The main catchment is further divided into the following sub-catchments:

- Witbank Dam sub-catchment;
- Middelburg Dam sub-catchment;
- Wilge River sub-catchment;
- Klipspruit sub-catchment; and
- Lower Loskop Dam sub-catchment.

The Upper Olifants River water resources are under constant pressure from both a supply/demand perspective as well as from a water quality perspective.

9.9 ECOLOGY

An Ecological Scan was performed for the purposes of this project. The comprehensive report titled Ecological Scan for the Proposed Tailings Storage Facility (TSF) for Ferrometals within the Emalahleni Area, Mpumalanga Province is attached as **APPENDIX VII** to this report.

9.9.1 Regional Setting

The study area covers a portion of the remaining extent of the vulnerable Eastern Highveld Grassland vegetation type. The vegetation within the study area however has undergone irreversible loss of natural habitat, thus lowering the overall sensitivity of vegetation found within the study area.

According to the National Protected Area Expansion Strategy (NPAES), the study area is not located within a formal or informal NPAES protected area or within a NPAES Focus Area.

The study area is located in the Mpumalanga Province (QDS 2529CC). The terrestrial biodiversity assessment of the Mpumalanga Biodiversity Conservation Plan (MBCP) indicates that habitat is classified as "least concern" and that the majority of the study area is classified as "no natural habitat remaining" (Figure 9.9.1(a)). These areas have been largely transformed due to alien vegetation encroachment, where biodiversity has been irreversibly changed and virtually dysfunctional.

The Freshwater Ecosystem Priority Area (FEPA) database was consulted to define the ecology of wetland or river systems close to or within the study area that may be of ecological importance. No wetland or river systems were indicated by the FEPA database for the study area (Figure 9.9.1(b)). Two wetland types were located within the 500 m radius of the subject property, namely channelled valley bottom wetland feature and flat wetlands features. The flat wetland features can be further classified as artificial wetlands.

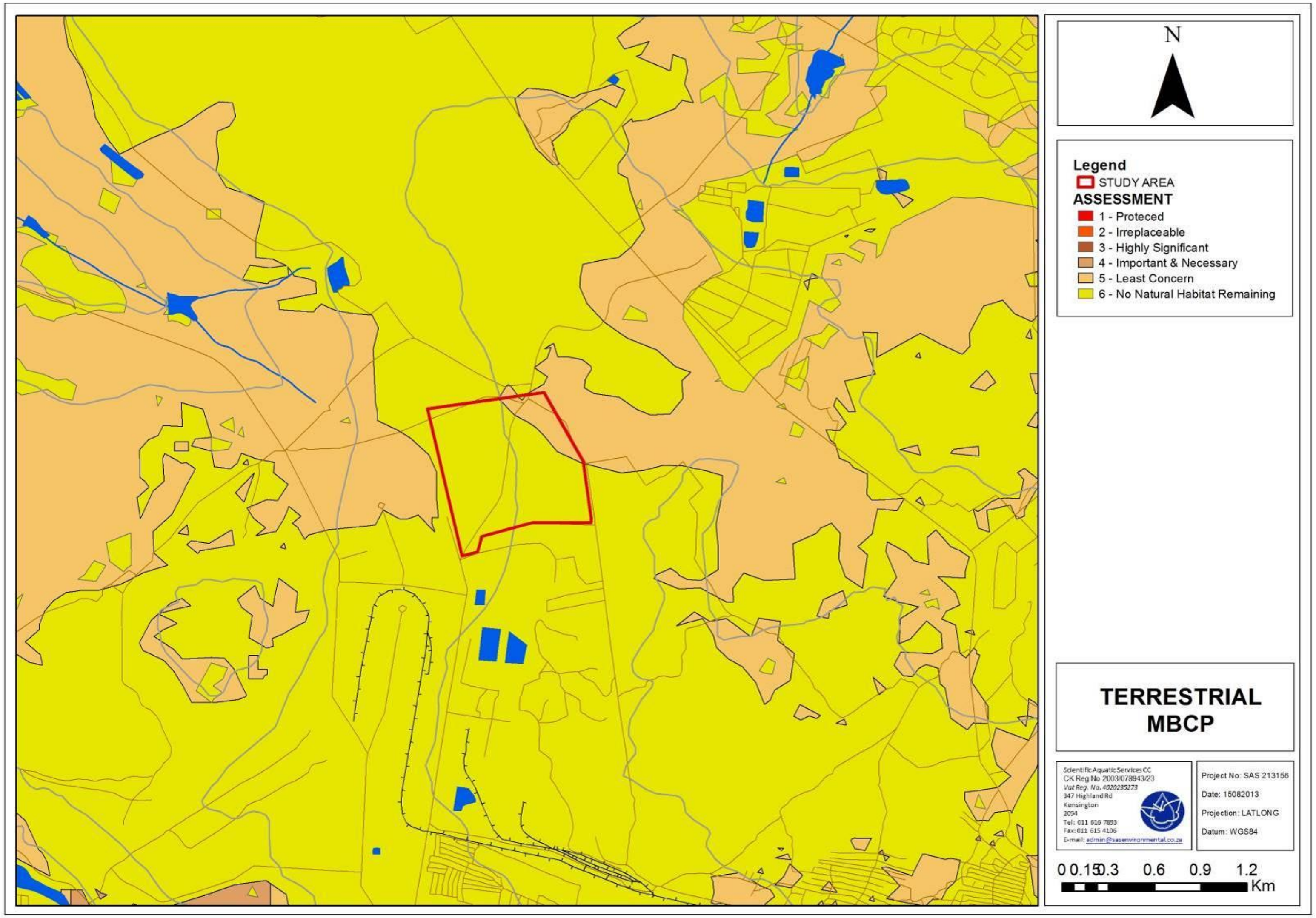


Figure 9.9.1 (a): Mpumalanga Biodiversity Conservation Plan (MBCP) Terrestrial Biodiversity Assessment

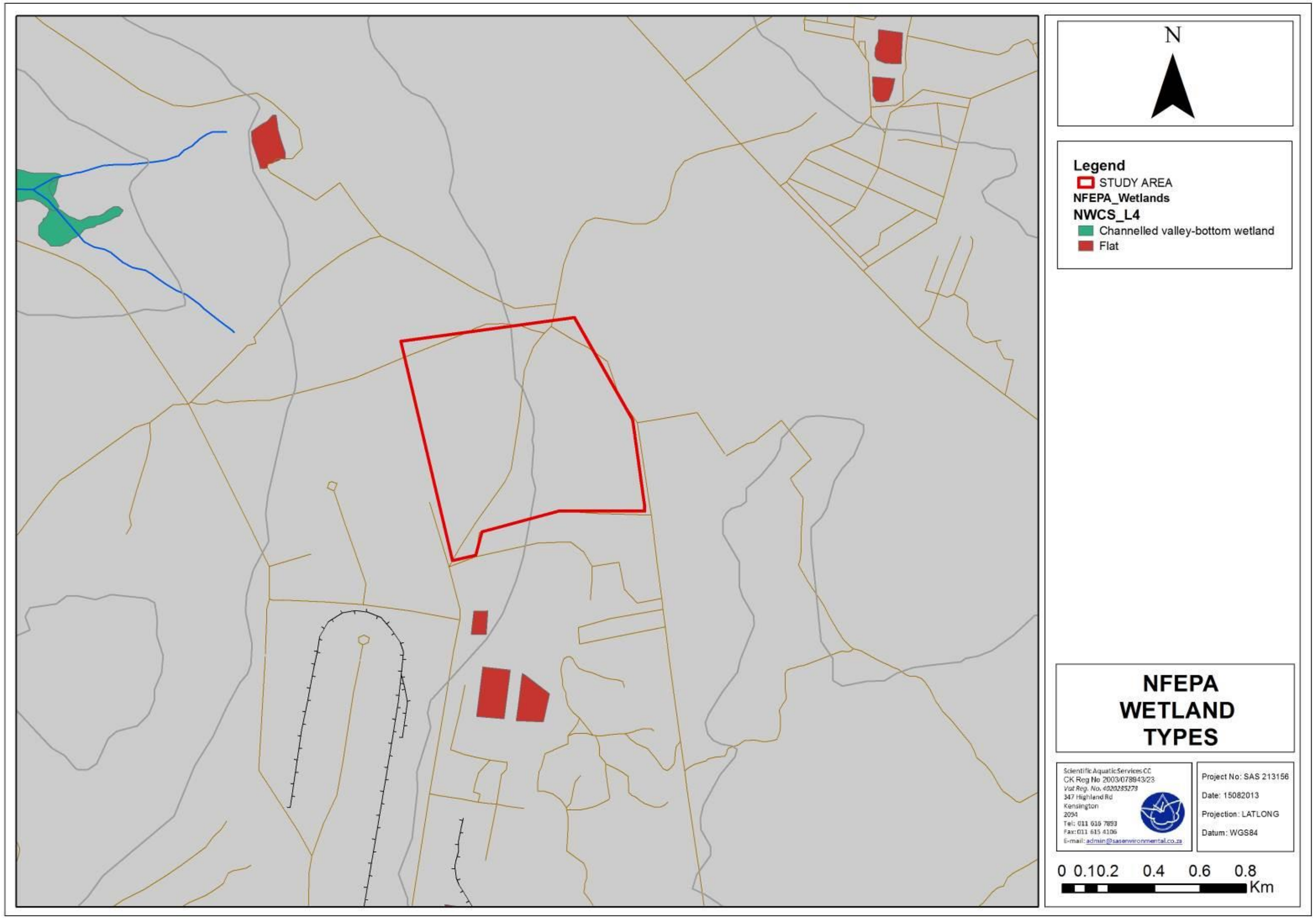


Figure 9.9.1 (b): Wetland Features as Indicated by the National Freshwater Ecosystem Priority Areas (NFEPA) Database (2011)

9.10 HERITAGE RESOURCES AND ASPECTS

9.10.1 The Study Area in Context

The study area for the Heritage Impact Assessment involved only a vacant section of land on the northern part of the property (see Figure 9.10.1 (a)). Except for the southern section, which has been cleared of vegetation, the largest section is currently heavily overgrown with various kinds of exotic trees. In the past the region has experienced a lot of mining (coal) activities, which contributed much to the development of an environmentally degraded area. The result is that any heritage feature that might have occurred here in the past was in all probability destroyed.

Figure 9.10.1(a): Ferrometals Operations Local Site Locality (Photo 2529CC 9&14).

9.10.2 Stone Age

Very little habitation of the highveld area took place during Stone Age times. Tools dating to the Early Stone Age period are mostly found in the vicinity of larger watercourses. During Middle Stone Age (MSA) times (c. 150 000 – 30 000 BP), people became more mobile, occupying areas formerly avoided.

The MSA is a technological stage characterized by flakes and flake-blades with faceted platforms, produced from prepared cores, as distinct from the core tool-based ESA technology. Open sites were still preferred near watercourses. Late Stone Age (LSA) people had even more advanced technology than the MSA people and therefore succeeded in occupying even more diverse habitats.

Also, for the first time we get evidence of people’s activities derived from material other than stone tools. Ostrich eggshell beads, ground bone arrowheads, small bored stones and wood fragments with incised markings are traditionally linked with the LSA. The LSA people have also left us with a rich legacy of rock art, which is an expression of their complex social and spiritual believes.

No sites, features or objects dating to the Stone Age were identified in the study area.

9.10.3 Iron Age

Iron Age people started to settle in southern Africa c. AD 300, with one of the oldest known sites at Broederstroom south of Hartebeespoort Dam dating to AD 470. Having only had cereals (sorghum, millet) that need summer rainfall, Early Iron Age (EIA) people did not move outside this rainfall zone, and neither did they occupy the central interior highveld area.

Because of their specific technology and economy, Iron Age people preferred to settle on the alluvial soils near rivers for agricultural purposes, but also for firewood and water.

The occupation of the larger geographical area (including the study area) did not start much before the 1500s. By the 16th century things changed, with the climate becoming warmer and wetter, creating condition that allowed Late Iron Age (LIA) farmers to occupy areas previously unsuitable, for example the treeless plains of the Free State and the Mpumalanga highveld.

This wet period came to a sudden end sometime between 1800 and 1820 by a major drought lasting 3 to 5 years. The drought must have caused an agricultural collapse on a large, subcontinent scale.

No sites, features or objects dating to the Iron Age were identified in the study area.

9.10.4 Historic Period

White settlers moved into the area during the first half of the 19th century. They were largely self-sufficient, basing their survival on cattle/sheep farming and hunting. Few towns were established and it remained an undeveloped area until the discovered of coal and later gold.

The establishment of the NZASM railway line in the 1880s, linking Pretoria with Lourenço Marques and the world at large, brought much infra-structural and administrative development to the area. This railway line also became the scene of many battles during the Anglo-Boer

War and after the battle of Bakenlaagte (30 October 1901) the Clewer station served as hospital for the wounded British soldiers.

A concentration camp was established near the Balmoral station, northwest of the study area (Cloete 2000). In line with the 'scorched earth' policy, most farmsteads were destroyed by the British during the latter part of the hostilities.

Coal mining occurred only sporadically in the area. However, with the discovery of the Witwatersrand gold fields, the need for a source of cheap energy became important, and coal mining developed on a large scale in various regions. By 1899, at least four collieries were operating in the Middelburg-Witbank1 district, supplying the gold mining industry (Praagh1906).

No sites, features or objects dating to the historic period were identified in the study area.

As no sites, features or objects of cultural heritage significance were identified in the study area, there would be no impact from the proposed development. See attached **APPENDIX VIII** for the feedback received from SAHRA in terms of the Heritage Resources at the Ferrometals site.

9.10.5 Site Palaeontology

A Desktop Palaeontological Impact Assessment was performed and extracts from this report is given below. The comprehensive specialist report is attached as **APPENDIX VIII** to this report.

The Ferrometals study area is underlain by rocks of the Karoo Supergroup comprising sedimentary rocks of the Carboniferous Dwyka Group and the Vryheid Formation of the Permian Ecca Group. The diamictites of the Dwyka Group were deposited in a grounded glacial setting and the mudrocks, coals and sandstones of the Vryheid Formation were deposited in a delta plain depositional environment.

The coarse grained diamictites of the Dwyka Group, which are positioned well below surface in the Ferrometals study area, are unlikely to contain fossils and in any case will not be exposed by the proposed development.

The overlying rocks of the Vryheid Formation of the Ecca Group are renowned for their wealth of plant fossils of the famous Gondwanan Glossopterus flora which has been described from Permian-aged rocks. This flora is the source of the coal which is mined from the Vryheid Formation in South Africa.

The proposed development of Ferrometals will cover Carboniferous to Permian-aged sedimentary rocks of the Dwyka and Ecca groups (Vryheid Formation) of the Karoo Supergroup. There is a good possibility that the rocks of the Vryheid Formation in the study area could contain fossil plant material of Glossopteris flora. As these fossils are not currently exposed, the development could enhance possibilities to discover plant fossils. If fossils are exposed in the course of the Ferrometals development, a qualified palaeontologist must be contacted to assess the exposure for fossils so that the necessary rescue operations are implemented.

10. PUBLIC PARTICIPATION PROCESS UP TO DATE

10.1 NEED FOR SCOPING PHASE PUBLIC PARTICIPATION

Public participation is one of the most important aspects of the environmental authorization process. This stems from the requirement that people have a right to be informed about potential decisions that may affect them and that they must be afforded an opportunity to influence those decisions. Effective public participation also improves the ability of the competent authority to make informed decisions and result in improved decision-making as the views of all parties are considered.

The public participation process:

- Provides an opportunity for interested and affected parties (I&AP's), EAPs and the Competent Authority (CA) to obtain clear, accurate and understandable information about the environmental impacts of the proposed activity or implications of a decision;
- Provides I&AP's with an opportunity to voice their support, concerns and questions regarding the project, application or decision;
- Provides I&AP's with the opportunity of suggesting ways of reducing or mitigating any negative impacts of the project and for enhancing its positive impacts;
- Enables an applicant to incorporate the needs, preferences and values of affected parties into its application;
- Provides opportunities for clearing up misunderstandings about technical issues, resolving disputes and reconciling conflicting interests;
- It is an important aspect of securing transparency and accountability in decision-making;
- It contributes towards maintaining a healthy, vibrant democracy.

Public participation is one of the most important aspects of the environmental authorisation process. It is considered so important that it is the only requirement for which exemption cannot be given. This is because people have a right to be informed about potential decisions that may affect them and to be afforded an opportunity to influence those decisions. Effective public participation also facilitates informed decision-making by the competent authority and may result in better decisions as the views of all parties are considered.

10.2 PUBLIC PARTICIPATION FOR SCOPING PHASE

10.2.1 Scope of the Public Participation Program for the Scoping Phase

The public participation program that was designed for the scoping phase of the Ferrometals Project, was derived from, and based on the regulations stipulated in regulation's 54 – 57 of Government Notice R 543 (GNR 543), which contains the EIA Regulations in terms of Chapter 5 of NEMA. The *Public Participation 2010, Integrated Environmental Management Guideline Series 7, Department of Environmental Affairs (2010),* was also used for guidance.

In the guideline document it is stated that the extent or scope of the public participation should be based on the extent of the envisaged impact, and not on the extent of the proposed development.

Also, it states that minimum requirements set for one project will not necessarily be sufficient for another, and that each project should be considered on its own merit.

The above mentioned was taken into consideration and it was decided that for the scoping phase of the EIA all of the identified I&APs would be notified according to regulations stipulated in GNR 543 informing them of the proposed project and inviting them to attend the public meeting scheduled for the **12 June 2013** at Emalahleni Local Municipality, Rehearsal Room (Cultural Centre). Along with these notifications were sent a Background Information Document, a comments sheet on which the I&APs could raise any concern they might have, or comment on a specific issue, and a map indicating the location of the venue for the Public Meeting.

10.2.2 Identification/Registration of Authorities and I&AP's

During the pre-application phase of the EIA process, members of JMA sat down and discussed the proposed project, investigating all of the proposed actions and determining what environmental authorisations will be required, and who the relevant lead authorities will be. During this discussion it was concluded that the Department of Environmental Affairs (**DEA**) Head Office, the Department of Economic Development, Environment & Tourism (**DEDET**) and the Department of Water Affairs (**DWA**) will be the lead authorities on this project.

For the identification of the I&APs to the proposed project, members of JMA consulted the current Ferrometals I&AP databases of previous projects obtained from Ferrometals. Furthermore anybody that responded to the newspaper advertisement, or notices were added to the I&AP database for this project. At the Public Meeting the I&APs were asked to provide details of persons that they deem necessary to be registered as an I&AP to the project. The current I&AP data base for this project is attached as Appendix 6.1.1(A) in the Public Participation Report (**APPENDIX IX**).

10.2.3 Notification of Authorities and I&AP's

As prescribed in GNR 543 written notices were compiled containing information on the proposed project, details of the Applicant, the appointed Consultant, and the Public Meeting that was scheduled for the 12 June 2013.

Along with this notification letter, sent to the I&APs, was a BID (Background Information Document) that contained additional information regarding the Ferrometals project, and a comment sheet on which the I&AP could raise issues or concerns that he/she may have regarding the project. A copy of the BID and a copy of the notification e-mail in Appendix 6.2.1(A) in the Public Participation Report (**APPENDIX IX**).

Press advertisements were also compiled and published in the local newspaper being the Witbank News.

The advertisements also contained some information regarding the project along with details and invitation to the public meeting. The advertisements were placed during the two weeks preceding the public meeting. Please see proof of these adverts in Appendix 6.2.1(A) in the Public Participation Report (**APPENDIX IX**).

Various site notices were located at the site itself, and throughout the surrounding communities. These notices also contained information regarding the proposed project, its location, and an invitation to attend the public meeting.

Please see proof of these Notices in Appendix 6.2.1(A) in the Public Participation Report (**APPENDIX IX**).

10.2.4 Information to Authorities and I&AP's

The information that was sent to the I&APs contained details of the following:

- Background to the Project;
- Description of actions to be undertaken for the current proposed project;
- Environmental authorisations that is required for the proposed project;
- Location of the project;
- Invitation to the public meeting that was scheduled, and the role of the I&APs in the public participation process as a whole;

10.2.5 Meetings with Authorities and I&AP's

Focus Group Meetings are meetings that are scheduled for I&APs that have more or less similar issues pertaining to the proposed project. Such meetings are usually on a smaller scale than the I&AP Public Meeting and has the function of Providing additional opportunities for communication between the applicant and I&APs in order to prevent any misunderstanding and/or to address sensitive issues that may arise during the formal public participation process.

10.2.6 Obtaining Comments from Authorities and I&AP's

Contained in all of the notifications sent out, and advertisements that was placed, were the full contact details of JMA along with an invitation to contact them regarding any issue or concerns that they may have regarding the project. A comment sheet was also attached to all notifications that was sent to the I&APs.

During the Public Meeting it was conveyed to the I&AP's, that the Draft Scoping Report will be made available as soon as JMA have finished compiling minutes of the Public Meeting. The draft scoping report was made available on 20 June 2013 for review at the following locations:

- Ferrometals Reception (At the Main entrance Gate)
- Ferrometals Environmental Department
- Public Library- Emalahleni

Furthermore the document was distributed to some of the I&AP's, that indicated that they will not be able to visit a library to review the document, in electronic format on a CD-ROM.

10.2.7 Responding to Comments from Authorities and I&AP's

All the comments and feedback gathered from the I&AP's and Authorities, throughout the Public Participation Process, were compiled into the Issues and Response Register. Each comment were reviewed by the EAP and responded to either by the EAP, or else by the relevant specialist, before submitting the final scoping report to the relevant competent authorities. The Comments Register is attached as Appendix 6.2.14(A) in the Final Public Participation Report (**APPENDIX IX**).

11. RELEVANT INFORMATION FROM APPLICATION FORMS

In order to obtain the necessary environmental authorisations from the Regulating Authorities, for the Decommissioning and Rehabilitation of the current Existing Slimes Dam footprint and the Construction of a new Slimes Dam footprint, an Enviro-Legal assessment was commissioned by JMA for the specific purpose of identifying all the listed activities contained in the active South African Environmental and related Legislation.

The requirement for authorisation applications pertaining to the above mentioned activities were identified in terms of the following legislation:

- National Environmental Management Act, Act 107 of 1998 – NEMA
  (Listed Activities in terms of GNR 544 are present and require a basic Environmental Impact Assessment to be done)
  DEDET Ref 17/2/3 N-84
- National Environmental Management: Waste Act, Act 59 of 2008 – NEMWA
  (Slimes Disposal is deemed Hazardous Waste Disposal and as such requires Licensing in terms of the provisions contained in NEMWA. The disposal of any quantity of hazardous waste requires a Scoping and EIA Process to be followed).
  DEA Ref: 12/9/11/L670/6: Closure of Existing Slimes Disposal Facility;
  DEA Ref: 12/9/11/L700/6: Construction and Operation – New Slimes Disposal Facility
- National Water Act, Act 36 of 1998 – NWA
  The current Integrated Water Use License for Ferrometals will have to be amended in order to adequately address new developments with regard to the decommissioning of the Existing and construction of a New Slimes Dam footprint. **DWA: Ref 16/2/7/B100/B49 (WUL:04/B11K/709).**

11.1 APPLICATION SUBMITTED TO DEDET AND RELEVANT CORRESPONDENCE

A Letter (LET 7779) requesting an upgrade from the basic assessment application (DEDET Ref: 17/ 2/3 N-84) to the formal Scoping & Environmental Impact Assessment (S&EIA) was submitted to the Department of Economic Development, Environment and Tourism (DEDET: Emalahleni) on 07 October 2013. Permission was granted, by DEDET on 28 November 2013, to perform a Scoping & Environmental Impact Assessment instead of the Basic assessment as requested in Letter 7779.

JMA submitted the Final Scoping Report to the DEDET on 23 August 2013 and received acknowledgement of receipt of the report on 11 September 2013. The Acceptance Letter for the Final Scoping Report was received from DEDET, in the form of a letter, on 05 December 2013.

11.2 APPLICATION SUBMITTED TO DEA AND RELEVANT CORRESPONDENCE

An Application for the Waste Disposal Site (Operation of the Existing Northern Slimes Dam) was submitted to DEA (Ref No: 12/9/11/L700/6) and acknowledgment of receipt was send on the 29/08/2011.

In addition, an Application for the Closure (Decommissioning) of the Existing Northern Slimes Dam was submitted to DEA (Ref No: 12/9/11/L691/6) and receipt of this application was confirmed on the 15/08/2011.

In terms of the Construction and Operation (disposal of waste) of the new Slimes Dam, a waste application was submitted to DEA (Ref No: 12/9/11/L670/6) and the receipt of this application was confirmed 29/08/2011.

JMA submitted the Final Scoping Report to the DEA on 23 August 2013 and received acknowledgement of receipt of the report on 09 October 2013.

The Final Scoping Document was accepted by the Department on 10 October 2013 and permission to proceed with the Environmental Impact Assessment in accordance with the tasks contemplated in the Plan of Study for Environmental Impact Assessment as required in terms of the EIA Regulation, 2010, was granted.

11.3 APPLICATION SUBMITTED TO DWA AND RELEVANT CORRESPONDENCE

The current Integrated Water Use License for Ferrometals will have to be amended in order to adequately address new developments with regard to the decommissioning of the Existing and construction of a New Slimes Dam footprint.

Detail designs with regards to the Storm Water Management Plan as well as Concept designs for the rehabilitation of the Historic Slimes Dams and the New Slimes Dam & Northern Slimes Dam was submitted to the DWA on the 20 August 2013.

JMA submitted the Final Scoping Report to the DWA on 23 August 2013 and received comments from the Department on 30 August 2013.

Once the concept designs have been approved for the relevant dams, a formal Water Use License Application will be lodged.

12. IMPACT ASSESSMENT METHODOLOGY

The impact assessment methodology used for the Ferrometals Project is based on an Impact Assessment Rating Matrix developed by JMA Consulting.

This matrix contains all the critical elements for Environmental Impact Assessment as proposed in the formal DEAT Protocol for Environmental Impact Assessment – *DEAT (2002) Impact Significance, Information Series 5, Department of Environmental Affairs and Tourism (DEAT), Pretoria.*

The protocol comprises a series of steps in order to systematically go through a process of:

1. Identifying and Quantifying the **Significance** of an impact. **Step 1**.
2. Determining the **Probability** of an impact happening. **Step 2.**
3. Determine the **Risk Level** attached to the impact. **Step 3.**

The identification process is conducted by each individual specialist and then the Step 1 Significance Assessment is completed based on the specialist's interpretation. The interpretation is converted into the numerical rating contained in Table 12(a), and an Impact Significance Total is calculated. The Significance Total is converted into a Significance S Number, for population of the overall Risk Matrix. The components considered to arrive at the Significance Rating (S Number) are as follows:

- Spatial extent of the impact
- Intensity or Severity of the impact
- Duration of the impact
- Unacceptability of the impact
- Mitigatory difficulty of the impact

The sum of the numerical ratings for the above components represents the Significance Total.

Table 12(a): Impact Significance Assessment Criteria

CRITERIA FOR DETERMINING SIGNIFICANCE		
Criteria	**Definition**	**Points**
Spatial Extent		
High	Widespread. Far beyond site boundary. Regional/national/international scale.	**3**
Medium	Beyond site boundary. Local area.	**2**
Low	Within site boundary.	**1**
Intensity or Severity		
High	Disturbance of pristine areas that have important conservation value. Destruction of rare or endangered species.	**3**
Medium	Disturbance of areas that have potential conservation value or are of use as a resource. Complete change in species occurrence or variety.	**2**
Low	Disturbance of degraded areas that have little conservation value. Minor change in species occurrence or variety.	**1**
Duration		
High (Long term)	Permanent. Long Term (more than 20 years). Beyond decommissioning.	**3**
Medium (Medium term)	Reversible over time. Lifespan of the project. Medium Term (3-20 years). Operational Phase	**2**
Low (Short term)	Quickly reversible. Less than the project lifespan. Short Term (0 – 3 years). Construction Phase	**1**
Un-Acceptability		
High (Unacceptable)	Abandon project in part or in its entirety. Redesign project to remove impact or avoid impact.	**3**
Medium (Manageable)	With regulatory controls. With project proponent's commitments.	**2**
Low (Acceptable)	No risk to public health.	**1**
Mitigatory Difficulty		
High	Little or no mechanism to mitigate negative impacts.	**3**
Medium	Potential to mitigate negative impacts. However, the implementation of mitigation measures may still not prevent some negative effects.	**2**
Low	High potential to mitigate negative impacts to the level of insignificant effects.	**1**

Once a Significance Total has been calculated for a specific impact, an Impact Significance Number is determined (S-number) as completion of **Step 1**, based on the Table below:

Table 12(b): Assignment of Impact Significance S-Number

Significance Total	Significance S-Number
15	S5
12 - 14	S4
9 - 11	S3
6 - 8	S2
5	S1

Table 12(c): Explanation for Impact Significance Rating

EXPLANATION FOR IMPACT SIGNIFICANCE RATING		
Impact Significance	**Explanation**	**Points**
Very High	Of the highest order possible within the bounds of impacts that could occur. In the case of adverse impacts, there is no possible mitigation that could counteract the impact, or mitigation is difficult, expensive, time-consuming or a combination of these. Social, cultural and economic activities of communities are disrupted to such an extent that these come to a halt. In the case of beneficial impacts, the impact is of a substantial order within the bounds of impacts that could occur.	**>14**
High	Impact is high and substantial in relation to other impacts that might take effect within the bounds of those that could occur. In the case of adverse impacts, mitigation is possible but expensive. Social, cultural and economic activities of communities are changed, but can be continued (albeit in a different form). Modification of the project design or alternative action will be required. In the case of beneficial impacts, the project out performs other alternatives in terms of time, cost and effort.	**12-14**
Medium	Impact is real, but not substantial in relation to other impacts that might take effect within the bounds of those that could occur. In the case of adverse impacts, mitigation is both feasible and fairly easily possible. Social, cultural and economic activities of communities are changed, but can be continued (albeit in a different form). Modification of the project design or alternative action may be required. In the case of beneficial impacts, other means of achieving this benefit are about equal in time, cost and effort.	**9-11**
Low	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts, mitigation is either easily achieved or little will be required, or both. Social, cultural and economic activities of communities can continue unchanged. In the case of beneficial impacts, alternative means of achieving this benefit are likely to be easier, cheaper, more effective and less time-consuming.	**6-8**
Insignificant	Although an impact may exist it is rated as insignificant and is not deemed to warrant any specific management measures or even monitoring.	**<6**

During **Step 2** the Probability of an impact occurring/re-occurring is assessed.

Table 12(d): Probability of an Impact Occurring (P-Value)

Likelihood Descriptors		Probability Intervals	Likelihood Definitions
P1	**Unlikely**	**0 - 25%**	**Less than 25% probability that a specific impact will occur.**
P2	**Possible**	**25 - 50%**	**25% - 50% probability that a specific impact will occur.**
P3	**Probable**	**50 - 75%**	**50% - 75% probability that a specific impact will occur.**
P4	**Highly Probable**	**75 - 100%**	**More than 75% probability that a specific impact will occur.**

Finally, the overall impact is quantified in a Risk Matrix, by combining the S-Number (determined in **Step 1**) with the P-Value (determined in **Step 2**) in the Risk Matrix provided below (**Step 3**). The Risk Matrix also provides and Action Table to indicate and allocate responsibility. The matrices shown above make use of generic criteria in order to systematically identify, predict, evaluate and determine the significance of impacts resulting from project construction, operation and decommissioning. In order to enhance the accuracy and integrity of the outcome of the Impact Assessment, the suite of potential environmental impacts (to both the natural and human environments) identified in the EIA, were as far as possible **quantified during the various specialist studies conducted.**

Table 12(e): Risk Matrix and Action Table

RISK MATRIX					
	Significance S1	**Significance S2**	**Significance S3**	**Significance S4**	**Significance S5**
Probability P4	**Low Risk**	**Low Risk**	**Moderate Risk**	**High Risk**	**High Risk**
Probability P3	**Very Low Risk**	**Low Risk**	**Moderate Risk**	**Moderate Risk**	**High Risk**
Probability P2	**Very Low Risk**	**Very Low Risk**	**Low Risk**	**Low Risk**	**Moderate Risk**
Probability P1	**Very Low Risk**	**Very Low Risk**	**Very Low Risk**	**Very Low Risk**	**Low Risk**

13. ENVIRONMENTAL IMPACT ASSESSMENT

13.1 ACTIVITIES ASSOCIATED WITH THIS APPLICATION

Activities as defined by the National Environmental Management Act 107 of 1998, means *policies, programmes, processes, plans and projects.*

In terms of the Ferrometals project two Activities were identified, namely:

- the **development of a New Slimes Dam**
- the **decommissioning and closure of the current Existing Slimes Dam**

13.2 RELEVANT ENVIRONMENTAL ASPECTS

An "**Environmental Aspect**" as defined in the ISO 14001 Environmental Management System (EMS) Standard is: *"Elements of an Organisations Activity, Products or Services which can interact with the Environment. A significant Environmental Aspect is an Environmental Aspect which has, or can have a Significant Environmental Impact."*

The Environmental Aspects arising from the identified Activities for the Ferrometals projects were identified per life cycle phase and were subsequently assessed in terms of the ensuing environmental impacts.

13.2.1 Environmental Aspects – Planning and Design Phase – New Slimes Dam only

Planning and Design Phase	
Environmental Aspect	Potential Environmental Impacts/Issues
Slimes Dam Liner	Groundwater
Storm Water Management System	Surface Water
Side Slopes	Surface Water
Slurry Delivery and Return Water Pipe Lines	Surface Water

13.2.2 Environmental Aspects - Construction Phase – New Slimes Dam only

Construction Phase	
Environmental Aspect	Potential Environmental Impacts/Issues
Removal of Vegetation	Surface Water, Plant Life, Animal Life
Stripping and Stockpiling of Soils	Soils, Surface Water, Air Quality, Noise
Construction of the Slimes Dam Liner and Starter Walls	Surface Water, Air Quality, Noise
Re-routing of the Existing Slurry Pipe Lines	Surface Water

13.2.3 Environmental Aspects – Operational Phase – New Slimes Dam only

Operational Phase	
Environmental Aspect	Potential Environmental Impacts/Issues
Pumping of Slurry along the Slurry Pipe Lines from the Furnaces to the Slimes Dam	Soils, Groundwater, Surface Water
Deposition of Slurry, Decanting of Water, Building of Day and Night Walls, Collection of Drainage and Seepage from Slimes Dam into the Slimes Dam RWD (existing)	Groundwater, Surface Water, Air Quality
Return of Slimes Decant Water from the Slimes Dam RWD, along the Return Water Pipe Lines to the Furnaces	Soils, Groundwater, Surface Water

13.2.4 Environmental Aspects – Decommissioning and Closure Phase – New and Old Slimes Dam

Decommissioning and Closure Phase	
Environmental Aspect	Potential Environmental Impacts/Issues
Remove, reclaim and dispose of all pipes, plant and equipment associated with the Slimes Dam	Surface Water, Air Quality, Noise
Shape and Cap the Slimes Dam with an appropriate Capping and install Drains and Berms	Surface Water, Air Quality, Noise
Re-vegetate the Capped Slimes Dam	Plant Life

13.2.5 Environmental Aspects – Post Closure – New and Old Slimes Dam

Post Closure	
Environmental Aspect	Potential Environmental Impacts/Issues
Ineffective Vegetation Cover	Soils, Surface Water, Plant life, Animal Life, Air Quality
Ineffective Capping System	Groundwater
Ineffective Seepage Drainage and Collection System	Groundwater
Ineffective Storm Water Drainage System	Soils, Surface Water

13.3 POTENTIAL ENVIRONMENTAL IMPACTS/ISSUES

A Table with the identified Aspects and Potential Environmental Impact/Issues as deemed relevant to a specific Activity is given for each of the applicable life-cycle phases below.

13.3.1 Potential Environmental Impact/Issue – Planning and Design Phase – New Slimes Dam only

Planning and Design Phase		
Activity	Aspect	Potential Environmental Impact/Issue
Development of New Slimes Dam	Slimes Dam Liner	Groundwater: Contamination of the groundwater resource due to seepage of contaminated water through the footprint of the Slimes Dam into the sub-surface.
	Storm Water Management System	Surface Water: Contamination of the surface water resource due to uncontrolled run-off of contaminated storm water from the Slimes Dam.
	Side Slopes	Surface Water: Contamination of the surface water resource due to erosion of the Slimes Dam Side slopes if too steep.
	Slurry Delivery and Return Water Pipelines	Surface Water: Contamination of the surface water resource due to possible leakages and spillages from slurry and return water pipelines.

13.3.2 Potential Environmental Impact/Issue – Construction Phase – New Slimes Dam only

Construction Phase		
Activity	Aspect	Potential Environmental Impact/Issue
Development of New Slimes Dam	Removal of Vegetation	Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.
		Plant Life: Destruction of Habitat due to physical removal of vegetation layer.
		Plant Life: Impact on Biodiversity due to loss of natural habitat.
		Plant Life: No threat to Red Data List (RDL) species.
		Animal Life: Destruction of Habitat due to physical removal of vegetation layer.
		Animal Life: Impact on Biodiversity due to loss of natural habitat.
		Animal Life: No threat to Red Data List (RDL) species.
	Stripping and Stockpiling of Soils	Soils: Loss of soil horizon due to removal (stripping) of the soil layers during the excavation of the footprint.
		Soils: Loss of soil fertility due to inappropriate stockpiling.
		Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.

Construction Phase		
Activity	Aspect	Potential Environmental Impact/Issue
		Air Quality (Gaseous Emissions): Deterioration in ambient air quality due to gaseous emissions generated from construction machinery and vehicles.
		Air Quality (Dust Fallout): Deterioration in ambient air quality due to dust generated from construction activities.
		Noise: Impact on ambient sound level due to construction activities.
		Noise: Generation of noise due to reverse hooters/alarms from construction machinery and vehicles.
	Slimes Dam Liner and Starter Walls	Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.
		Air Quality (Gaseous Emissions): Deterioration in ambient air quality due to gaseous emissions generated from construction machinery and vehicles.
		Air Quality (Dust Fallout): Deterioration in ambient air quality due to dust generated from construction activities.
		Noise: Impact on ambient sound level due to construction activities.
		Noise: Generation of noise due to reverse hooters/alarms from construction machinery and vehicles.
	Re-routing of the Existing Slurry Pipeline	Surface Water: Contamination of the surface water resource due to spillages from the existing slurry pipeline.

13.3.3 Potential Environmental Impact/Issue – Operational Phase – New Slimes Dam Only

Operational Phase		
Activity	Aspect	Potential Environmental Impact/Issue
Development of New Slimes Dam	Pumping of Slurry along the Slurry Pipe Lines from the Furnaces to the Slimes Dam	Soils: Contamination of soil due to leakages from the pipeline over prolonged periods of time.
		Groundwater: Contamination of the groundwater resource due to the infiltration of leakages/spillages from the pipeline over prolonged periods of time.
		Surface Water: Contamination of the surface water resource due to incidental spillages/bursts from the slurry pipeline.
	Deposition of Slurry, Decanting of Water, Building of Day and Night Walls, Collection of Drainage and Seepage from Slimes Dam into the Slimes Dam RWD (existing)	Groundwater: Contamination of the groundwater resource due to the infiltration of leakages/ spillages through the lined footprint over prolonged periods of time.
		Surface Water: Contamination of the surface water resource due to spillages from the storm water management system.
		Air Quality (Dust Fallout): Deterioration in ambient air quality due to windblown dust from dry surfaces on the Slimes Dam.
	Return of Slimes Decant Water from the Slimes Dam RWD, along the Return Water Pipe Lines to the Furnaces	Soils: Contamination of soil due to leakages from the pipeline over prolonged periods of time.
		Groundwater: Contamination of the groundwater resource due to the infiltration of leakages/spillages from the pipeline over prolonged periods of time.
		Surface Water: Contamination of the surface water resource due to incidental spillages/bursts from the slurry pipelines.

13.3.4 Potential Environmental Impact/Issue – Decommissioning and Closure Phase – New and Old Slimes Dam

Decommissioning and Closure Phase		
Activity	Aspect	Potential Environmental Impact/Issue
Development of New Slimes Dam	Remove, reclaim and dispose of all pipes, plant and equipment associated with the Slimes Dam	Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.
		Air Quality (Gaseous Emissions): Deterioration in ambient air quality due to gaseous emissions generated from construction machinery and vehicles
		Air Quality (Dust Fallout): Deterioration in ambient air quality due to dust generated from decommissioning activities.
		Noise: Impact on ambient sound level due to decommissioning activities.
		Noise: Generation of noise due to reverse hooters/alarms from construction machinery and vehicles.
	Shape and Cap the Slimes Dam with an appropriate Capping and install Drains and Berms	Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.
		Air Quality (Gaseous Emissions): Deterioration in ambient air quality due to gaseous emissions generated from construction machinery and vehicles
		Air Quality (Dust Fallout): Deterioration in ambient air quality due to dust generated from capping activities.
		Noise: Impact on ambient sound level due to decommissioning activities.
		Noise: Generation of noise due to reverse hooters/alarms from construction machinery and vehicles
	Re-vegetate the Capped Slimes Dam	Plant Life: Restoration of Habitat due to re-vegetation of the footprint.
		Plant Life: Restoration of Biodiversity due to the repair of natural vegetation/habitat.
Decommissioning and Closure of the current Existing Slimes Dam	Remove, reclaim and dispose of all pipes, plant and equipment associated with the Slimes Dam	Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.
		Air Quality (Gaseous Emissions): Deterioration in ambient air quality due to gaseous emissions generated from construction machinery and vehicles
		Air Quality (Dust Fallout): Deterioration in ambient air quality due to dust generated from decommissioning activities.
		Noise: Impact on ambient sound level due to decommissioning activities.
		Noise: Generation of noise due to reverse hooters/alarms from construction machinery and vehicles.
	Shape and Cap the Slimes Dam with an appropriate Capping and install Drains and Berms	Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.
		Air Quality (Gaseous Emissions): Deterioration in ambient air quality due to gaseous emissions generated from construction machinery and vehicles
		Air Quality (Dust Fallout): Deterioration in ambient air quality due to dust generated from capping activities.
		Noise: Impact on ambient sound level due to decommissioning activities.
		Noise: Generation of noise due to reverse hooters/alarms from construction machinery and vehicles
	Re-vegetate the Capped Slimes Dam	Plant Life: Restoration of Habitat due to re-vegetation of the footprint.
		Plant Life: Restoration of Biodiversity due to the repair of natural vegetation/habitat.

13.3.5 Potential Environmental Impact/Issue – Post Closure – New and Old Slimes Dam

Post Closure Phase		
Activity	Aspect	Potential Environmental Impact/Issue
Development of New Slimes Dam	Ineffective Vegetation Cover	Soils: Loss of soil horizon due to erosion and surface water run-off.
		Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.
		Plant Life: Loss of habitat due to vegetation cover not returning to natural state.
		Plant Life: Loss of biodiversity due to a loss of habitat.
		Animal Life: Loss of habitat due to vegetation cover not returning to natural state.
		Animal Life: Loss of biodiversity due to a loss of habitat.
		Air Quality (Dust Fallout): Deterioration in ambient air quality due to windblown dust generated from denuded surfaces.
	Ineffective Capping System	Groundwater: Contamination of the groundwater resource due to infiltration of rainwater through the capping and the subsequent infiltration of contaminated water through the footprint of the Slimes Dam into the sub-surface.
	Ineffective Seepage Drainage and Collection System	Groundwater: Contamination of the groundwater resource due to seepage of contaminated water through the footprint of the Slimes Dam into the sub-surface.
	Ineffective Storm Water Drainage System	Soils: Loss of soil horizon due to erosion.
		Soils: Contamination of soil due to toe seepages and storm water run-off.
		Surface Water: Contamination of the surface water resource due to uncontrolled run-off of contaminated storm water from the Slimes Dam.
Decommissioning and Closure of the current Existing Slimes Dam	Ineffective Vegetation Cover	Soils: Loss of soil horizon due to erosion and surface water run-off.
		Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.
		Plant Life: Loss of habitat due to vegetation cover not returning to natural state.
		Plant Life: Loss of biodiversity due to a loss of habitat.
		Animal Life: Loss of habitat due to vegetation cover not returning to natural state.
		Animal Life: Loss of biodiversity due to a loss of habitat.
		Air Quality (Dust Fallout): Deterioration in ambient air quality due to windblown dust generated from denuded surfaces.
	Ineffective Capping System	Groundwater: Contamination of the groundwater resource due to infiltration of rainwater through the capping and the subsequent infiltration of contaminated water through the footprint of the Slimes Dam into the sub-surface.
	Ineffective Seepage Drainage and Collection System	Groundwater: Contamination of the groundwater resource due to seepage of contaminated water through the footprint of the Slimes Dam into the sub-surface.
	Ineffective Storm Water Drainage System	Soils: Loss of soil horizon due to erosion.
		Soils: Contamination of soil due to toe seepages and storm water run-off.
		Surface Water: Contamination of the surface water resource due to uncontrolled run-off of contaminated storm water from the Slimes Dam.

13.4 ENVIRONMENTAL IMPACT ASSESSMENT

An Environmental Impact Assessment was compiled for both activities; namely the development of a New Slimes Dam as well as the decommissioning and closure of the current Existing Slimes Dam for the relevant life cycle phases.

An "**Environmental Impact**" is defined (ISO 14001) as a *"Change to the Environment. Such a change can be Positive of Negative. Environmental Impacts are caused by Environmental Aspects."*

Following the Environmental Impact Assessment Regulations GNR 543 of 2010, a "**Significant Impact**" means *"An impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment."*

The Impact Assessment is presented as a Table in the following sections:

- Planning and Design Phase (section 13.4.1; **only** for the development of the New Slimes Dam activity)
- Construction Phase (section 13.4.2; **only** for the development of the New Slimes Dam activity)
- Operational Phase (section 13.4.3; **only** for the development of the New Slimes Dam activity)
- Decommissioning and Closure Phase (section 13.4.4; for **both** activities)
- Post Closure Phase (Section 13.4.5; for **both** activities)

An Impact Assessment Table consists of the following 12 columns:

- Column 1 – Activity
- Column 2 - Aspect
- Column 3 – Potential Environmental Impact/Issue
- Column 4 - Spatial Extent
- Column 5 - Intensity/Severity
- Column 6 - Duration
- Column 7 - Unacceptability
- Column 8 - Mitigatory Difficulty
- Column 9 - Significance Total
- Column 10 - Significance S Number
- Column 11 - Probability of Occurrence
- Column 12- Risk Level Before Management

13.4.1 Planning and Design Phase Impact Assessment

Planning and Design Phase Impact Assessment												
Activity	**Aspect**	**Potential Environmental Impact/Issue**	**Criteria for Determining Significance**						**Significance S-Number**	**Probability of Occurrence**	**Risk Level Before Management**
			Spatial Extent	**Intensity/ Severity**	**Duration**	**Unacceptability**	**Mitigatory Difficulty**	**Significance Total**			
Development of New Slimes Dam	Slimes Dam Liner	Groundwater: Contamination of the groundwater resource due to seepage of contaminated water through the footprint of the Slimes Dam into the sub-surface.	2	3	3	3	1	12	S4	P4	**High Risk**
	Storm Water Management System	Surface Water: Contamination of the surface water resource due to uncontrolled run-off of contaminated storm water from the Slimes Dam.	2	2	3	3	1	11	S3	P4	**Moderate Risk**
	Side Slopes	Surface Water: Contamination of the surface water resource due to erosion of the Slimes Dam Side slopes if too steep.	2	2	3	3	1	11	S3	P4	**Moderate Risk**
	Slurry Delivery and Return Water Pipelines	Surface Water: Contamination of the surface water resource due to possible leakages and spillages from slurry and return water pipelines.	2	2	3	3	1	11	S3	P4	**Moderate Risk**

13.4.2 Construction Phase Impact Assessment

Construction Phase Impact Assessment												
Activity	Aspect	Potential Environmental Impact/Issue	Criteria for Determining Significance						Significance S-Number	Probability of Occurrence	Risk Level Before Management
			Spatial Extent	Intensity/ Severity	Duration	Unacceptability	Mitigatory Difficulty	Significance Total			
Development of New Slimes Dam	Removal of Vegetation	Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.	2	2	1	2	1	8	S2	P3	**Low Risk**
		Plant Life: Destruction of Habitat due to physical removal of vegetation layer.	1	1	3	1	3	9	S3	P4	**Moderate Risk**
		Plant Life: Impact on Biodiversity due to loss of natural habitat.	1	1	3	1	3	9	S3	P4	**Moderate Risk**
		Plant Life: No threat to Red Data List (RDL) species.	0	0	0	0	0	0	-	-	**No Risk**
		Animal Life: Destruction of Habitat due to physical removal of vegetation layer.	1	1	3	1	3	9	S3	P4	**Moderate Risk**
		Animal Life: Impact on Biodiversity due to loss of natural habitat.	1	1	3	1	3	9	S3	P4	**Moderate Risk**
		Animal Life: No threat to Red Data List (RDL) species.	0	0	0	0	0	0	-	-	**No Risk**
	Stripping and Stockpiling of Soils	Soils: Loss of soil horizon due to removal (stripping) of the soil layers during the excavation of the footprint.	1	3	3	1	3	11	S3	P4	**Moderate Risk**
		Soils: Loss of soil fertility due to inappropriate stockpiling.	1	2	2	2	2	9	S3	P4	**Moderate Risk**
		Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.	2	2	1	2	1	8	S2	P3	**Low Risk**
		Air Quality (Gaseous Emissions): Deterioration in ambient air quality due to gaseous emissions generated from construction machinery and vehicles.	1	1	1	2	3	8	S2	P4	**Low Risk**

Construction Phase Impact Assessment												
Activity	**Aspect**	**Potential Environmental Impact/Issue**	**Criteria for Determining Significance**						**Significance S-Number**	**Probability of**	**Risk Level Before**
		Air Quality (Dust Fallout): Deterioration in ambient air quality due to dust generated from construction activities.	2	2	1	2	1	8	S2	P4	**Low Risk**
		Noise: Impact on ambient sound level due to construction activities.	2	1	1	1	2	7	S2	P4	**Low Risk**
		Noise: Generation of noise due to reverse hooters/alarms from construction machinery and vehicles.	2	2	1	2	1	8	S2	P4	**Low Risk**
	Slimes Dam Liner and Starter Walls	Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.	2	2	1	2	1	8	S2	P3	**Low Risk**
		Air Quality (Gaseous Emissions): Deterioration in ambient air quality due to gaseous emissions generated from construction machinery and vehicles.	1	1	1	2	3	8	S2	P4	**Low Risk**
		Air Quality (Dust Fallout): Deterioration in ambient air quality due to dust generated from construction activities.	2	2	1	2	1	8	S2	P4	**Low Risk**
		Noise: Impact on ambient sound level due to construction activities.	2	1	1	1	2	7	S2	P4	**Low Risk**
		Noise: Generation of noise due to reverse hooters/alarms from construction machinery and vehicles.	2	2	1	2	1	8	S2	P4	**Low Risk**
	Re-routing of the Existing Slurry Pipeline	Surface Water: Contamination of the surface water resource due to spillages from the existing slurry pipeline.	2	3	1	3	1	10	S3	P2	**Low Risk**

13.4.3 Operational Phase Impact Assessment

Operational Phase Impact Assessment												
Activity	**Aspect**	**Potential Environmental Impact/Issue**	**Criteria for Determining Significance**						**Significance S-Number**	**Probability of Occurrence**	**Risk Level Before Management**
			Spatial Extent	**Intensity/ Severity**	**Duration**	**Unacceptability**	**Mitigatory Difficulty**	**Significance Total**			
Development of New Slimes Dam	Pumping of Slurry along the Slurry Pipe Lines from the Furnaces to the Slimes Dam	Soils: Contamination of soil due to leakages from the slurry pipeline over prolonged periods of time.	1	2	2	2	1	8	S2	P2	**Very Low Risk**
		Groundwater: Contamination of the groundwater resource due to the infiltration of leakages/spillages from the slurry pipeline over prolonged periods of time.	1	1	2	2	1	7	S2	P2	**Very Low Risk**
		Surface Water: Contamination of the surface water resource due to incidental spillages/bursts from the slurry pipeline.	2	1	1	2	1	7	S2	P3	**Low Risk**
	Deposition of Slurry, Decanting of Water, Building of Day and Night Walls, Collection of Drainage and Seepage from Slimes Dam into the Slimes Dam RWD (existing)	Groundwater: Contamination of the groundwater resource due to the infiltration of leakages/ spillages through the lined footprint over prolonged periods of time.	1	1	2	2	2	8	S2	P1	**Very Low Risk**
		Surface Water: Contamination of the surface water resource due to spillages from the storm water management system.	1	2	1	2	1	7	S2	P1	**Very Low Risk**
		Air Quality (Dust Fallout): Deterioration in ambient air quality due to windblown dust from dry surfaces.	2	2	2	2	1	9	S3	P4	**Moderate Risk**
	Return of Slimes Decant Water from the Slimes Dam RWD, along the Return Water Pipe Lines	Soils: Contamination of soil due to leakages from the pipeline over prolonged periods of time.	1	2	2	2	1	8	S2	P2	**Very Low Risk**

Operational Phase Impact Assessment											
Activity	**Aspect**	**Potential Environmental Impact/Issue**	**Criteria for Determining Significance**						**Significance S-Number**	**Probability of Occurrence**	**Risk Level Before Management**
			Spatial Extent	**Intensity/ Severity**	**Duration**	**Unacceptability**	**Mitigatory Difficulty**	**Significance Total**			
	to the Furnaces	Groundwater: Contamination of the groundwater resource due to the infiltration of leakages/spillages from the pipeline over prolonged periods of time.	1	1	2	2	1	7	S2	P2	**Very Low Risk**
		Surface Water: Contamination of the surface water resource due to incidental spillages/bursts from the pipelines.	2	1	1	2	1	7	S2	P3	**Low Risk**

13.4.4 Decommissioning and Closure Phase Impact Assessment

Decommissioning and Closure Phase Impact Assessment												
Activity	Aspect	Potential Environmental Impact/Issue	Criteria for Determining Significance						Significance S-Number	Probability of Occurrence	Risk Level Before Management
			Spatial Extent	Intensity/ Severity	Duration	Unacceptability	Mitigatory Difficulty	Significance Total			
Development of New Slimes Dam	Remove, reclaim and dispose of all pipes, plant and equipment associated with the Slimes Dam	Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.	2	2	1	2	1	8	S2	P3	**Low Risk**
		Air Quality (Gaseous Emissions): Deterioration in ambient air quality due to gaseous emissions generated from construction machinery and vehicles.	1	1	1	2	3	8	S2	P4	**Low Risk**
		Air Quality (Dust Fallout): Deterioration in ambient air quality due to dust generated from decommissioning activities.	2	2	1	2	1	8	S2	P4	**Low Risk**
		Noise: Impact on ambient sound level due to decommissioning activities.	2	1	1	1	2	7	S2	P4	**Low Risk**
		Noise: Generation of noise due to reverse hooters/alarms from construction machinery and vehicles.	2	2	1	2	1	8	S2	P4	**Low Risk**
	Shape and Cap the Slimes Dam with an appropriate Capping and install Drains and Berms	Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.	2	2	1	2	1	8	S2	P4	**Low Risk**
		Air Quality (Gaseous Emissions): Deterioration in ambient air quality due to gaseous emissions generated from construction machinery and vehicles.	1	1	1	2	3	8	S2	P4	**Low Risk**
		Air Quality (Dust Fallout): Deterioration in ambient air quality due to dust generated from capping activities.	2	2	1	2	1	8	S2	P4	**Low Risk**

Decommissioning and Closure Phase Impact Assessment											
Activity	**Aspect**	**Potential Environmental Impact/Issue**	**Criteria for Determining Significance**						**Significance S-Number**	**Probability of Occurrence**	**Risk Level Before Management**
			Spatial Extent	**Intensity/ Severity**	**Duration**	**Unacceptability**	**Mitigatory Difficulty**	**Significance Total**			
		Noise: Impact on ambient sound level due to decommissioning activities.	2	1	1	1	2	7	S2	P4	**Low Risk**
		Noise: Generation of noise due to reverse hooters/alarms from construction machinery and vehicles	2	2	1	2	1	8	S2	P4	**Low Risk**
	Re-vegetate the Capped Slimes Dam	Plant Life: Restoration of Habitat due to re-vegetation of the footprint.	+1	+2	+3	+3	+1	+10	S3	P4	**Moderate Positive Risk**
		Plant Life: Restoration of Biodiversity due to the repair of natural vegetation/habitat.	+1	+2	+3	+2	+1	+10	S3	P4	**Moderate Positive Risk**
Decommissioning and Closure of the current Existing Slimes Dam	Remove, reclaim and dispose of all pipes, plant and equipment associated with the Slimes Dam	Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.	2	2	1	2	1	8	S2	P3	**Low Risk**
		Air Quality (Gaseous Emissions): Deterioration in ambient air quality due to gaseous emissions generated from construction machinery and vehicles	1	1	1	2	3	8	S2	P4	**Low Risk**
		Air Quality (Dust Fallout): Deterioration in ambient air quality due to dust generated from decommissioning activities.	2	2	1	2	1	8	S2	P4	**Low Risk**
		Noise: Impact on ambient sound level due to decommissioning activities.	2	1	1	1	2	7	S2	P4	**Low Risk**
		Noise: Generation of noise due to reverse hooters/alarms from construction machinery and vehicles.	2	2	1	2	1	8	S2	P4	**Low Risk**
	Shape and Cap the Slimes Dam with an appropriate Capping and install Drains and Berms	Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.	2	2	1	2	1	8	S2	P4	**Low Risk**

Decommissioning and Closure Phase Impact Assessment												
Activity	**Aspect**	**Potential Environmental Impact/Issue**	**Criteria for Determining Significance**						**Significance S-Number**	**Probability of Occurrence**	**Risk Level Before Management**
			Spatial Extent	**Intensity/ Severity**	**Duration**	**Unacceptability**	**Mitigatory Difficulty**	**Significance Total**			
		Air Quality (Gaseous Emissions): Deterioration in ambient air quality due to gaseous emissions generated from construction machinery and vehicles	1	1	1	2	3	8	S2	P4	**Low Risk**
		Air Quality (Dust Fallout): Deterioration in ambient air quality due to dust generated from capping activities.	2	2	1	2	1	8	S2	P4	**Low Risk**
		Noise: Impact on ambient sound level due to decommissioning activities.	2	1	1	1	2	7	S2	P4	**Low Risk**
		Noise: Generation of noise due to reverse hooters/alarms from construction machinery and vehicles	2	2	1	2	1	8	S2	P4	**Low Risk**
	Re-vegetate the Capped Slimes Dam	Plant Life: Restoration of Habitat due to re-vegetation of the footprint.	+1	+2	+3	+3	+1	+10	S3	P4	**Moderate Positive Risk**
		Plant Life: Restoration of Biodiversity due to the repair of natural vegetation/habitat.	+1	+2	+3	+2	+1	+10	S3	P4	**Moderate Positive Risk**

13.4.5 Post Closure Phase Impact Assessment

Post Closure Phase Impact Assessment												
Activity	Aspect	Potential Environmental Impact/Issue	Criteria for Determining Significance						Significance S-Number	Probability of Occurrence	Risk Level Before Management
			Spatial Extent	Intensity/ Severity	Duration	Unacceptability	Mitigatory Difficulty	Significance Total			
Development of New Slimes Dam	Ineffective Vegetation Cover	Soils: Loss of soil horizon due to erosion and surface water run-off.	1	2	3	2	1	9	S3	P2	**Low Risk**
		Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.	2	2	3	2	1	10	S3	P2	**Low Risk**
		Plant Life: Loss of habitat due to vegetation cover not returning to natural state.	1	1	3	2	1	8	S2	P2	**Very Low Risk**
		Plant Life: Loss of biodiversity due to a loss of habitat.	1	1	3	2	1	8	S2	P2	**Very Low Risk**
		Animal Life: Loss of habitat due to vegetation cover not returning to natural state.	1	1	3	2	1	8	S2	P2	**Very Low Risk**
		Animal Life: Loss of biodiversity due to a loss of habitat.	1	1	3	2	1	8	S2	P2	**Very Low Risk**
		Air Quality (Dust Fallout): Deterioration in ambient air quality due to windblown dust generated from denuded surfaces.	2	1	3	2	1	9	S3	P2	**Low Risk**
	Ineffective Capping System	Groundwater: Contamination of the groundwater resource due to infiltration of rainwater through the capping and the subsequent infiltration of contaminated water through the footprint of the Slimes Dam into the sub-surface.	1	2	3	2	1	9	S3	P1	**Very Low Risk**
	Ineffective Seepage Drainage and Collection System	Groundwater: Contamination of the groundwater resource due to seepage of contaminated water through the footprint of the Slimes Dam into the sub-surface.	1	1	3	2	1	8	S2	P1	**Very Low Risk**

Post Closure Phase Impact Assessment												
Activity	**Aspect**	**Potential Environmental Impact/Issue**	**Criteria for Determining Significance**						**Significance S-Number**	**Probability of Occurrence**	**Risk Level Before Management**
			Spatial Extent	**Intensity/ Severity**	**Duration**	**Unacceptability**	**Mitigatory Difficulty**	**Significance Total**			
	Ineffective Storm Water Drainage System	Soils: Loss of soil horizon due to erosion.	1	2	3	2	1	9	S3	P1	**Very Low Risk**
		Soils: Contamination of soil due to toe seepages and storm water run-off.	1	2	3	2	1	9	S3	P1	**Very Low Risk**
		Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.	2	2	3	2	1	10	S3	P1	**Very Low Risk**
Decommissioning and Closure of the current Existing Slimes Dam	Ineffective Vegetation Cover	Soils: Loss of soil horizon due to erosion and surface water run-off.	1	2	3	2	1	9	S3	P2	**Low Risk**
		Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.	2	2	3	2	1	10	S3	P2	**Low Risk**
		Plant Life: Loss of habitat due to vegetation cover not returning to natural state.	1	1	3	2	1	8	S2	P2	**Very Low Risk**
		Plant Life: Loss of biodiversity due to a loss of habitat.	1	1	3	2	1	8	S2	P2	**Very Low Risk**
		Animal Life: Loss of habitat due to vegetation cover not returning to natural state.	1	1	3	2	1	8	S2	P2	**Very Low Risk**
		Animal Life: Loss of biodiversity due to a loss of habitat.	1	1	3	2	1	8	S2	P2	**Very Low Risk**
		Air Quality (Dust Fallout): Deterioration in ambient air quality due to windblown dust generated from denuded surfaces.	2	1	3	2	1	9	S3	P2	**Low Risk**
	Ineffective Capping System	Groundwater: Contamination of the groundwater resource due to infiltration of rainwater through the capping and the subsequent infiltration of contaminated water	1	2	3	2	1	9	S3	P1	**Very Low Risk**

Post Closure Phase Impact Assessment												
Activity	**Aspect**	**Potential Environmental Impact/Issue**	**Criteria for Determining Significance**						**Significance S-Number**	**Probability of Occurrence**	**Risk Level Before Management**
			Spatial Extent	**Intensity/ Severity**	**Duration**	**Unacceptability**	**Mitigatory Difficulty**	**Significance Total**			
		through the footprint of the Slimes Dam into the sub-surface.									
	Ineffective Seepage Drainage and Collection System	Groundwater: Contamination of the groundwater resource due to seepage of contaminated water through the footprint of the Slimes Dam into the sub-surface.	1	1	3	2	1	8	S2	P1	**Very Low Risk**
	Ineffective Storm Water Drainage System	Soils: Loss of soil horizon due to erosion.	1	2	3	2	1	9	S3	P1	**Very Low Risk**
		Soils: Contamination of soil due to toe seepages and storm water run-off.	1	2	3	2	1	9	S3	P1	**Very Low Risk**
		Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.	2	2	3	2	1	10	S3	P1	**Very Low Risk**

13.5 Cumulative Impacts

A Cumulative Impact as defined by GNR 543 of 18 June 2010, in relation to an Activity (here the Construction of a New Slimes Dam Facility and the Decommissioning of an Existing Slimes Dam Facility), means:

"the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area".

In areas where extensive mining and associated industrial activities occur, as is the case for the greater Witbank area, impacts experienced at individual mines and/or plants may combine, and whereas they may be of acceptable magnitude and significance on individual plant scale, could after they have accumulated, be fully un-acceptable on a regional scale.

Most of the identified biophysical impacts related to ferrochrome smelting have the potential to accumulate and therefore have to be considered. In this regard, however, it is important to separate those that would accumulate linearly and those that would accumulate exponentially.

Linear accumulation is defined for impacts for which the aerial extent and zone of influence is directly related to the extent of the surface area where the impact is generated and occurs, or impacts for which the time duration is short. Examples of environmental attributes for which this is the case are:

- Topography
- Soils
- Land Capability
- Geology
- Plant Life
- Heritage

Exponential accumulation is defined for impacts for which the aerial extent and zone of influence exist beyond the extent of the surface area where the impact is generated and which could therefore increase in significance as it combines with the manifestations of other external impacts generated by neighbouring or down-gradient/down-stream sources.

Examples of environmental attributes for which this is the case are:

- Land Use
- Groundwater
- Surface Water
- Animal Life
- Aquatic Ecosystems
- Air Quality

In terms of linear accumulation, the only activities that do alter the topography to any significant degree, relate to the facilities used for Slimes Disposal, both of which represent landfill operations on site. These features start out on a dedicated footprint and then grow in height until they do represent “new” topographical features on site. The main impact associated with this relates to a change in surface drainage patterns around these areas, as well as a visual alteration evident to neighbouring or passing observers.

Environmental impacts emanating from soil disturbance are generally restricted to a particular site and the direct surrounds thereof. Disturbed soils tend to be shallower and not well drained and most of the water that would originally have been stored in the profile will now be discharged into the receiving environment as surface run-off. Consequently, increased soil erosion can be expected which could ultimately impede vegetation growth during the rehabilitation phase (Post Closure) and on a long term basis.

Currently the study area is characterised by high level of alien floral invasion as a result of historic and on-going disturbances and edge effects from surrounding areas. This has resulted in significant transformation of the natural floral community composition and structure.

No sites, features or objects of cultural heritage significance were identified in the study area, therefore no impact (i.e. cumulative impact) will amount from the project activities.

From an exponential accumulation perspective, groundwater quality contamination could occur if contaminants in solution percolate into the subsurface, through the unsaturated zone and then into the groundwater resource. These impacts could occur at raw materials stockpiles, in plant areas due to spillages of raw materials, additives and process waters, at the slag disposal facility, at the slimes disposal facility and from storm water pollution control dams which contain affected storm water.

In order for these impacts to manifest, a number of conditions need to be present such as contaminants in solution, a permeable footprint interface with the sub-surface as well as a hydraulic driving force (head) from the source towards the groundwater resource.

In the event that contamination of the groundwater resource does occur, a groundwater pollution plume could manifest that could impact on the surrounding groundwater receptors and streams in the area.

With regards to the surface water environment, the Ferrometals’ plant site is located in a surface water environment that is heavily impaired, with respect to both the availability of water as well as its quality.

Water quality in the Klipspruit sub-catchment is heavily impacted on by several sources of contamination which include, urban related activities, extensive coal-mining activities, power stations and the associated ash-deposits as well as historical, non-reclaimed abandoned mining operations.

Impacts on surface water can occur during all the life cycles of a ferrochrome plant. The water captured and contained by the storm water management measures, will be isolated from the natural catchment and will represent an impact on surface water availability. Post closure, the surface water impact will become very small provided that rehabilitation is optimized to ensure free draining run-off is of good quality. Should this not be the case, the Ferrometals operations will adversely contribute to the already depreciated surface water environment.

Currently the study area is characterised by high level of alien floral invasion as a result of historic and on-going disturbances and edge effects from surrounding areas. This has resulted in significant transformation of the natural floral community composition and structure. No wetlands or any other sensitive habitat types that warrant conservation are present within the study area. The study area is not deemed sensitive in terms of RDL or sensitive faunal or floral species conservation.

Cumulative impacts in terms of Air Quality can be summarised as below:

- The maximum annual average and highest daily average **PM10** concentrations predicted to occur at KwaQuqa as a result of cumulative routine emissions were 289 $\mu g/m^3$ and 1400 $\mu g/m^3$ respectively. Exceedences of the current and proposed South African annual average standards were predicted to occur only at KwaQuqa South. Exceedences of the current and proposed South African daily average PM10 standards were predicted at KwaQuqa South, Hlanikahle (119 µg/m) and KwaQuqa West (159 µg/m). Cumulative emissions from FMT and FVD were predicted to result in 232 days of Exceedence of the EC daily average PM10 standard of 50 $\mu g/m^3$.
- The maximum annual, highest daily and highest hourly average **SO2** concentrations predicted to occur at KwaQuqa were 0.87 $\mu g/m^3$, 6.5 $\mu g/m^3$ and 54.6 $\mu g/m^3$ respectively. No exceedences of the current SO_2 standards for any of the averaging periods were predicted at any of the sensitive receptors.
- The maximum annual, highest daily, and highest hourly average **NO** concentrations predicted to occur at KwaQuqa were 4.68 $\mu g/m^3$, 35.9 $\mu g/m^3$ and 307 $\mu g/m^3$ respectively. No exceedences of the current NO standards for any of the averaging periods were predicted at any of the sensitive receptors.
- The maximum annual, highest daily and highest hourly average **NO2** concentrations predicted to occur at KwaQuqa were 7.3 $\mu g/m^3$, 46.6 $\mu g/m^3$ and 44.2 $\mu g/m^3$ respectively. No exceedences of the current NO_2 standards for any of the averaging periods were predicted at any of the sensitive receptors.
- The maximum highest hourly average **CO** concentration predicted to occur at KwaQuqa was 165 $\mu g/m^3$. No exceedences of the current CO standard were predicted at any of the sensitive receptors.
- The average daily and maximum daily **dustfall** levels predicted to occur at KwaQuqa a result of cumulative emissions were 656 mg/m2/day ("heavy") and 1940 mg/m2/day ("very heavy") respectively. The maximum daily dustfall level predicted at KwaQuqa was in the SANS "Action" dustfall band and requires investigation and remediation if two sequential months lie in this band, or more than three occur in a year. Dustfall levels as a result of

cumulative emissions at all other sensitive receptors were in accord with the "Residential" band, permissible for residential and light commercial areas.

Dust emanating from the project activities (i.e. Decommissioning and Rehabilitation of existing Slimes Dam as well as the Construction of a New Slimes Dam) as well as a change in the natural topography will contribute to the already visually impaired greater Witbank Area.

14. ASSUMPTIONS AND LIMITATIONS

This Chapter was compiled to give fulfilment to the requirements set out in the EIA Regulations (GNR 543; NEMA (107 of 1998)) in terms of:

(2) An environmental impact assessment report must contain all information that is necessary for the competent authority to consider the application and to reach a decision contemplated in regulation 35, and must include-
(m) a description of any assumptions, uncertainties and gaps in knowledge;

In terms of the Ferrometals project, the sections below address the above-mentioned requirements relevant to the two activities assessed, namely:

- the **development of a New Slimes Dam**
- the **decommissioning and closure of the current Existing Slimes Dam**

14.1 ASSUMPTIONS

- That the information regarding the Project supplied by Samancor Chrome Ferrometals is correct at the time of the assessment.
- That all relevant available documentation and information concerning the Project have been brought to the attention of JMA.
- The design for the development of a New Slimes Dam (either Option A or Option B) is acceptable from an environmental, economic and stability point of view.
- The objectives identified in terms of the rehabilitation and closure of the current Existing Slimes Dam will *inter alia* ensure that the post closure state is not a source of on-going pollution to the environment, and that it is neither a danger to public or animal health and safety as well as that it will not be a source of on-going pollution to the environment.
- In terms of the groundwater quality modelling, specifically when determining the seepage volumes of the old and new slimes dams, the seepage models assumed that the old slimes dam will be capped with a soil layer and that the new slimes dam will have a H:H lagoon lining.

14.2 UNCERTAINTIES

It was not deemed necessary to investigate the Noise and Visuals Aspects of the environment, due to the location of the project area. The Project is located in an already heavily developed industrial area; hence the new activities would not have a significant impact on the baseline environment. No significant increase in the ambient sound/noise level is expected from the new Ferrometals activities when compared to the already existing noise levels generated from the surrounding activities in the area. In addition, the visual impact would also not be of great significance as the landscape morphology would not be considerably different from the current landscape. There would also not be a significant alteration in terms of the visual intrusion caused by the new activities.

14.3 LIMITATIONS (Gaps in Knowledge)

No Limitations/Gaps in knowledge were identified.

15. PROFESSIONAL OPINION (AUTHORISATION)

15.1 RECOMMENDATION FOR APPROVAL

The proposed closure of the existing Slimes Dam, as well as the construction and commissioning of the new Slimes Dam at Ferrometals, will occur on a brown fields industrial site.

The detailed planning and design of the proposed activities took full cognizance of the potential impacts of the activities on the environment. Bearing this in mind and based on the outcome of the high integrity impact and risk assessments undertaken, there exists, however, no scientific evidence that environmental impacts associated with the proposed activities at Ferrometals will result in impacts of unacceptable magnitude and risk.

All impacts and risks identified for all the life cycle phases of the project can indeed be fully managed to acceptable levels using existing best practice methodologies. In this regard Ferrometals, through innovative planning and design, has demonstrated their full capacity and commitment towards managing their Slimes Disposal related impacts to acceptable levels.

It is therefore recommended by the EAP that approval be granted to Ferrometals to proceed with the activities as applied for, subject of course to conditions as could be specified by the relevant regulatory authorities within their respective mandates of regulation.

15.2 CONDITIONS FOR APPROVAL

Conditions for approval remain the prerogative and responsibility of the relevant regulatory authority. However, the Recommendation for Approval of the EAP is made subject to the following conditions:

- That the Environmental Management Plan as detailed in the Management Measure Tables, be implemented as proposed, or alternatively with motivated alterations.
- That on-going monitoring and auditing, also as proposed in the EMP be conducted during the life span of the project.
- That environmental management measures be adapted, or continued, based on the outcome of the monitoring and auditing programmes.

Respectfully submitted,

Original Signed By

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Riaan Grobbelaar (Pr.Sci.Nat.)

16. ENVIRONMENTAL IMPACT STATEMENT

16.1 SUMMARY OF KEY FINDINGS

A comprehensive Environmental Impact and Risk Assessment was conducted for the activities related to the closure of the Existing Slimes Dam, as well as for the construction and commissioning of a new Slimes Dam at Ferrocmetals.

The EIA conducted was of high integrity with a very high degree of confidence, mainly due to:

- Environmental base line descriptions were compiled by the EAP and specialists for the following aspects:
  - Heritage
  - Climate/Meteorology
  - Topography
  - Soils
  - Land Capability
  - Land Use
  - Geology
  - Ground Water
  - Surface Water
  - Terrestrial Ecology
  - Aquatic Ecology
  - Air Quality
- The base line studies provided detailed, site specific quantitative descriptions of the current and future situation at Ferrometals.
- Detailed project descriptions and designs for the proposed activities were provided by the applicant and which could be used to identify impacts.
- A formal numerical Impact Significance and Risk Assessment Matrix, based on the official DEAT guidelines was then used to assess the impacts and risk associated with all the identified activities, for all five life cycle phases of the project (including the planning and design phase).
- The numerical impact and risk significance assessment matrix considered the following criteria:
  - Spatial extent of the impact
  - Intensity or Severity of the impact
  - Duration of the impact
  - Unacceptability of the impact
  - Mitigatory difficulty of the impact
  - Probability of Occurrence

- Based on the numerical rating obtained, Impact Significance and Risk was determined to fall in one of the following four possible outcomes:

RISK MATRIX					
	Significance S1	Significance S2	Significance S3	Significance S4	Significance S5
Probability P4	Low Risk	Low Risk	Moderate Risk	High Risk	High Risk
Probability P3	Very Low Risk	Low Risk	Moderate Risk	Moderate Risk	High Risk
Probability P2	Very Low Risk	Very Low Risk	Low Risk	Low Risk	Moderate Risk
Probability P1	Very Low Risk	Very Low Risk	Very Low Risk	Very Low Risk	Low Risk

- The key findings of the Impact and Risk Assessment will be discussed with reference to the Impact Significance and Risk Categories listed above, for each of the project life cycle phases.

16.1.1 Planning and Design Phase

For the environmental impacts assessed for the Planning and Design Phase, the highest assessed negative **pre-mitigation** Impact and Risk Significance is summarized in Table 16.1.1(a) below. The Table also reflects the Impact and Risk as assessed for **after mitigation**.

With reference to the information contained in the Table, it is obvious that most of the **Planning and Design Phase** risks, which essentially relates to ground water and surface water risks, could, through best practice designs, be managed to lower levels. In terms of the Risk Significance Rating Protocol used, assessments of post mitigation Very Low Risk indicate that impacts can be managed to acceptable levels in terms of spatial extent, intensity or severity, duration and general acceptability of the impact.

Table 16.1.1(a): Construction Phase Impact and Risk Significance

Environmental Component	Impact and Risk prior to Mitigation	Impact and Risk after Mitigation	Comment
Ground Water	High Risk	Very Low Risk	Ground water contamination can be fully prevented through the installation of an appropriate lining system for the new Slimes Dam.
Surface Water	Moderate Risk	Very Low Risk	Impacts on surface water can be prevented through the installation of effective storm water management measures, the provision of stable side slopes and the prevention of spillages from the slurry pipe lines.

16.1.2 Construction Phase

For the environmental impacts assessed for the Construction Phase, the highest assessed negative **pre-mitigation** Impact and Risk Significance is summarized in Table 16.1.2(a) below. The Table also reflects the Impact and Risk as assessed for **after mitigation**.

With reference to the information contained in the Table, it is obvious that most of the **Construction Phase** risks, could be managed to lower levels. In terms of the Risk Significance Rating Protocol used, assessments of post mitigation Low Risk and Very Low Risk indicate that impacts can be managed to acceptable levels in terms of spatial extent, intensity or severity, duration and general acceptability of the impact.

Table 16.1.2(a): Construction Phase Impact and Risk Significance

Environmental Component	Impact and Risk prior to Mitigation	Impact and Risk after Mitigation	Comment
Soils	Moderate Risk	Low Risk	The impact and risk to soils can be managed through restriction of soil stripping and the appropriate stockpiling of soil for later use.
Surface Water	Low Risk	Very Low Risk	The impact and risk to surface water can be managed through the construction of earth berms around the construction area, the settling of suspended solids in storm water run-off prior to release and finally by scheduling construction for during the dry period.
Plant Life	Moderate Risk	Low Risk	The impact and risk to plant life can be managed by restricting the removal of vegetation to the development footprint only.
Animal Life	Moderate Risk	Low Risk	The impact and risk to animal life can be managed by restricting the removal of vegetation to the development footprint only.
Air Quality	Low Risk	Very Low Risk	The impact and risk to air quality can be managed by ensuring all construction vehicles to be in a good state of repair and by conducting dust suppression during construction.
Noise	Low Risk	Very Low Risk	The noise impact and risk can be managed by restricting construction activities to daylight hours and by replacing the reverse hooters on construction machinery with hiss-type reverse alarms.

16.1.3 Operational Phase

For the environmental impacts assessed for the Operational Phase, the highest assessed negative **pre-mitigation** Impact and Risk Significance is summarized in Table 16.1.3(a) below. The Table also reflects the Impact and Risk as assessed for **after mitigation**.

With reference to the information contained in the Table, it is obvious that most of the **Operational Phase** risks, could be managed to lower levels. In terms of the Risk Significance Rating Protocol used, assessments of post mitigation Very Low Risk indicate that impacts can be managed to acceptable levels in terms of spatial extent, intensity or severity, duration and general acceptability of the impact.

Table 16.1.3(a): Operational Phase Impact and Risk Significance

Environmental Component	Impact and Risk prior to Mitigation	Impact and Risk after Mitigation	Comment
Soils	Very Low Risk	Very Low Risk	The impact and risk to soils can be managed through effective maintenance to the slurry pipe lines.
Ground Water	Very Low Risk	Very Low Risk	The impact and risk to ground water can be managed through effective maintenance to the slurry pipe lines and the ground water seepage collection system.
Surface Water	Low Risk	Very Low Risk	The impact and risk to surface water can be managed through effective maintenance to the slurry pipe lines and the storm water management system.
Air Quality	Moderate Risk	Very Low Risk	The impact and risk to air quality can be managed by maintaining a rotational slurry deposition system on top of the Slimes Dam.

16.1.4 Decommissioning and Closure Phase

For the environmental impacts assessed for the Decommissioning and Closure Phase, the highest assessed negative **pre-mitigation** Impact and Risk Significance is summarized in Table 16.1.4(a) below. The Table also reflects the Impact and Risk as assessed for **after mitigation**.

With reference to the information contained in the Table, it is obvious that most of the **Decommissioning and Closure Phase** risks, could be managed to lower levels. In terms of the Risk Significance Rating Protocol used, assessments of post mitigation Very Low Risk , as well as a High Positive Risk for plant life, indicate that impacts can be managed to acceptable levels in terms of spatial extent, intensity or severity, duration and general acceptability of the impact.

Table 16.1.4(a): Decommissioning and Closure Phase Impact and Risk Significance

Environmental Component	Impact and Risk prior to Mitigation	Impact and Risk after Mitigation	Comment
Surface Water	Low Risk	Very Low Risk	The impact and risk to surface water can be managed through the construction of earth berms around the decommissioning area, the settling of suspended solids in storm water run-off prior to release and finally by scheduling decommissioning for during the dry period.
Plant Life	Moderate Positive Risk	High Positive Risk	The positive impact and risk to plant life arises from the re-vegetation of the rehabilitated and closed facility.
Air Quality	Low Risk	Very Low Risk	The impact and risk to air quality can be managed by ensuring all earth moving vehicles to be in a good state of repair and by conducting dust suppression during decommissioning.
Noise	Low Risk	Very Low Risk	The noise impact and risk can be managed by restricting decommissioning activities to daylight hours and by replacing the reverse hooters on earth moving machinery with hiss-type reverse alarms.

16.1.5 Post Closure Phase

For the residual environmental impacts assessed for the Post Closure Phase, the highest assessed negative **pre-mitigation** Impact and Risk Significance is summarized in Table 16.1.5(a) below. The Table also reflects the Impact and Risk as assessed for **after mitigation**.

With reference to the information contained in the Table, it is obvious that all of the residual Post Closure Phase risks, could be managed to acceptable levels. In terms of the Risk Significance Rating Protocol used, assessments of post mitigation Very Low Risk, indicate that impacts can be managed to fully acceptable levels in terms of spatial extent, intensity or severity, duration and general acceptability of the impact.

Table 16.1.5(a): Post Closure Phase Impact and Risk Significance

Environmental Component	Impact and Risk prior to Mitigation	Impact and Risk after Mitigation	Comment
Soils	Low Risk	Very Low Risk	Conduct regular inspections of status of re-vegetation and implement recommendations for maintenance.
Surface Water	Low Risk	Very Low Risk	Conduct regular inspections of status of storm water management measures and implement recommendations for maintenance.
Plant Life	Very Low Risk	Very Low Risk	Conduct regular inspections of status of re-vegetation and implement recommendations for maintenance.
Animal Life	Very Low Risk	Very Low Risk	Conduct regular inspections of status of re-vegetation and faunal conditions and implement recommendations for maintenance.
Air Quality	Low Risk	Very Low Risk	Conduct regular inspections of status of re-vegetation and implement recommendations for maintenance.
Ground Water	Very Low Risk	Very Low Risk	Conduct regular inspections of status of capping system and implement recommendations for maintenance.

16.2 COMPARATIVE ASSESSMENT (POSITIVES/NEGATIVES)

The activities applied for in this application, comprise the proposed closure of the existing Slimes Dam, as well as the construction and commissioning of a new Slimes Dam at Ferrometals.

The activities as such are aimed at improving and maintaining sound environmental management at the site in order to ensure sustainable production of ferrochrome at an existing facility.

The detailed planning and design of the proposed activities took full cognizance of the potential impacts of the activities on the environment. Based on the outcome of the high integrity impact and risk assessment undertaken for the project, it is obvious that the negative impacts associated with the proposed activities can all be managed to fully acceptable levels.

When comparing this outcome against the potential negative impacts on the environment if the closure of the existing Slimes Dam is not undertaken, as well as if the new Slimes Dam is not developed as planned and designed, it is evident that **the positives of the project going ahead, far outweighs the negatives in it does not go ahead**.

17. DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME

Specified in the Environmental Impact Assessment Regulations – GNR 543 of 2010; 31(2) (p) a draft Environmental Management Programme (EMP) should contain the aspects contemplated in regulation 33;

33 (a) details of-

(i) the person who prepared the environmental management programme; and

(ii) the expertise of that person to prepare an environmental management programme;

(b) information on any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified in a report contemplated by these Regulations, including environmental impacts or objectives in respect of-

(i) planning and design;

(ii) pre-construction and construction activities;

(iii) operation or undertaking of the activity

(iv) rehabilitation of the environment; and

(v) closure, where relevant.

(c) a detailed description of the aspects of the activity that are covered by the draft environmental management programme;

(d) an identification of the persons who will be responsible for the implementation of the measures contemplated in paragraph (b);

(e) proposed mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon;

(f) as far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of any listed 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, including, where appropriate, concurrent or progressive rehabilitation measures;

(g) a description of the manner in which it intends to-

(i) modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;

(ii) remedy the cause of pollution or degradation and migration of pollutants;

(iii) comply with any prescribed environmental management standards or practices;

(iv) comply with any applicable provisions of the Act regarding closure, where applicable;

(v) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;

(h) time periods within which the measure contemplated in the environmental management programme must be implemented;

(i) the process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking a listed activity;

(j) an environmental awareness plan describing the manner in which-

(i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and

(ii) risks must be dealt with in order to avoid pollution or the degradation of the environment;

(k) where appropriate, closure plans, including closure objectives.

17.1 ENVIRONMENTAL ASPECTS, MANAGEMENT OBJECTIVES AND MEASURES

An Environmental Management Programme (EMP) was compiled for both activities; namely the development of a New Slimes Dam as well as the decommissioning and closure of the current Existing Slimes Dam for the relevant life cycle phases.

The EMP is presented as a Table in the following sections:

- Planning and Design Phase (section 17.1.1; **only** for the development of the New Slimes Dam activity)
- Construction Phase (section 17.1.2; **only** for the development of the New Slimes Dam activity)
- Operational Phase (section 17.1.3; **only** for the development of the New Slimes Dam activity)
- Decommissioning and Closure Phase (section 17.1.4; for **both** activities)
- Post Closure Phase (Section 17.1.5; for **both** activities)

The EMP Tables contain the following columns:

- Column 1: Activity
- Column 2: Aspect
- Column 3: Potential Environmental Impact/Issue
- Column 4: Risk Level Before Management
- Column 5: Management Objective
- Column 6: Proposed Management Measure
- Column 7: Risk Level After Management
- Column 8: Responsible Person
- Column 9: Management Time Schedule
- Column 10: Management Budget Quantum
- Column 11: Management Budget Allocation/Provisioning
- Column 12: Monitoring Requirement
- Column 13: Monitoring Frequency
- Column 14: Monitoring Budget Quantum
- Column 15: Monitoring Budget Allocation/Provisioning
- Column 16: Performance Assessment
- Column 17: Performance Assessment Time Schedule

17.1.1 Planning and Design Phase Management Plan

Planning and Design Phase Management Plan																
Activity	Aspect	Potential Environmental Impact/Issue	Management Measures													
			Risk Level Before Management	Management Objective	Proposed Management Measure	Risk Level after Management	Responsible Person	Management Time Schedule	Management Budget Quantum	Management Budget Allocation/ Provisioning	Monitoring Required	Monitoring Frequency	Monitoring Budget Quantum	Monitoring Budget Allocation/ Provisioning	Performance Assessment	Performance Assessment Time Schedule
Development of New Slimes Dam	Slimes Dam Liner	Groundwater: Contamination of the groundwater resource due to seepage of contaminated water through the footprint of the Slimes Dam into the sub-surface.	**High Risk**	Prevent seepage of contaminated water through the footprint of the Slimes Dam into the sub-surface.	Install an appropriate lining system.	**Very Low Risk**	Ferrometals Logistics Manager	Design Phase	Included in Project Design Budget	Included in Project Design Budget	Authorities to Approve Designs	N/A	N/A	N/A	As Build Drawings	First Environmental Audit
	Storm Water Management System	Surface Water: Contamination of the surface water resource due to uncontrolled run-off of contaminated storm water from the Slimes Dam.	**Moderate Risk**	Capture and contain all storm water run-off on the Slimes Dam.	Install storm water drainage shutes/canals and storm water collection toe paddocks.	**Very Low Risk**	Ferrometals Logistics Manager	Design Phase	Included in Project Design Budget	Included in Project Design Budget	Authorities to Approve Designs	N/A	N/A	N/A	As Build Drawings	First Environmental Audit
	Side Slopes	Surface Water: Contamination of the surface water resource due to erosion of the Slimes Dam Side slopes if too steep.	**Moderate Risk**	Prevent erosion of side slopes.	Construct Slimes Dam according to side slope design specification.	**Very Low Risk**	Ferrometals Logistics Manager	Design Phase	Included in Project Design Budget	Included in Project Design Budget	Authorities to Approve Designs	N/A	N/A	N/A	As Build Drawings	First Environmental Audit
	Slurry Delivery and Return Water Pipe Lines	Surface Water: Contamination of the surface water resource due to possible leakages and spillages from slurry and return water pipelines.	**Moderate Risk**	Prevent leakages/ spillages from pipelines.	Enclose pipeline routes in berm walls.	**Very Low Risk**	Ferrometals Logistics Manager	Design Phase	Included in Project Design Budget	Included in Project Design Budget	Authorities to Approve Designs	N/A	N/A	N/A	As Build Drawings	First Environmental Audit

17.1.2 Construction Phase Management Plan

Construction Phase Management Plan																
			Management Measures													
Activity	**Aspect**	**Potential Environmental Impact/Issue**	**Risk Level Before Management**	**Management Objective**	**Proposed Management Measure**	**Risk Level after Management**	**Responsible Person**	**Management Time Schedule**	**Management Budget Quantum**	**Management Budget Allocation/ Provisioning**	**Monitoring Required**	**Monitoring Frequency**	**Monitoring Budget Quantum**	**Monitoring Budget Allocation/ Provisioning**	**Performance Assessment**	**Performance Assessment Time Schedule**
Development of New Slimes Dam	Removal of Vegetation	Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.	**Low Risk**	Prevent contamination of Water Resource.	Construct earth berms around area to be cleared. Preferable to construct during dry season. Settle suspended solids out and analyse for quality before any discharge into environment.	**Very Low Risk**	Ferrometals Logistics Manager	Construction Phase	See Construction Phase Environmental Management Budget	Construction Phase Environmental Management Budget	Water Quality sampling	Monthly	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Plant Life: Destruction of Habitat due to physical removal of vegetation layer.	**Moderate Risk**	Minimize habitat destruction.	Restrict vegetation clearance to development footprint.	**Low Risk**	Ferrometals SHEQ Manager	Construction Phase	See Construction Phase Environmental Management Budget	Construction Phase Environmental Management Budget	Visual Inspection	Daily	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Plant Life: Impact on Biodiversity due to loss of natural habitat.	**Moderate Risk**	Minimize impact on biodiversity	Restrict vegetation clearance to development footprint.	**Low Risk**	Ferrometals SHEQ Manager	Construction Phase	See Construction Phase Environmental Management Budget	Construction Phase Environmental Management Budget	Visual Inspection	Daily	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Plant Life: No threat to Red Data List (RDL) species.	**No Risk**	N/A	-	**No Risk**	-	-	-	-	-	-	-	-	-	-
		Animal Life: Destruction of Habitat due to physical removal of vegetation layer.	**Moderate Risk**	Minimize habitat destruction.	Restrict vegetation clearance to development footprint.	**Low Risk**	Ferrometals SHEQ Manager	Construction Phase	See Construction Phase Environmental Management Budget	Construction Phase Environmental Management Budget	Visual Inspection	Daily	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Animal Life: Impact on Biodiversity due to loss of natural habitat.	**Moderate Risk**	Minimize impact on biodiversity	Restrict vegetation clearance to development footprint.	**Low Risk**	Ferrometals SHEQ Manager	Construction Phase	See Construction Phase Environmental Management Budget	Construction Phase Environmental Management Budget	Visual Inspection	Daily	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Animal Life: No threat to Red Data List (RDL) species.	**No Risk**	N/A	-	**No Risk**	-	-	-	-	-	-	-	-	-	-
	Stripping and Stockpiling of Soils	Soils: Loss of soil horizon due to removal (stripping) of the soil layers during the excavation of the footprint.	**Moderate Risk**	Minimize soil stripping and removal.	Restrict soil stripping to development footprint.	**Low Risk**	Ferrometals SHEQ Manager	Construction Phase	See Construction Phase Environmental Management Budget	Construction Phase Environmental Management Budget	Visual Inspection	Daily	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually

Construction Phase Management Plan																
Activity	Aspect	Potential Environmental Impact/Issue	Management Measures													
			Risk Level Before Management	Management Objective	Proposed Management Measure	Risk Level after Management	Responsible Person	Management Time Schedule	Management Budget Quantum	Management Budget Allocation/ Provisioning	Monitoring Required	Monitoring Frequency	Monitoring Budget Quantum	Monitoring Budget Allocation/ Provisioning	Performance Assessment	Performance Assessment Time Schedule
		Soils: Loss of soil fertility due to inappropriate stockpiling.	**Moderate Risk**	Minimize soil stockpiling.	Conduct stockpiling in accordance with specifications of soil scientist (layering, compaction, final height, etc.)	**Low Risk**	Ferrometals SHEQ Manager	Construction Phase	See Construction Phase Environmental Management Budget	Construction Phase Environmental Management Budget	Visual Inspection	Daily	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.	**Low Risk**	Prevent contamination of Water Resource	Construct earth berms around area to be stripped and around stockpiles. Preferable to construct during dry season. Settle suspended solids out and analyse for quality before any discharge into environment.	**Very Low Risk**	Ferrometals Logistics Manager	Construction Phase	See Construction Phase Environmental Management Budget	Construction Phase Environmental Management Budget	Water Quality sampling	Monthly	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Air Quality (Gaseous Emissions): Deterioration in ambient air quality due to gaseous emissions generated from construction machinery and vehicles.	**Low Risk**	Minimize gaseous emissions.	Service machinery and vehicles on a regular basis. Prevent unnecessary idling of motors.	**Very Low Risk**	Ferrometals Logistics Manager	Construction Phase	See Construction Phase Environmental Management Budget	Construction Phase Environmental Management Budget	Visual Inspection	Continuously	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Air Quality (Dust Fallout): Deterioration in ambient air quality due to dust generated from construction activities.	**Low Risk**	Minimize dust generation.	Perform regular dust suppression of the construction site in a scheduled fashion.	**Very Low Risk**	Ferrometals SHEQ Manager	Construction Phase	See Construction Phase Environmental Management Budget	Construction Phase Environmental Management Budget	Dust fall-out monitoring	Monthly	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Noise: Impact on ambient sound level due to construction activities.	**Low Risk**	Minimize noise impact on ambient sound levels.	Restrict construction activities to daylight hours.	**Very Low Risk**	Ferrometals Logistics Manager	Construction Phase	See Construction Phase Environmental Management Budget	Construction Phase Environmental Management Budget	Complaints register	Continuously	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Noise: Generation of noise due to reverse hooters/alarms from construction machinery and vehicles.	**Low Risk**	Minimize noise generation.	Replace reverse hooters with hiss-type reverse alarms.	**Very Low Risk**	Ferrometals Logistics Manager	Construction Phase	See Construction Phase Environmental Management Budget	Construction Phase Environmental Management Budget	Complaints register	Continuously	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually

Construction Phase Management Plan																
Activity	**Aspect**	**Potential Environmental Impact/Issue**	**Management Measures**													
			Risk Level Before Management	**Management Objective**	**Proposed Management Measure**	**Risk Level after Management**	**Responsible Person**	**Management Time Schedule**	**Management Budget Quantum**	**Management Budget Allocation/ Provisioning**	**Monitoring Required**	**Monitoring Frequency**	**Monitoring Budget Quantum**	**Monitoring Budget Allocation/ Provisioning**	**Performance Assessment**	**Performance Assessment Time Schedule**
	Slimes Dam Liner and Starter Walls	Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.	**Low Risk**	Prevent contamination of Water Resource	Construct earth berms around area of construction. Preferable to construct during dry season. Settle suspended solids out and analyse for quality before any discharge into environment.	**Very Low Risk**	Ferrometals Logistics Manager	Construction Phase	See Construction Phase Environmental Management Budget	Construction Phase Environmental Management Budget	Water Quality sampling	Monthly	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Air Quality (Gaseous Emissions): Deterioration in ambient air quality due to gaseous emissions generated from construction machinery and vehicles.	**Low Risk**	Minimize gaseous emissions.	Service machinery and vehicles on a regular basis. Prevent unnecessary idling of motors.	**Very Low Risk**	Ferrometals Logistics Manager	Construction Phase	See Construction Phase Environmental Management Budget	Construction Phase Environmental Management Budget	Visual Inspection	Continuously	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Air Quality (Dust Fallout): Deterioration in ambient air quality due to dust generated from construction activities.	**Low Risk**	Minimize dust generation.	Preform regular dust suppression of the construction site in a scheduled fashion.	**Very Low Risk**	Ferrometals SHEQ Manager	Construction Phase	See Construction Phase Environmental Management Budget	Construction Phase Environmental Management Budget	Dust fall-out monitoring	Monthly	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Noise: Impact on ambient sound level due to construction activities.	**Low Risk**	Minimize noise impact on ambient sound levels.	Restrict construction activities to daylight hours.	**Very Low Risk**	Ferrometals Logistics Manager	Construction Phase	See Construction Phase Environmental Management Budget	Construction Phase Environmental Management Budget	Complaints register	Continuously	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Noise: Generation of noise due to reverse hooters/alarms from construction machinery and vehicles.	**Low Risk**	Minimize noise generation.	Replace reverse hooters with hiss-type reverse alarms.	**Very Low Risk**	Ferrometals Logistics Manager	Construction Phase	See Construction Phase Environmental Management Budget	Construction Phase Environmental Management Budget	Complaints register	Continuously	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
	Re-routing of the Existing Slurry Pipeline	Surface Water: Contamination of the surface water resource due to spillages from the existing slurry pipeline.	**Low Risk**	Prevent contamination of Water Resource	Construct earth berms around area of construction. Preferable to construct during dry season. Settle suspended solids out and analyse for quality before any discharge into environment.	**Very Low Risk**	Ferrometals Logistics Manager	Construction Phase	See Construction Phase Environmental Management Budget	Construction Phase Environmental Management Budget	Water Quality sampling	Monthly	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually

17.1.3 Operational Phase Management Plan

Operational Phase Management Plan																
Activity	Aspect	Potential Environmental Impact/Issue	Management Measures													
			Risk Level Before Management	Management Objective	Proposed Management Measure	Risk Level after Management	Responsible Person	Management Time Schedule	Management Budget Quantum	Management Budget Allocation/ Provisioning	Monitoring Required	Monitoring Frequency	Monitoring Budget Quantum	Monitoring Budget Allocation/ Provisioning	Performance Assessment	Performance Assessment Time Schedule
Development of New Slimes Dam	Pumping of Slurry along the Slurry Pipe Lines from the Furnaces to the Slimes Dam	Soils: Contamination of soil due to leakages from the slurry pipeline over prolonged periods of time.	**Very Low Risk**	Minimize leakages from pipelines.	Regular maintenance on pipelines.	**Very Low Risk**	Ferrometals Logistics Manager	Operational Phase	See Operational Phase Environmental Management Budget	Operational Phase Environmental Management Budget	Visual Inspection	Daily	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Groundwater: Contamination of the groundwater resource due to the infiltration of leakages/spillages from the slurry pipeline over prolonged periods of time.	**Very Low Risk**	Minimize leakages from pipelines.	Regular maintenance on pipelines.	**Very Low Risk**	Ferrometals Logistics Manager	Operational Phase	See Operational Phase Environmental Management Budget	Operational Phase Environmental Management Budget	Water Quality sampling	Bi-annually	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Surface Water: Contamination of the surface water resource due to incidental spillages/bursts from the slurry pipeline.	**Low Risk**	Minimize leakages from pipelines and migration of spilled water across surface.	Pipeline to be contained in bermed area. Regular maintenance on pipelines. Report pollution incidents to DWA Regional Office within 24 hours.	**Very Low Risk**	Ferrometals Logistics Manager	Operational Phase	See Operational Phase Environmental Management Budget	Operational Phase Environmental Management Budget	Water Quality sampling	Monthly	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
	Deposition of Slurry, Decanting of Water, Building of Day and Night Walls, Collection of Drainage and Seepage from Slimes Dam into the Slimes Dam RWD (existing)	Groundwater: Contamination of the groundwater resource due to the infiltration of leakages/ spillages through the lined footprint over prolonged periods of time.	**Very Low Risk**	Minimize infiltration.	Maintain seepage drains and collection of seepage.	**Very Low Risk**	Ferrometals Logistics Manager	Operational Phase	See Operational Phase Environmental Management Budget	Operational Phase Environmental Management Budget	Water Quality sampling	Bi-annually	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Surface Water: Contamination of the surface water resource due to spillages from the storm water management system.	**Very Low Risk**	Minimize spillages.	Maintain storm water management collection and storage facilities. Report pollution incidents to DWA Regional Office within 24 hours.	**Very Low Risk**	Ferrometals Logistics Manager	Operational Phase	See Operational Phase Environmental Management Budget	Operational Phase Environmental Management Budget	Water Quality sampling	Monthly	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually

Operational Phase Management Plan																
Activity	Aspect	Potential Environmental Impact/Issue	Management Measures													
			Risk Level Before Management	Management Objective	Proposed Management Measure	Risk Level after Management	Responsible Person	Management Time Schedule	Management Budget Quantum	Management Budget Allocation/ Provisioning	Monitoring Required	Monitoring Frequency	Monitoring Budget Quantum	Monitoring Budget Allocation/ Provisioning	Performance Assessment	Performance Assessment Time Schedule
		Air Quality (Dust Fallout): Deterioration in ambient air quality due to windblown dust from dry surfaces.	**Moderate Risk**	Minimize dry surfaces on slimes dam.	Implement rotational deposition cycle on top of slimes dam.	**Very Low Risk**	Ferrometals Logistics Manager	Operational Phase	See Operational Phase Environmental Management Budget	Operational Phase Environmental Management Budget	Dust fall-out monitoring	Monthly	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
	Return of Slimes Decant Water from the Slimes Dam RWD, along the Return Water Pipe Lines to the Furnaces	Soils: Contamination of soil due to leakages from the pipeline over prolonged periods of time.	**Very Low Risk**	Minimize leakages from pipelines.	Regular maintenance on pipelines.	**Very Low Risk**	Ferrometals Logistics Manager	Operational Phase	See Operational Phase Environmental Management Budget	Operational Phase Environmental Management Budget	Visual Inspection	Daily	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Groundwater: Contamination of the groundwater resource due to the infiltration of leakages/spillages from the pipeline over prolonged periods of time.	**Very Low Risk**	Minimize leakages from pipelines.	Regular maintenance on pipelines.	**Very Low Risk**	Ferrometals Logistics Manager	Operational Phase	See Operational Phase Environmental Management Budget	Operational Phase Environmental Management Budget	Water Quality sampling	Bi-annually	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Surface Water: Contamination of the surface water resource due to incidental spillages/bursts from the pipelines.	**Low Risk**	Minimize leakages from pipelines and migration of spilled water across surface.	Pipeline to be contained in bermed area. Regular maintenance on pipelines. Report pollution incidents to DWA Regional Office within 24 hours.	**Very Low Risk**	Ferrometals Logistics Manager	Operational Phase	See Operational Phase Environmental Management Budget	Operational Phase Environmental Management Budget	Water Quality sampling	Monthly	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually

17.1.4 Decommissioning and Closure Phase Management Plan

Decommissioning and Closure Phase Management Plan																
Activity	Aspect	Potential Environmental Impact/Issue	Management Measures													
			Risk Level Before Management	Management Objective	Proposed Management Measure	Risk Level after Management	Responsible Person	Management Time Schedule	Management Budget Quantum	Management Budget Allocation/ Provisioning	Monitoring Required	Monitoring Frequency	Monitoring Budget Quantum	Monitoring Budget Allocation/ Provisioning	Performance Assessment	Performance Assessment Time Schedule
Development of New Slimes Dam	Remove, reclaim and dispose of all pipes, plant and equipment associated with the Slimes Dam	Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.	**Low Risk**	Prevent contamination of Water Resource.	Construct earth berms around area to be cleared. Preferable to decommission during dry season. Settle suspended solids out and analyse for quality before any discharge into environment.	**Very Low Risk**	Ferrometals Logistics Manager	Decommissioning and Closure Phase	See Decommissioning and Closure Phase Environmental Management Budget	Decommissioning and Closure Phase Environmental Management Budget	Water Quality sampling	Monthly	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Air Quality (Gaseous Emissions): Deterioration in ambient air quality due to gaseous emissions generated from construction machinery and vehicles.	**Low Risk**	Minimize gaseous emissions.	Service machinery and vehicles on a regular basis. Prevent unnecessary idling of motors.	**Very Low Risk**	Ferrometals Logistics Manager	Decommissioning and Closure Phase	See Decommissioning and Closure Phase Environmental Management Budget	Decommissioning and Closure Phase Environmental Management Budget	Visual Inspection	Continuously	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Air Quality (Dust Fallout): Deterioration in ambient air quality due to dust generated from decommissioning activities.	**Low Risk**	Minimize dust generation.	Perform regular dust suppression of the decommissioning site in a scheduled fashion.	**Very Low Risk**	Ferrometals SHEQ Manager	Decommissioning and Closure Phase	See Decommissioning and Closure Phase Environmental Management Budget	Decommissioning and Closure Phase Environmental Management Budget	Dust fall-out monitoring	Monthly	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Noise: Impact on ambient sound level due to decommissioning activities.	**Low Risk**	Minimize noise impact on ambient sound levels.	Restrict decommissioning activities to daylight hours.	**Very Low Risk**	Ferrometals Logistics Manager	Decommissioning and Closure Phase	See Decommissioning and Closure Phase Environmental Management Budget	Decommissioning and Closure Phase Environmental Management Budget	Complaints register	Continuously	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Noise: Generation of noise due to reverse hooters/alarms from construction machinery and	**Low Risk**	Minimize noise generation.	Replace reverse hooters with hiss-type reverse alarms.	**Very Low Risk**	Ferrometals Logistics Manager	Decommissioning and Closure Phase	See Decommissioning and Closure Phase Environmental Management Budget	Decommissioning and Closure Phase Environmental Management Budget	Complaints register	Continuously	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually

Decommissioning and Closure Phase Management Plan																
Activity	Aspect	Potential Environmental Impact/Issue	Management Measures													
			Risk Level Before Management	Management Objective	Proposed Management Measure	Risk Level after Management	Responsible Person	Management Time Schedule	Management Budget Quantum	Management Budget Allocation/ Provisioning	Monitoring Required	Monitoring Frequency	Monitoring Budget Quantum	Monitoring Budget Allocation/ Provisioning	Performance Assessment	Performance Assessment Time Schedule
		vehicles.														
	Shape and Cap the Slimes Dam with an appropriate Capping and install Drains and Berms	Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.	**Low Risk**	Prevent contamination of Water Resource.	Construct earth berms around area to be capped. Preferable to construct/decommission during dry season. Settle suspended solids out and analyse for quality before any discharge into environment.	**Very Low Risk**	Ferrometals Logistics Manager	Decommissioning and Closure Phase	See Decommissioning and Closure Phase Environmental Management Budget	Decommissioning and Closure Phase Environmental Management Budget	Water Quality sampling	Monthly	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Air Quality (Gaseous Emissions): Deterioration in ambient air quality due to gaseous emissions generated from construction machinery and vehicles.	**Low Risk**	Minimize gaseous emissions.	Service machinery and vehicles on a regular basis. Prevent unnecessary idling of motors.	**Very Low Risk**	Ferrometals Logistics Manager	Decommissioning and Closure Phase	See Decommissioning and Closure Phase Environmental Management Budget	Decommissioning and Closure Phase Environmental Management Budget	Visual Inspection	Continuously	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Air Quality (Dust Fallout): Deterioration in ambient air quality due to dust generated from capping activities.	**Low Risk**	Minimize dust generation.	Perform regular dust suppression of the capping site in a scheduled fashion.	**Very Low Risk**	Ferrometals SHEQ Manager	Decommissioning and Closure Phase	See Decommissioning and Closure Phase Environmental Management Budget	Decommissioning and Closure Phase Environmental Management Budget	Dust fall-out monitoring	Monthly	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Noise: Impact on ambient sound level due to decommissioning activities.	**Low Risk**	Minimize noise impact on ambient sound levels.	Restrict decommissioning activities to daylight hours.	**Very Low Risk**	Ferrometals Logistics Manager	Decommissioning and Closure Phase	See Decommissioning and Closure Phase Environmental Management Budget	Decommissioning and Closure Phase Environmental Management Budget	Complaints register	Continuously	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Noise: Generation of noise due to reverse hooters/alarms from construction machinery and vehicles	**Low Risk**	Minimize noise generation.	Replace reverse hooters with hiss-type reverse alarms.	**Very Low Risk**	Ferrometals Logistics Manager	Decommissioning and Closure Phase	See Decommissioning and Closure Phase Environmental Management Budget	Decommissioning and Closure Phase Environmental Management Budget	Complaints register	Continuously	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually

Decommissioning and Closure Phase Management Plan																
Activity	Aspect	Potential Environmental Impact/Issue	Management Measures													
			Risk Level Before Management	Management Objective	Proposed Management Measure	Risk Level after Management	Responsible Person	Management Time Schedule	Management Budget Quantum	Management Budget Allocation/ Provisioning	Monitoring Required	Monitoring Frequency	Monitoring Budget Quantum	Monitoring Budget Allocation/ Provisioning	Performance Assessment	Performance Assessment Time Schedule
	Re-vegetate the Capped Slimes Dam	Plant Life: Restoration of Habitat due to re-vegetation of the footprint.	**Moderate Positive Risk**	Ensure successful re-vegetation.	Re-vegetate according to plant specialist recommendations/ specifications.	**High Positive Risk**	Ferrometals SHEQ Manager	Decommissioning and Closure Phase	See Decommissioning and Closure Phase Environmental Management Budget	Decommissioning and Closure Phase Environmental Management Budget	Visual Inspection	Daily	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Plant Life: Restoration of Biodiversity due to the repair of natural vegetation/habitat.	**Moderate Positive Risk**	Ensure successful re-vegetation.	Re-vegetate according to plant specialist recommendations/ specifications.	**High Positive Risk**	Ferrometals SHEQ Manager	Decommissioning and Closure Phase	See Decommissioning and Closure Phase Environmental Management Budget	Decommissioning and Closure Phase Environmental Management Budget	Visual Inspection	Daily	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
Decommissioning and Closure of the current Existing Slimes Dam	Remove, reclaim and dispose of all pipes, plant and equipment associated with the Slimes Dam	Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.	**Low Risk**	Prevent contamination of Water Resource.	Construct earth berms around area to be cleared. Preferable to decommission during dry season. Settle suspended solids out and analyse for quality before any discharge into environment.	**Very Low Risk**	Ferrometals Logistics Manager	Decommissioning and Closure Phase	See Decommissioning and Closure Phase Environmental Management Budget	Decommissioning and Closure Phase Environmental Management Budget	Water Quality sampling	Monthly	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Air Quality (Gaseous Emissions): Deterioration in ambient air quality due to gaseous emissions generated from construction machinery and vehicles	**Low Risk**	Minimize gaseous emissions.	Service machinery and vehicles on a regular basis. Prevent unnecessary idling of motors.	**Very Low Risk**	Ferrometals Logistics Manager	Decommissioning and Closure Phase	See Decommissioning and Closure Phase Environmental Management Budget	Decommissioning and Closure Phase Environmental Management Budget	Visual Inspection	Continuously	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Air Quality (Dust Fallout): Deterioration in ambient air quality due to dust generated from decommissioning activities.	**Low Risk**	Minimize dust generation.	Perform regular dust suppression of the decommissioning site in a scheduled fashion.	**Very Low Risk**	Ferrometals SHEQ Manager	Decommissioning and Closure Phase	See Decommissioning and Closure Phase Environmental Management Budget	Decommissioning and Closure Phase Environmental Management Budget	Dust fall-out monitoring	Monthly	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually

Decommissioning and Closure Phase Management Plan																
Activity	Aspect	Potential Environmental Impact/Issue	Management Measures													
			Risk Level Before Management	Management Objective	Proposed Management Measure	Risk Level after Management	Responsible Person	Management Time Schedule	Management Budget Quantum	Management Budget Allocation/ Provisioning	Monitoring Required	Monitoring Frequency	Monitoring Budget Quantum	Monitoring Budget Allocation/ Provisioning	Performance Assessment	Performance Assessment Time Schedule
		Noise: Impact on ambient sound level due to decommissioning activities.	**Low Risk**	Minimize noise impact on ambient sound levels.	Restrict decommissioning activities to daylight hours.	**Very Low Risk**	Ferrometals Logistics Manager	Decommissioning and Closure Phase	See Decommissioning and Closure Phase Environmental Management Budget	Decommissioning and Closure Phase Environmental Management Budget	Complaints register	Continuously	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Noise: Generation of noise due to reverse hooters/alarms from construction machinery and vehicles.	**Low Risk**	Minimize noise generation.	Replace reverse hooters with hiss-type reverse alarms.	**Very Low Risk**	Ferrometals Logistics Manager	Decommissioning and Closure Phase	See Decommissioning and Closure Phase Environmental Management Budget	Decommissioning and Closure Phase Environmental Management Budget	Complaints register	Continuously	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
	Shape and Cap the Slimes Dam with an appropriate Capping and install Drains and Berms	Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.	**Low Risk**	Prevent contamination of Water Resource.	Construct earth berms around area to be capped. Preferable to construct/decommission during dry season. Settle suspended solids out and analyse for quality before any discharge into environment.	**Very Low Risk**	Ferrometals Logistics Manager	Decommissioning and Closure Phase	See Decommissioning and Closure Phase Environmental Management Budget	Decommissioning and Closure Phase Environmental Management Budget	Water Quality sampling	Monthly	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Air Quality (Gaseous Emissions): Deterioration in ambient air quality due to gaseous emissions generated from construction machinery and vehicles	**Low Risk**	Minimize gaseous emissions.	Service machinery and vehicles on a regular basis. Prevent unnecessary idling of motors.	**Very Low Risk**	Ferrometals Logistics Manager	Decommissioning and Closure Phase	See Decommissioning and Closure Phase Environmental Management Budget	Decommissioning and Closure Phase Environmental Management Budget	Visual Inspection	Continuously	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Air Quality (Dust Fallout): Deterioration in ambient air quality due to dust generated from capping activities.	**Low Risk**	Minimize dust generation.	Perform regular dust suppression of the capping site in a scheduled fashion.	**Very Low Risk**	Ferrometals SHEQ Manager	Decommissioning and Closure Phase	See Decommissioning and Closure Phase Environmental Management Budget	Decommissioning and Closure Phase Environmental Management Budget	Dust fall-out monitoring	Monthly	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually

Decommissioning and Closure Phase Management Plan																
Activity	Aspect	Potential Environmental Impact/Issue	Management Measures													
			Risk Level Before Management	Management Objective	Proposed Management Measure	Risk Level after Management	Responsible Person	Management Time Schedule	Management Budget Quantum	Management Budget Allocation/ Provisioning	Monitoring Required	Monitoring Frequency	Monitoring Budget Quantum	Monitoring Budget Allocation/ Provisioning	Performance Assessment	Performance Assessment Time Schedule
		Noise: Impact on ambient sound level due to decommissioning activities.	Low Risk	Minimize noise impact on ambient sound levels.	Restrict decommissioning activities to daylight hours.	Very Low Risk	Ferrometals Logistics Manager	Decommissioning and Closure Phase	See Decommissioning and Closure Phase Environmental Management Budget	Decommissioning and Closure Phase Environmental Management Budget	Complaints register	Continuously	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Noise: Generation of noise due to reverse hooters/alarms from construction machinery and vehicles	Low Risk	Minimize noise generation.	Replace reverse hooters with hiss-type reverse alarms.	Very Low Risk	Ferrometals Logistics Manager	Decommissioning and Closure Phase	See Decommissioning and Closure Phase Environmental Management Budget	Decommissioning and Closure Phase Environmental Management Budget	Complaints register	Continuously	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
	Re-vegetate the Capped Slimes Dam	Plant Life: Restoration of Habitat due to re-vegetation of the footprint.	Moderate Positive Risk	Ensure successful re-vegetation.	Re-vegetate according to plant specialist recommendations/ specifications.	High Positive Risk	Ferrometals SHEQ Manager	Decommissioning and Closure Phase	See Decommissioning and Closure Phase Environmental Management Budget	Decommissioning and Closure Phase Environmental Management Budget	Visual Inspection	Daily	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Plant Life: Restoration of Biodiversity due to the repair of natural vegetation/habitat.	Moderate Positive Risk	Ensure successful re-vegetation.	Re-vegetate according to plant specialist recommendations/ specifications.	High Positive Risk	Ferrometals SHEQ Manager	Decommissioning and Closure Phase	See Decommissioning and Closure Phase Environmental Management Budget	Decommissioning and Closure Phase Environmental Management Budget	Visual Inspection	Daily	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually

17.1.5 Post Closure Management Plan

Post Closure Phase Management Plan																	
			Management Measures														
Activity	**Aspect**	**Potential Environmental Impact/Issue**	**Risk Level Before Management**	**Management Objective**	**Proposed Management Measure**	**Risk Level after Management**	**Responsible Person**	**Management Time Schedule**	**Management Budget Quantum**	**Management Budget Allocation/ Provisioning**	**Monitoring Required**	**Monitoring Frequency**	**Monitoring Budget Quantum**	**Monitoring Budget Allocation/ Provisioning**	**Performance Assessment**	**Performance Assessment Time Schedule**	
Development of New Slimes Dam	Ineffective Vegetation Cover	Soils: Loss of soil horizon due to erosion and surface water run-off.	**Low Risk**	Maintain stable vegetation cover.	Conduct bi-annual vegetation condition assessments. Implement recommendations (fertilization, irrigation, removal of aliens, etc.) as per outcome of assessment.	**Very Low Risk**	Ferrometals SHEQ Manager	Post Closure Phase	See Post Closure Phase Environmental Management Budget	Post Closure Phase Environmental Management Budget	Visual Inspection	Bi-annually	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually	
		Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.	**Low Risk**	Maintain zero quality impact on surface water resources.	Conduct bi-annual assessment of storm water management measures. Implement recommendations (maintain run-off shutes, vegetation, etc.) as per outcome of assessment.	**Very Low Risk**	Ferrometals SHEQ Manager	Post Closure Phase	See Post Closure Phase Environmental Management Budget	Post Closure Phase Environmental Management Budget	Water Quality sampling	Bi-annually	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually	
		Plant Life: Loss of habitat due to vegetation cover not returning to natural state.	**Very Low Risk**	Maintain stable vegetation habitat.	Conduct bi-annual vegetation condition assessments. Implement recommendations (fertilization, irrigation, removal of aliens, etc.) as per outcome of assessment.	**Very Low Risk**	Ferrometals SHEQ Manager	Post Closure Phase	See Post Closure Phase Environmental Management Budget	Post Closure Phase Environmental Management Budget	Visual Inspection	Bi-annually	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually	
		Plant Life: Loss of biodiversity due to a loss of habitat.	**Very Low Risk**	Maintain stable vegetation biodiversity.	Conduct bi-annual vegetation condition assessments. Implement recommendations (fertilization, irrigation, removal of aliens, etc.) as per outcome of assessment.	**Very Low Risk**	Ferrometals SHEQ Manager	Post Closure Phase	See Post Closure Phase Environmental Management Budget	Post Closure Phase Environmental Management Budget	Visual Inspection	Bi-annually	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually	
		Animal Life: Loss of habitat due to vegetation cover not returning to natural state.	**Very Low Risk**	Maintain stable faunal habitat.	Conduct bi-annual faunal condition assessments. Implement recommendations as pertaining to vegetation cover and diversity.	**Very Low Risk**	Ferrometals SHEQ Manager	Post Closure Phase	See Post Closure Phase Environmental Management Budget	Post Closure Phase Environmental Management Budget	Visual Inspection	Bi-annually	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually	
		Animal Life: Loss of biodiversity due to a loss of habitat.	**Very Low Risk**	Maintain stable faunal biodiversity.	Conduct bi-annual faunal condition assessments. Implement recommendations as pertaining to vegetation cover and diversity.	**Very Low Risk**	Ferrometals SHEQ Manager	Post Closure Phase	See Post Closure Phase Environmental Management Budget	Post Closure Phase Environmental Management Budget	Visual Inspection	Bi-annually	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually	

Post Closure Phase Management Plan																
Activity	**Aspect**	**Potential Environmental Impact/Issue**	**Management Measures**													
			Risk Level Before Management	**Management Objective**	**Proposed Management Measure**	**Risk Level after Management**	**Responsible Person**	**Management Time Schedule**	**Management Budget Quantum**	**Management Budget Allocation/ Provisioning**	**Monitoring Required**	**Monitoring Frequency**	**Monitoring Budget Quantum**	**Monitoring Budget Allocation/ Provisioning**	**Performance Assessment**	**Performance Assessment Time Schedule**
		Air Quality (Dust Fallout): Deterioration in ambient air quality due to windblown dust generated from denuded surfaces.	**Low Risk**	Maintain zero dust fallout.	Conduct bi-annual vegetation condition assessments. Implement recommendations (fertilization, irrigation, removal of aliens, etc.) as per outcome of assessment.	**Very Low Risk**	Ferrometals SHEQ Manager	Post Closure Phase	See Post Closure Phase Environmental Management Budget	Post Closure Phase Environmental Management Budget	Visual Inspection	Bi-annually	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
	Ineffective Capping System	Groundwater: Contamination of the groundwater resource due to infiltration of rainwater through the capping and the subsequent infiltration of contaminated water through the footprint of the Slimes Dam into the sub-surface.	**Very Low Risk**	Minimize infiltration.	Conduct bi-annual assessment of capping system. Implement recommendations (maintain run-off shutes, vegetation, etc.) as per outcome of assessment.	**Very Low Risk**	Ferrometals SHEQ Manager	Post Closure Phase	See Post Closure Phase Environmental Management Budget	Post Closure Phase Environmental Management Budget	Water Quality sampling	Bi-annually	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
	Ineffective Seepage Drainage and Collection System	Groundwater: Contamination of the groundwater resource due to seepage of contaminated water through the footprint of the Slimes Dam into the sub-surface.	**Very Low Risk**	Minimize infiltration.	Conduct bi-annual assessment of seepage drains and collection system. Implement recommendations as per outcome of assessment.	**Very Low Risk**	Ferrometals SHEQ Manager	Post Closure Phase	See Post Closure Phase Environmental Management Budget	Post Closure Phase Environmental Management Budget	Water Quality sampling	Bi-annually	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
	Ineffective Storm Water Drainage System	Soils: Loss of soil horizon due to erosion.	**Very Low Risk**	Maintain stable vegetation cover.	Conduct bi-annual vegetation condition assessments. Implement recommendations (fertilization, irrigation, removal of aliens, etc.) as per outcome of assessment.	**Very Low Risk**	Ferrometals SHEQ Manager	Post Closure Phase	See Post Closure Phase Environmental Management Budget	Post Closure Phase Environmental Management Budget	Visual Inspection	Bi-annually	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Soils: Contamination of soil due to toe seepages and storm water run-off.	**Very Low Risk**	Prevent toe seepages.	Conduct bi-annual assessment of seepage drains and collection system. Implement recommendations as per outcome of assessment.	**Very Low Risk**	Ferrometals SHEQ Manager	Post Closure Phase	See Post Closure Phase Environmental Management Budget	Post Closure Phase Environmental Management Budget	Visual Inspection	Bi-annually	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.	**Very Low Risk**	Maintain zero quality impact on surface water resources.	Conduct bi-annual assessment of storm water management measures. Implement recommendations (maintain run-off shutes, vegetation, etc.) as per outcome of assessment.	**Very Low Risk**	Ferrometals SHEQ Manager	Post Closure Phase	See Post Closure Phase Environmental Management Budget	Post Closure Phase Environmental Management Budget	Water Quality sampling	Bi-annually	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually

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Post Closure Phase Management Plan																
Activity	Aspect	Potential Environmental Impact/Issue	Management Measures													
			Risk Level Before Management	Management Objective	Proposed Management Measure	Risk Level after Management	Responsible Person	Management Time Schedule	Management Budget Quantum	Management Budget Allocation/ Provisioning	Monitoring Required	Monitoring Frequency	Monitoring Budget Quantum	Monitoring Budget Allocation/ Provisioning	Performance Assessment	Performance Assessment Time Schedule
Decommissioning and Closure of the current Existing Slimes Dam	Ineffective Vegetation Cover	Soils: Loss of soil horizon due to erosion and surface water run-off.	**Low Risk**	Maintain stable vegetation cover.	Conduct bi-annual vegetation condition assessments. Implement recommendations (fertilization, irrigation, removal of aliens, etc.) as per outcome of assessment.	**Very Low Risk**	Ferrometals SHEQ Manager	Post Closure Phase	See Post Closure Phase Environmental Management Budget	Post Closure Phase Environmental Management Budget	Visual Inspection	Bi-annually	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.	**Low Risk**	Maintain zero quality impact on surface water resources.	Conduct bi-annual assessment of storm water management measures. Implement recommendations (maintain run-off shutes, vegetation, etc.) as per outcome of assessment.	**Very Low Risk**	Ferrometals SHEQ Manager	Post Closure Phase	See Post Closure Phase Environmental Management Budget	Post Closure Phase Environmental Management Budget	Water Quality sampling	Bi-annually	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Plant Life: Loss of habitat due to vegetation cover not returning to natural state.	**Very Low Risk**	Maintain stable vegetation habitat.	Conduct bi-annual vegetation condition assessments. Implement recommendations (fertilization, irrigation, removal of aliens, etc.) as per outcome of assessment.	**Very Low Risk**	Ferrometals SHEQ Manager	Post Closure Phase	See Post Closure Phase Environmental Management Budget	Post Closure Phase Environmental Management Budget	Visual Inspection	Bi-annually	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Plant Life: Loss of biodiversity due to a loss of habitat.	**Very Low Risk**	Maintain stable vegetation biodiversity.	Conduct bi-annual vegetation condition assessments. Implement recommendations (fertilization, irrigation, removal of aliens, etc.) as per outcome of assessment.	**Very Low Risk**	Ferrometals SHEQ Manager	Post Closure Phase	See Post Closure Phase Environmental Management Budget	Post Closure Phase Environmental Management Budget	Visual Inspection	Bi-annually	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Animal Life: Loss of habitat due to vegetation cover not returning to natural state.	**Very Low Risk**	Maintain stable faunal habitat.	Conduct bi-annual faunal condition assessments. Implement recommendations as pertaining to vegetation cover and diversity.	**Very Low Risk**	Ferrometals SHEQ Manager	Post Closure Phase	See Post Closure Phase Environmental Management Budget	Post Closure Phase Environmental Management Budget	Visual Inspection	Bi-annually	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Animal Life: Loss of biodiversity due to a loss of habitat.	**Very Low Risk**	Maintain stable faunal biodiversity.	Conduct bi-annual faunal condition assessments. Implement recommendations as pertaining to vegetation cover and diversity.	**Very Low Risk**	Ferrometals SHEQ Manager	Post Closure Phase	See Post Closure Phase Environmental Management Budget	Post Closure Phase Environmental Management Budget	Visual Inspection	Bi-annually	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Air Quality (Dust Fallout): Deterioration in ambient air quality due to windblown dust generated from denuded surfaces.	**Low Risk**	Maintain zero dust fallout.	Conduct bi-annual vegetation condition assessments. Implement recommendations (fertilization, irrigation, removal of aliens, etc.) as per outcome of	**Very Low Risk**	Ferrometals SHEQ Manager	Post Closure Phase	See Post Closure Phase Environmental Management Budget	Post Closure Phase Environmental Management Budget	Visual Inspection	Bi-annually	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually

Post Closure Phase Management Plan																	
Activity	Aspect	Potential Environmental Impact/Issue	Management Measures														
			Risk Level Before Management	Management Objective	Proposed Management Measure	Risk Level after Management	Responsible Person	Management Time Schedule	Management Budget Quantum	Management Budget Allocation/ Provisioning	Monitoring Required	Monitoring Frequency	Monitoring Budget Quantum	Monitoring Budget Allocation/ Provisioning	Performance Assessment	Performance Assessment Time Schedule
					assessment.											
	Ineffective Capping System	Groundwater: Contamination of the groundwater resource due to infiltration of contaminated water through the footprint of the Slimes Dam into the sub-surface.	**Very Low Risk**	Minimize infiltration.	Conduct bi-annual assessment of capping system. Implement recommendations (maintain run-off shutes, vegetation, etc.) as per outcome of assessment.	**Very Low Risk**	Ferrometals SHEQ Manager	Post Closure Phase	See Post Closure Phase Environmental Management Budget	Post Closure Phase Environmental Management Budget	Water Quality sampling	Bi-annually	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
	Ineffective Seepage Drainage and Collection System	Groundwater: Contamination of the groundwater resource due to seepage of contaminated water through the footprint of the Slimes Dam into the sub-surface.	**Very Low Risk**	Minimize infiltration.	Conduct bi-annual assessment of seepage drains and collection system. Implement recommendations as per outcome of assessment.	**Very Low Risk**	Ferrometals SHEQ Manager	Post Closure Phase	See Post Closure Phase Environmental Management Budget	Post Closure Phase Environmental Management Budget	Water Quality sampling	Bi-annually	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
	Ineffective Storm Water Drainage System	Soils: Loss of soil horizon due to erosion.	**Very Low Risk**	Maintain stable vegetation cover.	Conduct bi-annual vegetation condition assessments. Implement recommendations (fertilization, irrigation, removal of aliens, etc.) as per outcome of assessment.	**Very Low Risk**	Ferrometals SHEQ Manager	Post Closure Phase	See Post Closure Phase Environmental Management Budget	Post Closure Phase Environmental Management Budget	Visual Inspection	Bi-annually	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Soils: Contamination of soil due to toe seepages and storm water run-off.	**Very Low Risk**	Prevent toe seepages.	Conduct bi-annual assessment of seepage drains and collection system. Implement recommendations as per outcome of assessment.	**Very Low Risk**	Ferrometals SHEQ Manager	Post Closure Phase	See Post Closure Phase Environmental Management Budget	Post Closure Phase Environmental Management Budget	Visual Inspection	Bi-annually	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually
		Surface Water: Contamination of the surface water resource due to erosion caused by storm water runoff and surface water discharge with high suspended solids load.	**Very Low Risk**	Maintain zero quality impact on surface water resources.	Conduct bi-annual assessment of storm water management measures. Implement recommendations (maintain run-off shutes, vegetation, etc.) as per outcome of assessment.	**Very Low Risk**	Ferrometals SHEQ Manager	Post Closure Phase	See Post Closure Phase Environmental Management Budget	Post Closure Phase Environmental Management Budget	Water Quality sampling	Bi-annually	Environmental Monitoring Budget	Environmental Monitoring Budget	EMP Audit	Annually

17.2 ENVIRONMENTAL MANAGEMENT BUDGET

17.2.1 Construction Phase Environmental Management Budget

CONSTRUCTION PHASE ENVIRONMENTAL MANAGEMENT BUDGET			
IMPACTS REQUIRING MANAGEMENT	**FUNCTIONAL MANAGEMENT REQUIREMENTS**	**BUDGET ALLOCATION**	**ANNUAL MANAGEMENT BUDGET**
Soils Impacts	**Soil Stripping and Stockpiling in accordance with Soil Specialist Specifications**	**Construction Phase Environmental Management Budget**	**R 230 000.00**
Surface Water Impacts	**Construct earth berms around the area to be cleared**	**Construction Phase Environmental Management Budget**	**R80 000.00**
Plant Life Impacts	**Restrict vegetation clearance to development footprint**	**Construction Phase Environmental Management Budget**	**R5 000.00**
Animal Life Impacts	**Restrict vegetation clearance to development footprint**	**Construction Phase Environmental Management Budget**	**R5 000.00**
Air Quality Impacts	**1. Service machinery and vehicles on a regular basis. Prevent unnecessary idling of motors**	**Construction Phase Environmental Management Budget**	**R5 000.00**
	2. Perform regular dust suppression of the construction site in a scheduled fashion	**Construction Phase Environmental Management Budget**	**R5 000.00**
Noise Impacts	**1. Restrict activities to daylight hours**	**Construction Phase Environmental Management Budget**	**R5 000.00**
	2. Replace reverse hooters with hiss-type reverse alarms	**Construction Phase Environmental Management Budget**	**R5 000.00**
Regulatory Compliance	**Compliance Audits for EIA, EMP, Integrated Water Use License and Waste License**	**Construction Phase Environmental Management Budget**	**R20 000.00**
Total Annual Management Costs			**R 360 000.00**

17.2.2 Operational Phase Environmental Management Budget

OPERATIONAL PHASE ENVIRONMENTAL MANAGEMENT BUDGET			
IMPACTS REQUIRING MANAGEMENT	**FUNCTIONAL MANAGEMENT REQUIREMENTS**	**BUDGET ALLOCATION**	**ANNUAL MANAGEMENT BUDGET**
Soils Impacts	**Maintain Slurry and Return Water Pipelines**	**Operational Phase Environmental Management Budget**	**R10 000.00**
Groundwater Impacts	**1. Maintain Slurry and Return Water Pipelines**	**Operational Phase Environmental Management Budget**	**R10 000.00**
	2. Maintain Seepage Drains	**Operational Phase Environmental Management Budget**	**R5 000.00**
Surface Water Impacts	**Maintain Slurry and Return Water Pipelines**	**Operational Phase Environmental Management Budget**	**R10 000.00**
Air Quality Impacts	**1. Service machinery and vehicles on a regular basis. Prevent unnecessary idling of motors**	**Operational Phase Environmental Management Budget**	**R5 000.00**
	2. Implement rotational deposition cycle on top of slimes dam	**Operational Phase Environmental Management Budget**	**R5 000.00**
Regulatory Compliance	**Compliance Audits for EIA, EMP, Integrated Water Use License and Waste License**	**Operational Phase Environmental Management Budget**	**R20 000.00**
Total Annual Management Costs			**R 65 000.00**

17.2.3 Decommissioning and Closure Phase Environmental Management Budget

DECOMMISSIONING AND CLOSURE PHASE ENVIRONMENTAL MANAGEMENT BUDGET			
IMPACTS REQUIRING MANAGEMENT	**FUNCTIONAL MANAGEMENT REQUIREMENTS**	**BUDGET ALLOCATION**	**ANNUAL MANAGEMENT BUDGET**
Surface Water Impacts	**Construct earth berms around the area to be cleared**	**Decommissioning and Closure Phase Environmental Management Budget**	**R 80 000.00**
Plant Life Impacts	**Re-vegetate according to plant specialist recommendations/specifications**	**Decommissioning and Closure Phase Environmental Management Budget**	**R 50 000.00**
Air Quality Impacts	**1. Service machinery and vehicles on a regular basis. Prevent unnecessary idling of motors**	**Decommissioning and Closure Phase Environmental Management Budget**	**R 5 000.00**
	2. Perform regular dust suppression of the decommissioning site in a scheduled fashion	**Decommissioning and Closure Phase Environmental Management Budget**	**R 5 000.00**
Noise Impacts	**1. Restrict activities to daylight hours**	**Decommissioning and Closure Phase Environmental Management Budget**	**R5 000.00**
	2. Replace reverse hooters with hiss-type reverse alarms	**Decommissioning and Closure Phase Environmental Management Budget**	**R 5 000.00**
Regulatory Compliance	**Compliance Audits for EIA, EMP, Integrated Water Use License and Waste License**	**Decommissioning and Closure Phase Environmental Management Budget**	**R 20 000.00**
Total Annual Management Costs			**R 170 000.00**

17.2.4 Post Closure Phase Environmental Management Budget

POST CLOSURE PHASE ENVIRONMENTAL MANAGEMENT BUDGET			
IMPACTS REQUIRING MANAGEMENT	**FUNCTIONAL MANAGEMENT REQUIREMENTS**	**BUDGET ALLOCATION**	**ANNUAL MANAGEMENT BUDGET**
Soils Impacts	**Maintain Stable Vegetation Cover**	**Post Closure Phase Environmental Management Budget**	**R 30 000.00**
Groundwater Impacts	**Maintain Capping and Seepage Drains and Collection Systems**	**Post Closure Phase Environmental Management Budget**	**R 10 000.00**
Surface Water Impacts	**Maintain Storm Water management collection and Storage Facilities**	**Post Closure Phase Environmental Management Budget**	**R 20 000.00**
Plant Life Impacts	**Maintain Stable Vegetation Habitat**	**Post Closure Phase Environmental Management Budget**	**R 5 000.00**
Animal Life Impacts	**Maintain Stable Faunal Habitat**	**Post Closure Phase Environmental Management Budget**	**R 5 000.00**
Regulatory Compliance	**Compliance Audits for EIA, EMP, Integrated Water Use License and Waste License**	**Post Closure Phase Environmental Management Budget**	**R 20 000.00**
Total Annual Management Costs			**R 90 000.00**

18. ENVIRONMENTAL MONITORING SYSTEM

Specified in the Environmental Impact Assessment Regulations – GNR 543 of 2010; 31(2) (p) a draft Environmental Management Programme (EMP) should contain the aspects contemplated in regulation 33;

33(e) proposed mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon;

18.1 MONITORING REQUIREMENTS

Formal monitoring systems/recommendations have been designed for each of the environmental components on which the two activities (the **development of a New Slimes Dam** the d**ecommissioning and closure of the current Existing Slimes Dam**) will potentially have an impact on that require monitoring:

- soils monitoring
- groundwater monitoring
- surface water monitoring
- plant life monitoring
- animal life monitoring
- air quality monitoring

18.1.1 Soils Monitoring

Planning and Design Phase:
No monitoring is necessary during this phase.

Construction Phase:
During the soil stripping and stockpiling procedures, visual inspections should be done daily to ensure that the soil stripping is restricted to the development footprint. In addition, visual inspections should also be carried out on a daily basis to ensure that the stockpiling (layering, compaction, final height etc.) is completed in accordance to the specification set out by a soil scientist.

Operational Phase:
Visual inspection should be done daily on the pipelines that pump the slurry from the furnaces to the slimes dam as well on the return water pipelines that carry the slimes dam decant water from the slimes dam return water dam to the furnaces, to ensure that leakages from the pipelines can be contained and rectified in a pro-active manner.

Decommissioning and Closure Phase:
No monitoring is necessary during this phase.

Post Closure Phase:
During this phase an ineffective vegetation cover an ineffective storm water drainage system could lead to loss in soil horizon as a result of erosion and surface water run-off. Visual inspections on the condition of the vegetation should be carried out bi-annually. If the condition of the vegetation is not optimal, management measures such as fertilization, irrigation and removal of alien species should be implemented and the success thereof monitored.

In addition, these bi-annual visual inspections should also include an assessment of the seepage drains and collection systems to ensure that contamination of the soil due to toe seepages and storm water run-off is prevented as far possible.

18.1.2 Groundwater Monitoring

The Groundwater Quality Monitoring represents a scientific exercise and therefore strict compliance with regards to the technical protocols that is required to ensure the scientific integrity of the data generated.

The dynamics of any operation, inevitably leads to ever changing environmental impacts and consequent changes to environmental monitoring requirements. As such, this Groundwater Monitoring System is structured according to a modular format to facilitate easy upgrading/expansion of the technical components to accommodate not only future component additions, but also to streamline the upgrading process which may become necessary for individual components.

The Groundwater monitoring protocol discussed in the sections below should be implemented during the Operational and Post Closure Phases.

Monitoring Infrastructure/Sites/Localities

In an effective monitoring system it is essential that all monitoring localities are optimally selected, formally listed and systematically named. The selection of the localities and the technical specifications for the monitoring/sampling points are critical, as they need to supply data of high integrity, which will support impact and risk assessment, related to the various environmental components being monitored, in support of Risk Based Environmental Management, according to the Source-Pathway-Receptor hierarchy.

In order to facilitate seamless interpretation and display of data, all data points should be geographically referenced into a Geographical Information System (GIS) and plotted on a map of reasonable scale.

Refer to Figure 18.1.2(a) that indicates the groundwater monitoring localities which form part of the current Existing Slimes Dam facility as well as Figure 18.1.2 (b) which form part of the New Slimes Dam Facility.

Table 18.1.2(a) contains the coordinates of all the groundwater monitoring localities; the localities currently monitored at the Existing Slimes Dam Facility as well as the for the localities proposed to be monitored at the New Slimes Dam Facility.

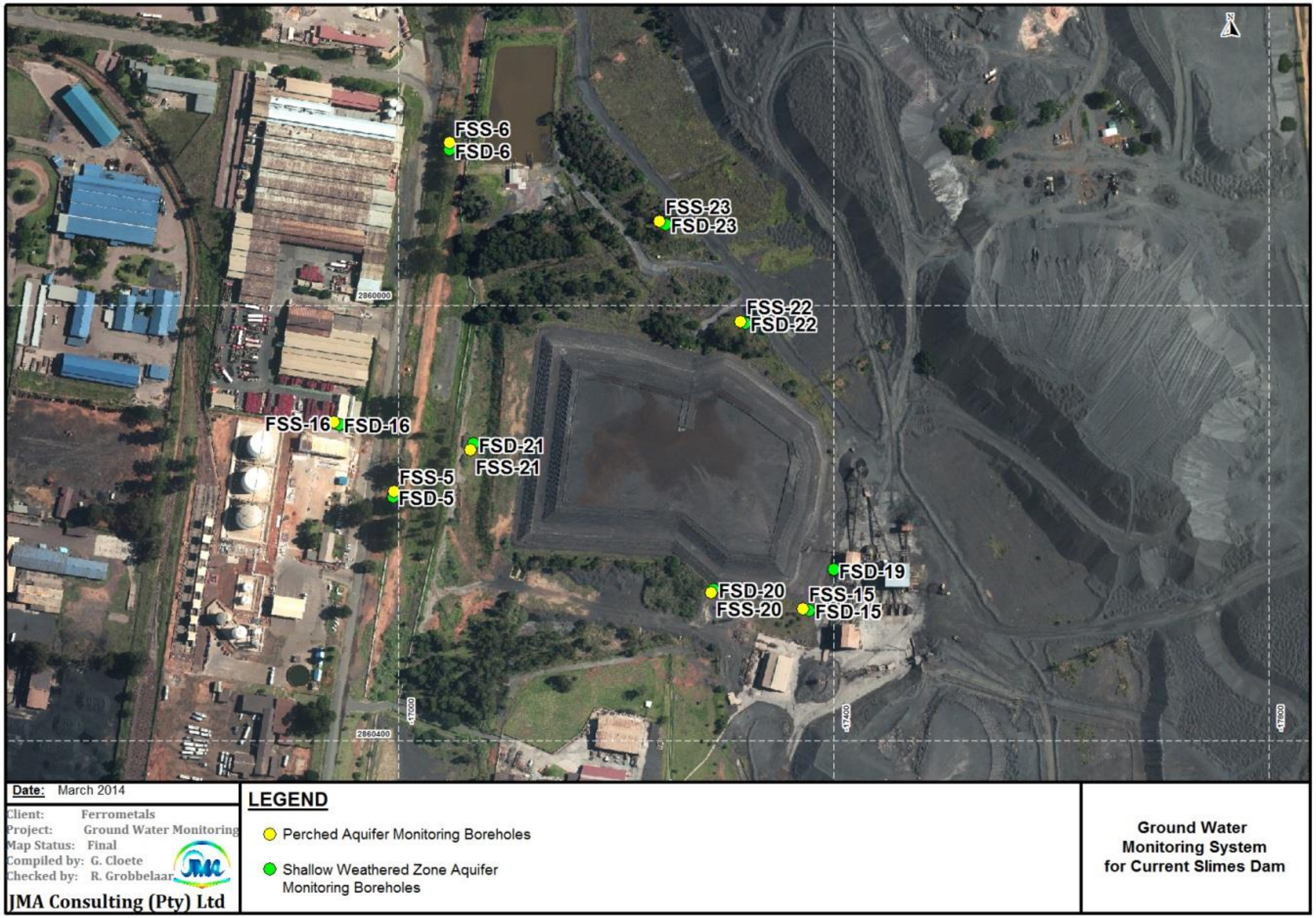

Figure 18.1.2(a): Ferrometals Groundwater Monitoring System at the Current Existing Slimes Dam

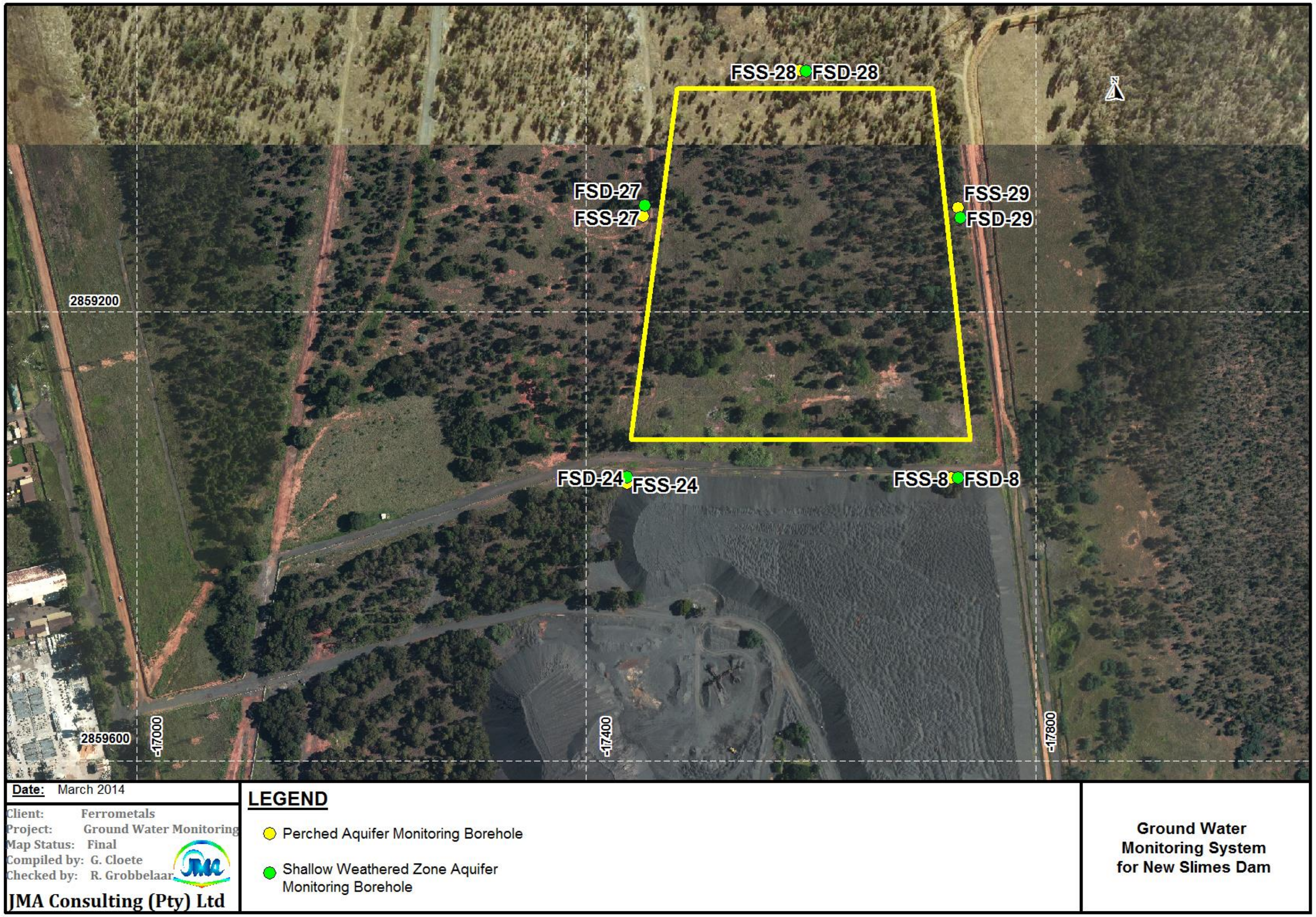

Figure 18.1.2(b): Ferrometals Groundwater Monitoring System at the New Slimes Dam

Table 18.1.2(a): Coordinates of the Ferrometals Groundwater Mmonitoring Boreholes

Monitoring locality	Management Area	Description	Latitude: Longitude
Current Existing Slimes Dam Groundwater Monitoring Localities			
FSS 5	**Current Existing Slimes Dam**	Western Perimeter, west of Northern Slimes Dam	25.8522°S 29.1692°E
FSD 5	**Current Existing Slimes Dam**	Western Perimeter, west of Northern Slimes Dam	25.8522°S 29.1692°E
FSS 6	**Current Existing Slimes Dam**	Western Perimeter, Process Water Dam	25.8493°S 29.1697°E
FSD 6	**Current Existing Slimes Dam**	Western Perimeter, Process Water Dam	25.8493°S 29.1697°E
FSS 15	**Current Existing Slimes Dam**	Northern Slimes Dam / Chrome Recovery Plant	25.8532°S 29.1730°E
FSD 15	**Current Existing Slimes Dam**	Northern Slimes Dam / Chrome Recovery Plant	25.8532°S 29.1730°E
FSS 16	**Current Existing Slimes Dam**	Plume Monitoring Borehole, west of the Northern Slimes Dam (Receiving environment)	25.8516°S 29.1687°E
FSD 16	**Current Existing Slimes Dam**	Plume Monitoring Borehole, west of the Northern Slimes Dam (Receiving environment)	25.8516°S 29.1687°E
FSD 19	**Current Existing Slimes Dam**	West of the Northern Slimes Dam	25.8528°S 29.1733°E
FSS 20	**Current Existing Slimes Dam**	South of the Northern Slimes Dam	25.8530°S 29.1721°E
FSD 20	**Current Existing Slimes Dam**	South of the Northern Slimes Dam	25.8530°S 29.1722°E
FSS 21	**Current Existing Slimes Dam**	West of the Northern Slimes Dam	25.8518°S 29.1699°E
FSD 21	**Current Existing Slimes Dam**	West of the Northern Slimes Dam	25.8518°S 29.1700°E

Monitoring locality	Management Area	Description	Latitude: Longitude
FSS 22	**Current Existing Slimes Dam**	North of the Northern Slimes Dam	25.8508°S 29.1724°E
FSD 22	**Current Existing Slimes Dam**	North of the Northern Slimes Dam	25.8508°S 29.1724°E
FSS 23	**Current Existing Slimes Dam**	West of the Slag Dump Area	25.8499°S 29.1717°E
FSD 23	**Current Existing Slimes Dam**	West of the Slag Dump Area	25.8500°S 29.1717°E
New Slimes Dam Groundwater Monitoring Localities			
FSS 8	**New Slimes Dam Facility**	Slag Dump Area	25.8447°S 29.1765°E
FSD 8	**New Slimes Dam Facility**	Slag Dump Area	25.8447°S 29.1766°E
FSS 24	**New Slimes Dam Facility**	Northern Perimeter Slag Dump	25.8448°S 29.1736°E
FSD 24	**New Slimes Dam Facility**	Northern Perimeter Slag Dump	25.8447°S 29.1736°E
FSS 27	**New Slimes Dam Facility**	West of New Slimes Dam	25.842559°S 29.173856°E
FSD 27	**New Slimes Dam Facility**	West of New Slimes Dam	25.842477°S 29.173862°E
FSS 28	**New Slimes Dam Facility**	North of New Slimes Dam	25.841537°S 29.175244°E
FSD 28	**New Slimes Dam Facility**	North of New Slimes Dam	25.841534°S 29.175318°E
FSS 29	**New Slimes Dam Facility**	East of New Slimes Dam	25.842634°S 29.176628°E
FSD 29	**New Slimes Dam Facility**	East of New Slimes Dam	25.842696°S 29.176640°E

Data Capture Protocols

Data capture protocols need to be developed for the various sampling localities. Aspects such as sampling technique, sampling equipment, sampling frequency, sample preservation, analysing technique, and variables to be analysed for, need to be formalized and documented, to ensure that the information generation protocols required to turn the data into Impact and Risk Assessment information, are supported.

Monitoring/Sampling Frequency

The frequency of monitoring/sampling should at all times be a combined function of the sampling objectives and the expected variability in the parameter(s) to be monitored. In the case of groundwater the quality thereof is less variable than that of surface water and can therefore accommodate lower sampling frequencies.

Groundwater Level Depth: **Six-Monthly**
Groundwater Quality Sample: **Six-Monthly**

Monitoring/Sampling Technique

The success of any monitoring program depends *inter alia* on the selection of appropriate sampling techniques and equipment to satisfy all monitoring objectives. Broadly speaking these objectives should support regulatory requirements, certain operational decision making requirements and corrective action evaluation. Incorrect or poorly selected sampling techniques will render all of the preceding effort (such as evaluation of site conditions, optimization of sampling frequency and selection of variables to be analysed for) futile. Great care should at all times be taken in the field to prevent mishaps or contamination.

Groundwater Level Depth: **Electrical Dip Meter**
Groundwater Quality Sample: **Stratified Sample with Bailer**

Monitoring/Sampling Equipment

Keeping a detailed list of all the sampling materials required prior to the commencement of a sampling run is essential. This "material" should be reviewed in detail before the sampler embarks on the field visit, so as to prevent the frustration that arises later in the field because of missing equipment, reagents or bottles. Sampling equipment should furthermore be selected in accordance with the type of sample to be taken, the type of analyses to be performed, and the objective to be achieved.

Monitoring/Sampling Procedure

Appropriate sampling procedures should be selected so that the most reliable samples possible can be collected. Further to the sampling procedure specifics, adherence should also be given to the principles of quality assurance and chain of custody.

Adherence to the operating principles of quality assurance, will ensure that data is produced that is of a known and defensible quality.

Quality assurance operating principles include quality assessment and quality control of the sample. To ensure quality control the following items should be considered: the use of buffer and standard solutions for calibration, including duplicate samples with a set of samples for the laboratory, making use of trip and field blanks during sampling runs and ensuring that the laboratory uses quality control standards for their own analysis. Quality assessment is external quality control and involves inter-laboratory comparison studies. These comparison studies are open to participation by all laboratories that analyse water and waste-water samples.

Following the correct chain of custody involves the gathering of adequate information regarding the circumstances during sample collection and subsequent handling of the sample. A field form must be supplied that provides space for the required information to be recorded.

Typical chain of custody information that should be collected include: sample description, time and date of sampling, sample number, the static water level of the borehole and any other information that appears to be significant.

The following procedure should be followed as close as possible to ensure that representative samples and field information are collected:

- Check all sampling equipment to ensure that everything is clean and in good working order.
- Take copy of monitoring field form.
- Take keys for gates/boreholes.
- Assess the physical status of the sampling locality (take photo if status has changed).
- Put on protective gloves.
- Measure the static water level in the borehole prior to sampling, and note it on the monitoring field form.
- On removal of the dip meter/measuring tape, dry with paper towel.
- Write the sample number, date of sampling and time of sampling on sample bottles for specific site with permanent marker.
- Note the sample number, date of sampling, time of sampling, as well as any comments on the provided monitoring field form.
- Take the water sample with a pre-washed bailer at the prescribed horizon using the measuring tape as line/cable.
- On removal of the bailer, dry the measuring tape with a paper towel.
- Pour the sample taken directly into the pre-marked sample bottles (500 ml + 250 ml) Depending on the laboratory specifications.
- The bottles are to be filled to the brim, squeezed slightly while the lid is screwed on tightly in order to expel all the air from the bottles.
- Seal the cap with insulation tape.
- Place the full sample bottles in the cooler bag.
- Dispose of gloves and paper towels.
- Move to the next sampling locality.

Sample Preservation/Submission to Laboratory

In order to keep the collected sample as close as possible to its original state, sample preservation is required. Preservation methodologies intend to affect the retardation of biological and chemical activity and to reduce volatility. Sample preservation requirements and methodologies should always be confirmed with the analytical laboratory to be used.

- The samples for analysis are to be sent to the laboratory as soon as possible.
- The samples should be accompanied by a copy of the monitoring field form.
- The original field form is to be filed and stored locally.
- A copy of the field form is to be faxed to the appointed consultant for computerization.
- On receiving the field form, the appointed consultant must compile and forward a letter with instructions to the designated laboratory, specifying which variables to analyse for.

Analysis Protocols

It is a DWA minimum requirement that water samples be analysed by a recognized analytical laboratory that uses approved analytical procedures. The analyses shall be carried out in accordance with methods prescribed by and obtainable from the South African Bureau of Standards, in terms of the Standards Act, 1982 (Act 30 of 1982).

Variables to be Analysed

The selection of parameters to be analysed for depends entirely on the purpose of the sampling. It is suggested that at all new sites, or where new monitoring programs are commissioned, a comprehensive analysis, as described in the DWA "Minimum Requirements Series" be utilized. This will ensure that accurate background levels for a wide range of constituents are determined from the outset.

A comprehensive analysis includes a complete macro spectrum as well as an analysis for trace elements. Once well understood trends have established, an indicator analysis can be performed. The analysis spectrum of an indicator analysis is smaller than the comprehensive analysis and will reduce analytical costs considerably. The following water quality variables should routinely be analysed for Ferrometals groundwater:

pH, EC, TDS, Total Alkalinity, Ca, Mg, Na, K, Si, F, Cl, SO_4, NO_3, NH_4, Al, Fe, Mn, Zn, Cr^{Total} and Cr^{6+}.

Laboratory Results Data Quality Control

It is imperative that the accuracy of data generated by the laboratory be established on a continuous basis. In this regard the assessment of cation/anion balance errors are essential for e.g. inorganic samples, whilst the analyses of field and trip blanks are essential for organic samples.

Laboratory Data Quality check:
Calculate cation/anion balance
Err < 5% Ideal
Err < 10% Acceptable
Err > 10% Unacceptable

Data Base Entry and Backup

In order to ensure that accurate and fast decisions can be taken, an environmental monitoring database is required that allows for complex queries and which facilitates seamless transformation of data into reports and maps. The electronic storage of data is thus of utmost importance. Typically the database should have full GIS capabilities and hold data in such a manner that it can easily be accessed.

Regular data back-ups should be made on a separate computer or disk so that data losses during computer failures can be prevented. Backed up data should be stored in a secure place.

Reporting Frequency

The frequency of reporting to the Regulatory Authorities should, in the absence of formal statutory requirements (usually stipulated as a condition in the Water Use License), be on a six-monthly basis. Any information that is to be submitted to the Regulatory Authorities should be closely scrutinized by Ferrometals prior to submission.

Report Content

For a bi-annual reporting frequency as applicable to Ferrometals, two reports will be generated per annum:

- A six-monthly data report.
- A comprehensive annual report.

Six-Monthly Report:

The six-monthly report is a synoptic data report compiled to show compliance with the monitoring schedules as well as to provide the basic monitoring data generated during the first six months of monitoring. The contents of the report will typically comprise:

- Data Capture Protocol Compliance Assessment.
- Submission and Synoptic Discussion of Captured Data including:
    - Groundwater Abstraction Data.
    - Groundwater Level Data.
    - Groundwater Chemistry Data Compliance Report.

Annual Report:

The annual report is a comprehensive systems audit, data submission, compliance assessment and trend assessment report, compiled to assess the efficiency of the water quality management measures implemented for the site. The contents of the report will typically comprise:

- Audit on Monitoring System Status:
  - Monitoring Infrastructure Assessment.
  - Data Capture Compliance Assessment.
  - Data Quality Compliance Assessment.
- Discussion of Site Status.
- Groundwater Abstraction Assessment (if active) including:
  - Borehole Pump Volume Compliance Assessment.
  - Cumulative Water Volume Assessment.
  - Abstracted/Supplied Water Quality Assessment.
- Groundwater Level Assessment including:
  - Groundwater Level Fluctuations.
- Groundwater Quality Assessment including:
  - Groundwater Quality Compliance Assessment.
  - Groundwater Quality Trend Assessment.
  - Groundwater Composition Trend Assessment.
  - Delineation of Groundwater Pollution Plume(s).
- Conclusions.
- Recommendations.

Management Protocols

Management Protocols are designed to facilitate easy management of the environmental monitoring system. This is achieved by summarizing the required data capture, reporting (information generation) and management actions into a tabular format/schedule that is easy to understand and can be copied and displayed at various premises for easy access by all personnel involved.

Data Capture Schedules

In order to ensure the effective management of the monitoring system, the data capture, reporting and system management protocols were summarized into a sequential monitoring schedule, with a monthly frequency.

18.1.3 Surface Water Monitoring

The Surface Water Quality Monitoring represents a scientific exercise and therefore strict compliance with regards to the technical protocols that is required to ensure the scientific integrity of the data generated. The dynamics of any operation inevitably leads to ever changing environmental impacts and consequent changes to environmental monitoring requirements. As such, this Surface Water Monitoring System is structured according to a modular format to facilitate easy upgrading/expansion of the technical components to accommodate not only future component additions, but also to streamline the upgrading process which may become necessary for individual components.

In an effective monitoring system it is essential that all monitoring localities are optimally selected, formally listed and systematically named. The selection of the localities and the technical specifications for the monitoring/sampling points are critical, as they need to supply data of high integrity, which will support impact and risk assessment, related to the various environmental components being monitored, in support of Risk Based Environmental Management.

The surface water monitoring protocol discussed in the section below, should be implemented during the Construction, Operational, Decommissioning and Closure as well as the Post Closure Phase.

In order to facilitate seamless interpretation and display of data, all data points should be geographically referenced into a Geographical Information System (GIS) and plotted on a map of reasonable scale.

Refer to Figure 18.1.3(a) that indicates the surface water monitoring localities which form part of the current Existing Slimes Dam facility as well as Figure 18.1.3(b) which form part of the New Slimes Dam Facility.

Table 18.1.3(a) contains the coordinates of all the surface water monitoring localities; the localities currently monitored at the Existing Slimes Dam Facility as well as the for the localities proposed to be monitored at the New Slimes Dam Facility.

Date: March 2014

Client: Ferrometals
Project: Surface Water Monitoring
Map Status: Final
Compiled by: G. Cloete
Checked by: R. Grobbelaar

JMA Consulting (Pty) Ltd

LEGEND

Surface Water Monitoring Localities

Surface Water Monitoring System for Current Slimes Dam

Figure 18.1.3 (a): Ferrometals Surface Water Monitoring System at the Current Existing Slimes Dam

Date: March 2014

Client: Ferrometals
Project: Surface Water Monitoring
Map Status: Final
Compiled by: G. Cloete
Checked by: R. Grobbelaar

JMA Consulting (Pty) Ltd

LEGEND

● Surface Water Monitoring Localities

Surface Water Monitoring System for New Slimes Dam

Figure 18.1.3(b): Ferrometals Surface Water Monitoring System at the New Slimes Dam

Table 18.1.3(a): Coordinates of the Ferrometals Surface Water Monitoring Localities

Monitoring locality	Management Area	Description	Latitude: Longitude
Current Existing Slimes Dam Surface Water Monitoring Localities			
FSW 13	**Current Existing Slimes Dam**	Slimes Dam Return Water Dam (RWD)	25.850997°S 29.171992°E
FSW 14	**Current Existing Slimes Dam**	Existing Slimes Dam Sump	25.849370°S 29.170545°E
New Slimes Dam Surface Water Monitoring Localities			
FSW 15	**New Slimes Dam Facility**	New Slimes Dam Sump	25.844429°S 29.173738°E

Monitoring/Sampling Frequency

The frequency of monitoring/sampling should at all times be a combined function of the sampling objectives and the expected variability in the parameter(s) to be monitored. In the case of Surface Water, streams can show high variability in quality over short time spans, and the quality of the water may fluctuate seasonally, resulting in more frequent sampling frequencies.

Dam Level/Flow Status: **Monthly**
Water Sample: **Monthly**

Monitoring/Sampling Technique

The success of any monitoring program depends *inter alia* on the selection of appropriate sampling techniques and equipment to satisfy all monitoring objectives. Broadly speaking these objectives should support regulatory requirements, certain operational decision making requirements and corrective action evaluation. Incorrect or poorly selected sampling techniques will render all of the preceding effort (such as evaluation of site conditions, optimization of sampling frequency and selection of variables to be analysed for) futile. Great care should at all times be taken in the field to prevent mishaps or contamination.

Dam Level/Flow Status: **Level Reading/Visual**
Water Sampling: **Grab Sample**

Monitoring/Sampling Equipment

Keeping a detailed list of all the sampling materials required prior to the commencement of a sampling run is essential. This “material” should be reviewed in detail before the sampler embarks on the field visit, so as to prevent the frustration that arises later in the field because of missing equipment, reagents or bottles. Sampling equipment should furthermore be selected in accordance with the type of sample to be taken, the type of analyses to be performed, and the objective to be achieved.

Monitoring/Sampling Procedure

Appropriate sampling procedures should be selected so that the most reliable samples possible can be collected. Further to the sampling procedure specifics, adherence should also be given to the principles of quality assurance and chain of custody.

Adherence to the operating principles of quality assurance, will ensure that data is produced that is of a known and defensible quality. Quality assurance operating principles include quality assessment and quality control of the sample. To ensure quality control the following items should be considered: the use of buffer and standard solutions for calibration, including duplicate samples with a set of samples for the laboratory, making use of trip and field blanks during sampling runs and ensuring that the laboratory uses quality control standards for their own analysis. Quality assessment is external quality control and involves inter-laboratory comparison studies. These comparison studies are open to participation by all laboratories that analyse water and waste-water samples.

Following the correct chain of custody involves the gathering of adequate information regarding the circumstances during sample collection and subsequent handling of the sample. A field form must be supplied that provides space for the required information to be recorded. Typical chain of custody information that should be collected include: sample description, time and date of sampling, sample number, for a surface sample such as a dam, the dam level status, for a surface sample such as a river, the river level/flow status and any other information that appears to be significant.

Variables to be Analysed

The selection of parameters to be analysed for depends entirely on the purpose of the sampling. It is suggested that at all new sampling localities, or where new monitoring programs are commissioned, a comprehensive analysis, as described in the DWAF "Minimum Requirements Series" be utilized. This will ensure that accurate background levels for a wide range of constituents are determined from the outset.

A comprehensive analysis includes a complete macro spectrum as well as an analysis for trace elements. Once well understood trends have established, an indicator analysis can be performed. The analysis spectrum of an indicator analysis is smaller than the comprehensive analysis and will reduce analytical costs considerably.

For Ferrometals the following water quality variables should be analysed for routinely:

pH, EC, TDS, Total Alkalinity, Ca, Mg, Na, K, Si, F, Cl, SO_4, NO_3, NH_4, Al, Fe, Mn, Zn, Cr^{Total} and Cr^{6+}.

Laboratory Results Data Quality Control

It is imperative that the accuracy of data generated by the laboratory be established on a continuous basis. In this regard the assessment of cation/anion balance errors are essential for e.g. inorganic samples, whilst the analyses of field and trip blanks are essential for organic samples.

Laboratory Data Quality check:
Calculate cation/anion balance
Err < 5%Ideal
Err < 10%Acceptable
Err > 10%Unacceptable

Data Base Entry and Backup

In order to ensure that accurate and fast decisions can be taken, an environmental monitoring database is required that allows for complex queries and which facilitates seamless transformation of data into reports and maps. The electronic storage of data is thus of utmost importance. Typically the database should have full GIS capabilities and hold data in such a manner that it can easily be accessed.

Reporting Frequency

The frequency of reporting to the Regulatory Authorities should, in the absence of formal statutory requirements (usually stipulated as a condition in the Water Use License), be on a six-monthly basis. Any information that is to be submitted to the Regulatory Authorities should be closely scrutinized by Ferrometals prior to submission.

Report Content

For a bi-annual reporting frequency as applicable to Ferrometals, two reports will be generated per annum:

- A synoptic six-monthly data report.
- A comprehensive annual report.

Six-Monthly Report:

The monthly report is a synoptic data report compiled to show compliance with the monitoring schedules as well as to provide the basic monitoring data generated during the first six-months of monitoring. The contents of the report will typically comprise:

- Data Capture Protocol Compliance Assessment.
- Submission and synoptic discussion of Captured Data including:
- Surface Water Chemistry Data Compliance Report.

Annual Report:

The annual report is a comprehensive systems audit, data submission, compliance assessment and trend assessment report, compiled to assess the efficiency of the water quality management measures implemented for the site. The contents of the report will typically comprise:

Audit on Monitoring System Status:
- Monitoring Infrastructure Assessment.
- Data Capture Compliance Assessment.
- Data Quality Compliance Assessment.

Discussion of Site Status.
Receptor Surface Water Quality Assessment including:
- Surface Water Quality Compliance Assessment.
- Surface Water Quality Trend Assessment.
- Surface Water Composition Trend Assessment.

Conclusions.
Recommendations.

Management Protocols

The Management Protocols are designed to facilitate easy management of the environmental monitoring system.

This is achieved by summarizing the required data capture, reporting (information generation) and management actions into a tabular format/schedule that is easy to understand and can be copied and displayed at various premises for easy access by all personnel involved.

Data Capture Schedules

In order to ensure the effective management of the monitoring system, the data capture, reporting and system management protocols were summarized into a sequential monitoring schedule, with a monthly frequency.

The monthly data capture schedules include:

- Surface Water Sampling.
- Surface Water Volumes and Response from the Ferrometals Surface Water Supply Scheme.

18.1.4 Plant Life Monitoring

Planning and Design Phase:
No monitoring is necessary during this phase.

Construction Phase:
During the removal of the vegetation procedure, daily visual inspections should be carried out to ensure that the vegetation clearance is restricted to the development footprint.

Operational Phase:
No monitoring is necessary during this phase.

Decommissioning and Closure Phase:
Daily visual inspections should be carried out when the capped slimes dam is being re-vegetated to ensure successful re-vegetation according to the plant scientist recommendations.

Post Closure Phase:
Visual assessment should be carried out bi-annually to assess the condition of the vegetation cover. If the condition of the vegetation is not optimal, management measures such as fertilization, irrigation and removal of alien species should be implemented and the success thereof monitored.

18.1.5 Animal Life Monitoring

Planning and Design Phase:
No monitoring is necessary during this phase.

Construction Phase:
To ensure that the faunal habitat and diversity is not unnecessarily disturbed, daily visual inspections should be carried out during the clearance of vegetation to ensure that the vegetation clearance is restricted to the development footprint.

Operational Phase:
No monitoring is necessary during this phase.

Decommissioning and Closure Phase:
No monitoring is necessary during this phase.

Post Closure Phase:
To ensure that the faunal habitat and diversity returns to a stable natural state, visual inspections pertaining to the condition of the vegetation cover should be carried out bi-annually. If the condition of the vegetation is not optimal, management measures such as fertilization, irrigation and removal of alien species should be implemented and the success thereof monitored.

18.1.6 Air Quality Monitoring

Dust fall-out monitoring at the Ferrometals site currently consist of 14 dust buckets around the perimeter of the site, which are sampled on a monthly basis. Refer to Figure 18.1.6(a) which depicts all the Dust Fall-out monitoring localities at the Ferrometals Site.

The current monitoring localities are numbered 1-14 on this figure in addition to three additional monitoring localities which have been suggested to measure the dust fall-out anticipated from the new Slimes Dam; numbered 15-17.

Dust fall-out monitoring should be carried out during the Construction, Operational, Decommissioning and Closure as well as the Post Closure Phase.

Figure 18.1.6(a): Dust Fall-out Monitoring Localities at the Ferrometals Site (current monitoring localities numbered 1-14; suggested monitoring localities for the New Slimes Dam numbered 15-17)

18.2 ENVIRONMENTAL MONITORING BUDGET

ENVIRONMENTAL MONITORING BUDGET				
IMPACTS REQUIRING MONITORING	FUNCTIONAL MONITORING REQUIREMENTS	TIMES FRAMES FOR MONITORING & REPORTING		ANNUAL MONITORING BUDGET
		MONITORING	REPORTING	
Topography Impacts	1. Assess changes to Slimes Dam Geometry – Accurate Survey	Continuously	Annually	R 50 000.00
Soils Impacts	1. Visual Inspection of Erosion and Sediment Deposition 2. Visual Inspection of Soil Surface Characteristics 3. Investigative Soil Sampling only in Contaminated Areas 4. Visual Verification of correct Soil Stockpiling	1. Continuous 2. Quarterly	Annually	R 40 000.00
Groundwater Impacts	1. Quantify groundwater quality through regular groundwater sampling and analyses from Slimes Dam monitoring boreholes.	1. Bi-annually	Bi-annually Annually	R 150 000.00
Surface Water Impacts	1. Quantify surface water quality of Slimes Return water. 2. Quantify surface water quality in receiving environment	1. Monthly 2. Monthly	Monthly Bi-annually Annually	R 60 000.00
Plant Life Impacts	1. Visual Inspection to verify Alien Species Control 2. Visual Inspection of Rehabilitated Vegetation Success	1. Bi-annually 2. Annually	Bi-annually Annually	R 20 000.00
Animal Life Impacts	1. Visual Inspection to verify Faunal Habitat Protection 2. Avi-Faunal Survey	1. Bi-annually 2. Annually	Annually	R 20 000.00
Air Quality Impacts	1. Quantify Dust Fallout Rates at Ambient Monitoring Localities	Continuously	Quarterly Annually	R 80 000.00
Total Annual Monitoring Costs				R 420 000.00

19. ENVIRONMENTAL AWARENESS PLAN

As specified in the Environmental Impact Assessment Regulations – GNR 543 of 2010; (33) A draft environmental management programme must comply with section 24N of the Act and include -

(j) an environmental awareness plan describing the manner in which-
(i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and
(ii) risks must be dealt with in order to avoid pollution or the degradation of the environment;

19.1 EMPLOYEE NOTIFICATION OF ENVIRONMENTAL RISKS

These requirements adhere to the legislation as stipulated in Section 39 (3)(c) of the Mineral and Petroleum Resources Development Act 28 of 2002 (MPRDA), where it specifies that an applicant who prepares an environmental management programme or an environmental management plan must; develop an Environmental Awareness Plan describing the manner in which the applicant intends to inform his or her employees of any environmental risks which may result from their work and the manner in which the risks must be dealt with in order to avoid pollution or the degradation of the environment and (d) describe the manner in which he or she intends to (i) modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; (ii) contain or remedy the cause of pollution or degradation and migration of pollutants; and (iii) comply with any prescribed waste standard or management standards or practices.

In order to address the above mentioned requirements, the general objectives of an Environmental Awareness Plan should include the education of employees on the importance of conserving natural resources and their specific role in conserving the environment which they encounter on a daily basis.

The Applicant (Ferrometals) informs employees of any environmental risk which may result from their work by means of a General Induction, Plant Specific Induction, Training on Operating Procedures, Pre-Shift Talks on SHEQ related matters as well as weekly communication opportunities.

Refer to **APPENDIX X** for the illustrations of the General Induction as well as an example of a Plant Specific Induction for a particular department discussed with employees. The objective of these inductions is to ensure zero harm to employees, contractors and the environment.

An example of the Applicants' Environmental Emergency Preparedness and Response procedure (document PRO144) is also provided in this Appendix. This procedure aims to enable all personnel to understand their responsibilities during an environmental and hazardous material emergency.

In addition, an Emergency Procedure (Document PRO148) specifically relaying guidance for emergencies related to the Laboratory, Canteen, Clinic, Security and Reception is also provided as well as the Emergency Procedure for the Chrome Recovery Plant (CRP) as well as the Logistics Department.

The objective of this procedure is to minimize the impact of injuries and losses to the applicant by establishing a compact, practical procedure to instruct and guide the employees of these departments on actions to be taken following or during a serious incident or accident.

19.2 ENVIRONMENTAL RISK MANAGEMENT

Environmental risk management will be conducted through implementation of the Environmental Management Measure Tables contained in Chapter 15 of this report. These Tables represent a Risk Based Environmental Management Programme and contains all the elements required to effectively deal with all environmental risks in order to avoid pollution or degradation of the environment.

Refer to **APPENDIX X** for an example of a risk assessment carried out at the Closed Furnaces along with a baseline risk assessment for the CRP and the Logistics department in the form of an Aspect/Impact Register. Hazards and risks are rated before controls are implemented and after controls are implemented.

19.3 ENVIRONMENTAL AWARENESS TRAINING

As stated above, the Applicant (Ferrometals) informs employees of any environmental risk which may result from their work by means of a General Induction, Plant Specific Induction, Training on Operating Procedures, Pre-Shift Talks on SHEQ related matters as well as weekly communication opportunities.

A comprehensive Procedure system is in place for the Environment, Health and Safety. Training on Standard Operating Procedures is conducted per department. An attendance register is signed by all those that were trained. Further verification of understanding is undertaken by the supervisor through a task observation (critical or planned task observations) and loaded onto Ferrometals Integrated Management System (IMS). Mock drills are carried out in a regular basis.

A few examples of weekly communication by Human Resources regarding SHEQ related matters are provided in **APPENDIX X**.

20. IDENTIFICATION OF THE REPORT

Herewith I, the person whose name and identity number is stated below, confirm that I am the person authorized to act as representative of the applicant in terms of the resolution submitted with the application, and confirm that the above report comprises the results of consultation as contemplated in Section 16(4)(b) or 27(5)(b) of the Act, as the case may be.	
Full Names and Surname	Riaan Grobbelaar (Pr.Sci.Nat.)
Identity Number	7309135005088
Signature	