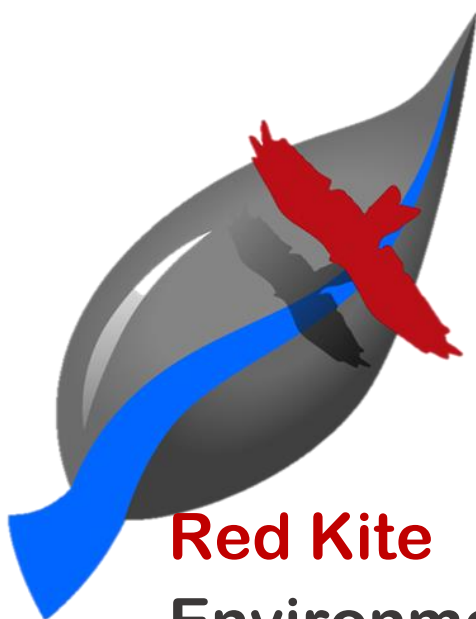


SURFACE WATER ASSESSMENT

FOR
KINETIC DEVELOPMENT GROUP
(PTY) LTD & SOUTH AFRICAN
ENERGY METALLURGICAL BASE
(PTY) LTD:
MMSEZ PV POWER PLANT,
INDUSTRIAL & METALLURGICAL
PROJECT

ON
THE FARMS DREYER 526 MS, VAN
DER BIJL 528 MS, STEENBOK 565
MS & ANTROBUS 566 MS

JUNE 2025



Red Kite

Environmental Solutions

Red Kite Environmental Solutions (Pty) Ltd

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Executive Summary

Red Kite Environmental Solutions (Pty) Ltd was appointed by Gudani Consulting (Pty) Ltd to conduct a Surface Water Assessment for the proposed Kinetic Development Group (Pty) Ltd (KDG) and South African Energy Metallurgical Base (Pty) Ltd (SAEMB) 1000 MW photovoltaic (PV) power station, industrial & metallurgical development in the Musina-Makhado Special Economic Zone (MMSEZ).

Key baseline datapoints utilized for interpretation and assessment included the following:

The following key activities are part of the proposed project:

- **Construction Phase:**
 - Site clearing – removal of vegetation groundworks
 - Construction of infrastructure:
 - Road infrastructure
 - Power infrastructure
 - Solar power plant
 - Perimeter fencing and security facilities
 - Offices, parking and staff facilities
 - Processing plants
 - Water storage, pipelines and boreholes
 - Water Treatment Plant
 - Stormwater management infrastructure
- **Operational Phase:**
 - Ongoing utilization and maintenance of the above infrastructure
 - Hauling of raw materials and products
 - Storage of raw materials and products
 - Storage and treatment of wastewater and residue materials
 - Stormwater management and storage/reuse of “dirty” area runoff
 - Discharge of treated water
- **Decommissioning Phase:**
 - Demolition and removal of all structures including transporting of waste materials off site.
 - Removing of road, power and water infrastructure.
 - Removal of stormwater containment infrastructure.
 - Rehabilitation, including shaping, spreading of soil and re-vegetation.

Region and Climate:

- The study area falls within the Level 1 Ecoregions: Limpopo Plain.
- The area has a hot semi-arid climate (Classification: BSh).
- The annual average precipitation is approximately 370 mm/year.
- The proposed operational activities are on a flat plain approximately 700 m above sea level.
- The project area slopes predominantly from the south (approximately 740 mamsl) to the north (approximately 680 mamsl) with a gradient of 0.01.

Surface water features and uses:

- The project area is located in the A71 tertiary catchment within the Limpopo Water Management Area (WMA) North, specifically in the A71K quaternary catchment.
- Secondary catchments A5 to A9, forming the Limpopo WMA North, does not have any resource classification available at the time of writing this report. A project is underway for the determination of water resource classes, reserve and resource quality objectives including these secondary catchments (DWS, March 2024).
- PES and reserve data for A71K catchment:

Component	A71K
River	Sand
EWR Site	SAND-A71K-R508B
Present Ecological Status (PES)	Class C
Recommended Ecological Status (REC)	Class C

- The project area is located in the A71K quaternary catchment, which is designated as a Freshwater Ecosystem Priority Area (FEPA).
- The project area is not located in a Strategic Water Source Area (SWSA).
- Multiple drainage lines were identified within and around the project site. Activities were planned to avoid the major drainage lines and farm dams.
- All drainage lines in and around the activities are non-perennial.
- The site drains through two non-perennial unnamed tributaries of the Sand River on the northeastern and northwestern sections of the site. These drainage lines converge north of Mopane before the confluence with the Sand River further north.
- The area is largely undeveloped with limited mining and livestock being the main uses in the areas surrounding the sites.
- From the assessment, there appears to be no wetlands within 500 m of the project footprint, which is supported by the 1:50,000 ortho-maps, as well as the NFEPA database.

Site sensitivity:

No significant watercourses, riparian areas or wetlands are located within 100 m of the project footprint, based on the study. Impacted drainage lines are non-perennial and expected to be of medium sensitivity. Therefore, in terms of surface water features, the entire project footprint and 100 m project area buffer is expected to be of medium sensitivity. However, this will need to be verified through a site survey.

Impact Assessment and Mitigation:

The potential impacts on surface water resources are summarised as follow:

- Erosion and sedimentation from exposed soils, alteration of drainage patterns and creation of compacted and impermeable surfaces.
- Contamination from transportation, storage and processing of raw materials and products.
- Contamination from waste/byproducts and wastewater generated from processing.
- Contamination from litter and sewage spills.
- Contaminated runoff due to the use of vehicles, heavy vehicles and machinery.

- Disturbing the natural environment that may lead to loss of biodiversity, proliferation of alien invasive plant species, and loss of ecological function of surface water features.

Key management and mitigation measures may be summarised as follow:

- Implement and maintain stormwater management infrastructure as well as flow impedance, erosion-, and sedimentation controls. Ensure a zero-discharge policy.
- Stockpiling/storage areas need to be licenced and constructed as per the requirements of the Competent Authority.
- Wastewater and byproduct/waste should be stored in containments, licenced, constructed based on requirements and continuously be inspected and maintained.
- Ensure spill prevention and incident management measures and equipment are in place.
- Ensure waste removal agreements are in place with a licenced service provider.
- Avoid natural, sensitive areas where possible and implement an Alien Invasive Plant Species Management Plan to eradicate AIPs.
- Implement / maintain environmental management, water conservation and rehabilitation programmes.

Assessment Conclusion:

Due to the high risk with the activities, high extent, as well as the potential intensity of the impacts, and taking into account the implementation of the recommended mitigation measures the cumulative risk should be in the region of medium to high significance.



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Abbreviations

DFFE	Department of Forestry, Fisheries and the Environment
DWS	Department of Water and Sanitation
EI	Ecological Importance
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme
ES	Ecological Sensitivity
FEPA	Freshwater Ecosystem Priority Area
GN	Government Notice
IUA	Integrated Unit of Analysis
m ³ /a	Cubic Meter per annum
MAE	Mean annual evaporation
MAP	Mean annual precipitation
MAR	Mean annual runoff
NEMA	National Environmental Management Act (Act 107 of 1998)
NFEPA	National Freshwater Ecosystem Priority Area
NWA	National Water Act, 1998 (Act 36 of 1998)
PES	Present Ecological State
REC	Recommended Ecological Category
RQO	Resource Quality Objectives
RWQO	Resource Water Quality Objectives
SR	Significance Rating
SWSA	Strategic Water Source Area
TDS	Total Dissolved Solids

Declaration

I, Nicole Upton, declare that -

- I act as an independent specialist;
- I will perform the work relating to the project in an objective manner, even if this results in views and findings that are not favourable to the project proponent;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this project, including knowledge of the National Environmental Management Act, 1998 (Act No. 107 of 1998; the Act), regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in Regulation 8;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the project proponent 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 project; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority or project proponent;
- All the particulars furnished by me in this document are true and correct; and
- I realise that a false declaration is an offense in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

Signature of Specialist:	
Name of Company:	Red Kite Environmental Solutions (Pty) Ltd
Date:	20 June 2025

1. INTRODUCTION

Red Kite Environmental Solutions (Pty) Ltd was appointed by Gudani Consulting (Pty) Ltd to conduct a Surface Water Assessment for the proposed Kinetic Development Group (Pty) Ltd (KDG) and South African Energy Metallurgical Base (Pty) Ltd (SAEMB) 1000 MW photovoltaic (PV) power station, industrial and metallurgical development in the Musina-Makhado Special Economic Zone (MMSEZ).

KDG and SAEMB are applying for an Environmental Authorisation for their photovoltaic, industrial and metallurgical project on the farms Dreyer 526 MS, Van Der Bijl 528 MS, Steenbok 565 MS and Antrobus 566 MS. The proposed project footprint is located in the MMSEZ, in the Musina and Makhado Local Municipalities of the Vhembe District Municipality, about 33 km south of Musina.

The proposed industrial and metallurgical development includes the following:

- Ferrochrome and Alloys smelter plant (125 000 – 1000 000 tons/year)
- 10 million tons/year coal wash plant
- 3 million tons/year coke plant
- Heat recovery electricity power plant - 600 MW
- Office and staff living facilities for the factory

The proposed footprint of the above developments is approximately 893 ha in extent.

The footprint of the proposed PV power station is approximately 314 ha in extent.

The below maps indicate the location and infrastructure as described above.

The natural resources of South Africa, with its highly complex and diversified society, are continually under pressure from development, especially in and close to areas richly endowed with natural resources. It is important that systematic planning and coordination of human activities and developments should receive priority to prevent the degradation of any ecosystem. This Surface Water Assessment will assist in identifying possible environmental impacts associated with the current operation on the receiving surface water environment, as well as to recommend mitigation measures to avoid or reduce the potential impacts identified.

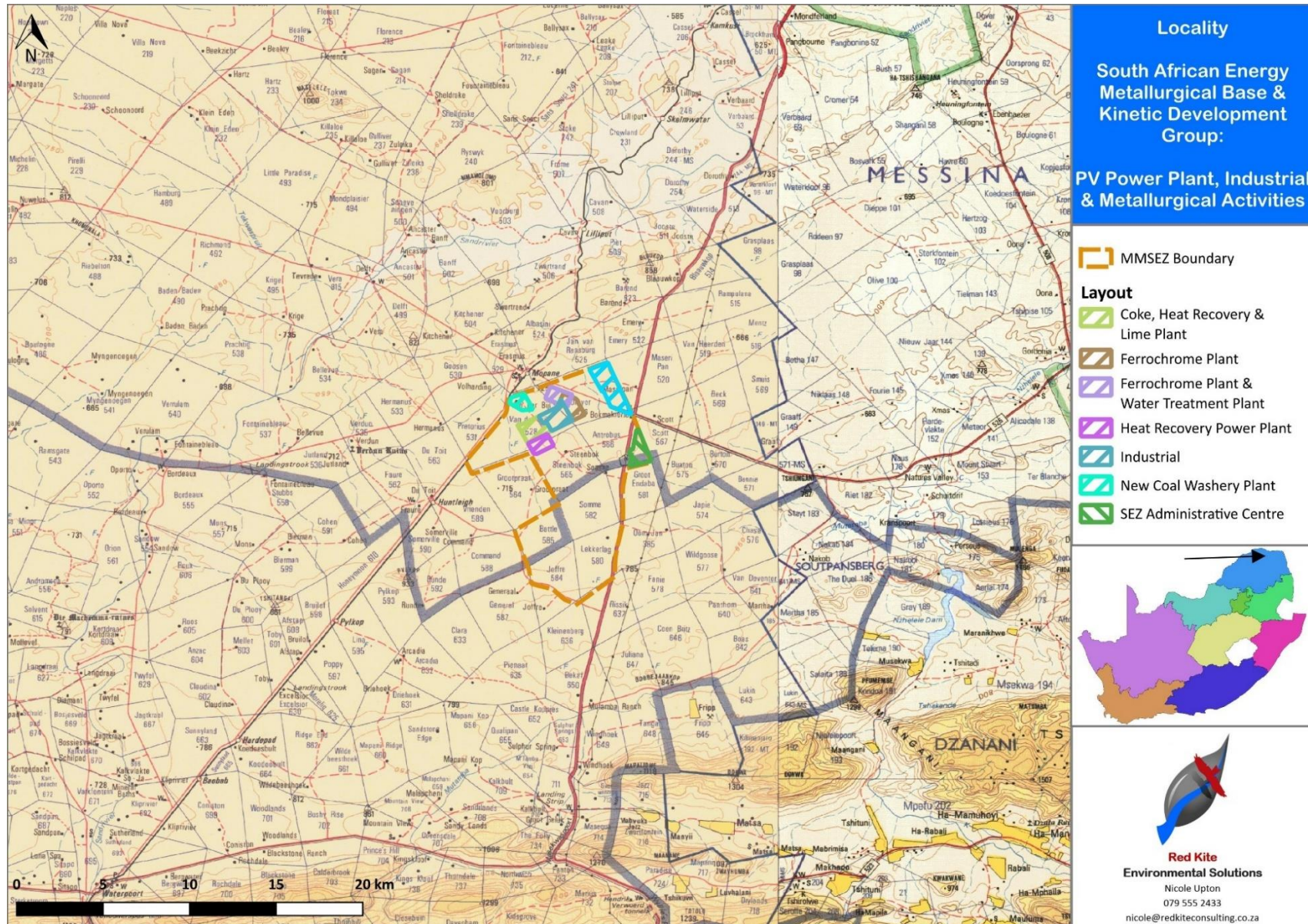


Figure 1: Locality of the Project

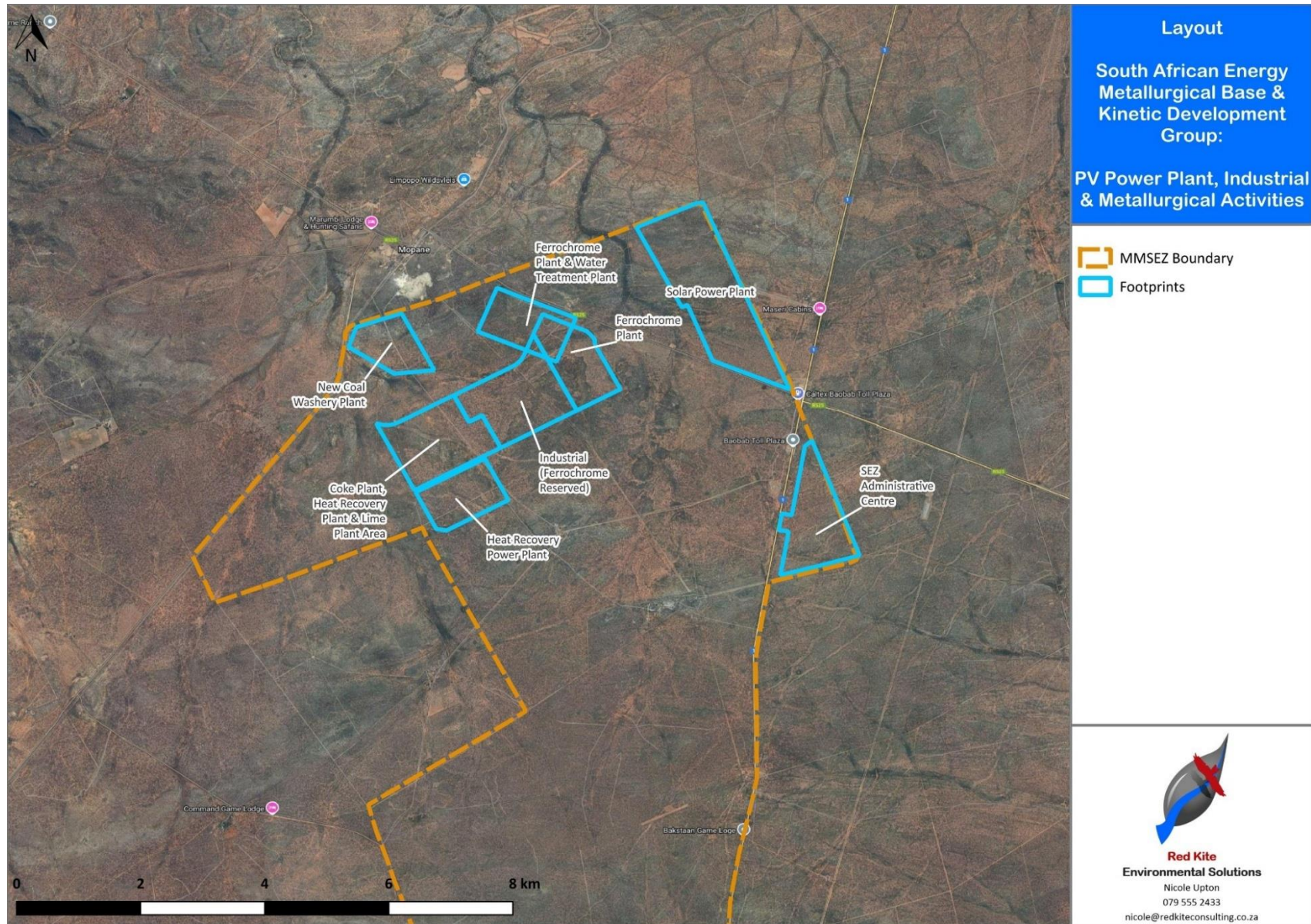


Figure 2: Layout of the Project

1.1. Scope of Work

The Surface Water Assessment was undertaken for the footprint of the proposed activities (refer to Figure 1), as provided by the client, and watercourses within the 100 m of the project footprint.

The Scope of Work for the surface water baseline and impact assessment study was to:

- Conduct an assessment on available information for the project area, including satellite images, databases, and specialist studies performed for the area.
- Summarise legislation pertaining to the project with regard to surface water aspects;
- Identification of watercourses within 100 m of the project footprint;
- Undertake an impact assessment on the surface water for the construction, operation and decommissioning phases of the proposed project;
- Recommendation of site-specific mitigation measures; and
- Compilation of a specialist assessment report detailing the methodology and findings of the assessment.

The overall purpose of the Surface Water Assessment is to evaluate the potential impacts that the proposed infrastructure, or activities might have on the surface water quality and quantity within the project area. The impactable water resources, with their accompanying catchments, and sub-catchment areas will be noted as well as setting forth information on which measures, and legislation will be applicable to the said property.

1.2. Assumptions and Limitations

It is assumed that all relevant project information provided by the applicant was correct and valid at the time that it was provided.

The study was conducted with up to date resources. It might however be possible that additional information become available in time, because environmental impact assessments deal with dynamic natural ecosystems. It is therefore important that the report be viewed and acted upon with these limitations in mind.

This report is a Surface Water Assessment. Field survey was also conducted for this assessment and all results given within this document are based on findings and assessments. Use was made of aerial photographs, digital satellite imagery, as well as provincial and national databases to identify areas of interest.

Although all possible measures were undertaken to ensure all drainage lines were identified to form part of the assessment, some smaller ephemeral drainage lines may have been overlooked. Watercourses were not delineated as part of the Scope of Work of this assessment. Watercourses identified in this report were obtained from the National Geo-spatial Information (NGI), a component of the Department of Agriculture, Land Reform and Rural Development (DALRRD).

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken.

1.3. Methodology Overview

The methodology used follows the process provided in the scope of work (Section 1.1) above. The study only includes an assessment used to generate the baseline information. The baseline information gathered include:

- Location detail including:
 - Identify the climate for the area;
 - Identify the topography of the site and the area surrounding the site; and
 - Identify the Ecoregion and characteristics.
- Surface water details including:
 - Determine whether the site overlaps with Freshwater Ecosystem Priority Areas (FEPA);
 - Determine whether the site overlaps with Strategic Water Source Areas (SWSA);
 - Identify the catchment, classification, ecological state and importance of the resource;
 - Identify affected surface water resources and surrounding drainage systems;
 - Create a baseline water quality objective; and
 - Identify potential surrounding surface water uses and users.

With the baseline in place, an impact assessment is undertaken, utilising rating criteria to assess the impacts of the proposed project on the surface water system, as well as providing proposed mitigation measures to avoid or minimise these potential impacts.

The complete impact assessment methodology is provided in detail with the impact assessment in Section 7 of this document for ease of reference.

2. LEGAL ASSESSMENT

2.1. National Environmental Management Act (Act No. 107 of 1998) (NEMA)

The overarching principles of sound environmental responsibility are reflected in the National Environmental Management Act, Act 107 of 1998 (NEMA). The principles of the Act include:

- Environmental management must place people and their needs at the forefront of its concern¹.
- Development must be socially, environmentally, and economically sustainable².
- That biological diversity is maintained, that pollution and degradation of the environment are avoided or minimised, that disturbance of landscapes and cultural heritage is avoided or minimised, that waste is avoided or minimised and recycled or disposed of in a responsible manner, that the use of non-renewable resources is responsible and equitable, that a risk-averse and cautious approach is applied (i.e. the Precautionary Principle is used) and that negative impacts on the environment are anticipated and prevented or minimised and remedied where they cannot be avoided³.
- Environmental management should be integrated and take into account the best practicable environmental option⁴.
- Equitable access to resources, public participation, cradle to grave philosophies, transparency, application of global and international responsibilities, the Polluter Pays Principle, and the recognition of sensitive and stressed ecosystems⁵.

NEMA states that before certain development activities can be undertaken, an environmental impact assessment must be followed. The environmental departments of the various provincial governments are responsible for evaluating applications that have been submitted in terms of the EIA regulations. Based on the findings of the EIA process, a decision will be made by the Department of Mineral Resources and Energy on whether the development is authorised or refused.

2.1.1. Appendix 6 of the EIA Regulations - Requirements for Specialist Reports

Government Notice R982 of 4 December 2014 [as amended], outlines in Appendix 6 the requirements for specialist reports. The table below provides an overview of the requirements and the applicable sections of this report.

¹ Section 2(2) of the NEMA

² Section 2(3) of the NEMA

³ Section 4(a) of the NEMA

⁴ Section 4(b) of the NEMA

⁵ Section 4(d)(e)(f)(k)(n)(p)(r) of the NEMA

Table 1: Legislative report requirements GNR982

GNR982 as amended by GN326	Report Section
(1) A specialist report prepared in terms of these Regulations must contain—	
(a) details of—	
(i) the specialist who prepared the report; and	Page i
(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	Appendix A
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page vii
(c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1
(cA) an indication of the quality and age of base data used for the specialist report;	Section 3
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 3 and 4.2
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1.2
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 1.3
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternative;	Section 0 and 3.2 – no alternatives are applicable
(g) an identification of any areas to be avoided, including buffers;	Section 3.2
(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 3.2
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.2
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 4.2
(k) any mitigation measures for inclusion in the EMPr;	Section 4.2 and Section 5
(l) any conditions for inclusion in the environmental authorisation;	Section 5 and Table 12
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 40
(n) a reasoned opinion—	Section 6
(i) whether the proposed activity, activities or portions thereof should be authorised;	Section 6
(iA) regarding the acceptability of the proposed activity or activities; and	Section 4.2 and Section 6
(ii) if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 4.2 and Section 5

GNR982 as amended by GN326	Report Section
(o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Not applicable
(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not applicable
(q) any other information requested by the competent authority.	Not applicable
(2) Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Not applicable

2.2. National Water Act (Act No. 36 of 1998) (NWA)

The National Water Act, (Act 36 of 1998) aims to manage the national water resources to achieve sustainable use of water for the benefit of all water users. This requires that the quality of water resources be protected and also requires the integration of the management of water resources with the delegation of powers to institutions at the regional or catchment level.

The purpose of the Act is to ensure that the nation's water resources are protected, used, developed, conserved, managed, and controlled in ways, which take into account:

- Meeting the basic human needs of present and future generation
- Promoting equitable access to water
- Redressing the results of past racial discrimination
- Promoting the efficient, sustainable and beneficial use of water in the public interest
- Facilitating social and economic development
- Providing for the growing demand for water use
- Protecting aquatic and associated ecosystems and their biological diversity
- Reducing and preventing pollution and degradation of water resources
- Meeting international obligations
- Promoting dam safety; and
- Managing floods and droughts

Water uses are authorised under the following Sections of the National Water Act:

- Section 39: General Authorisation
- Section 40: License

There are 11 water uses described in Section 21 of the National Water Act:

- taking water from a water resource;
- storing water;
- impeding or diverting the flow of water in a watercourse;
- engaging in a stream-flow reduction activity contemplated in section 36;
- engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1);
- discharging waste or water containing waste into a water resource through a pipe, canal, Sewer, sea outfall or other conduits;
- disposing of waste in a manner which may detrimentally impact on a water resource;

- (h) disposing of in any manner of water which contains waste from, or which has been heated in any industrial or power generation process;
- (i) altering the bed, banks, course or characteristics of a watercourse;
- (j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or the safety of people; and
- (k) using water for recreational purposes.

The above is regulated by the following:

- Government Gazette No. 40713 of 24 March 2017: No. R.267: Regulations regarding the Procedural Requirements for Water Use License Applications and Appeals.
- Government Gazette No. 40229 of 26 August 2016: No. 509: General authorisation in terms of Section 39 of the National Water Act, 1998 (Act No. 36 of 1998) for Water Uses as defined in Section 21(c) or Section 21(i).
- Government Gazette No. 40243 of 2 September 2016: No.538: Revision of General Authorisation for the Taking and Storing of Water (Section 21(a) and Section 21(b)).
- Government Gazette No. 36820 of 6 September 2013: No. 665: Revision of General Authorisations in terms of Section 39 of the National Water Act, 1998 (Act No. 36 of 1998), (Sections 21(e)(f)(g)(h) and (j)).

Regulations GN 509 dated August 2016 under the Section 21 (c) and (i) water uses of the NWA, 1998 (Act No 36 of 1998) stipulates the:

"Extent of a watercourse" as:

- a) The outer edge of the 1 in 100 year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; and
- b) Wetlands and pans: the delineated boundary [outer temporary zone (in this instance the edge of the riparian zone)] of any wetland or pan.

"Regulated area of a watercourse" for section 21(c) or (i) of the Act water uses in terms of this Notice means:

- a) The outer edge of the 1 in 100 year flood line and /or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam;
- b) In the absence of a determined 1 in 100 year flood line or riparian area the area within 100m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench (subject to compliance to section 144 of the Act); or
- c) A 500 m radius from the delineated boundary (extent) of any wetland or pan.

2.1. GN 704

In addition to the above, the project needs to adhere to Government Notice 704 as published on 4 June 1999. Regulation 704 (Government Gazette 2018) was drawn up to address the issues in relation to mining activities. Most impacts must be managed according to Condition 4, which describes the locality of infrastructure and mining activities; Condition 6, which deals with the capacity requirements of clean and dirty water systems; and Condition 7, which describes the measures which must be taken to protect water resources.

3. BASELINE DESCRIPTION

3.1. Climate

Musina has a hot semi-arid climate (Classification: BSh). The summers are long, hot, humid, and partly cloudy, while the winters are short, cool, dry, and clear.

Information on the climate baseline (i.e. historical climate conditions) was obtained from Meteoblue (2025). The Meteoblue climate diagrams are based on 30 years of hourly weather model simulations and give good indication of typical climate patterns and expected conditions. The simulated weather data have a spatial resolution of approximately 30 km and may not reproduce all local weather effects.

The below diagram shows the temperature data for the Musina area modelled based on the past 30 years.

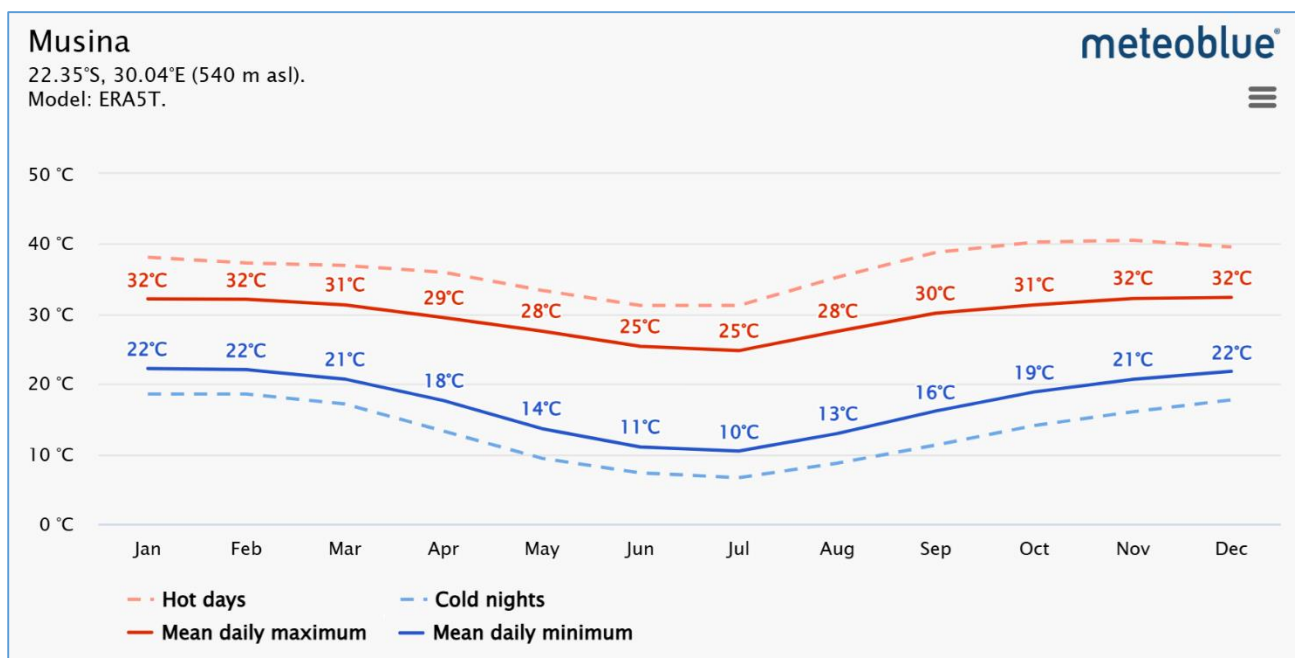


Figure 3: Temperature modelled (Meteoblue)

Average temperatures range from 10°C to 25°C in July, and 22°C to 32°C in January. Hot days reach temperatures of 38°C during the summer months, where cold days drop down to temperatures of 7°C.

The below table and diagram show the precipitation data for the Musina area modelled on data from the past 30 years.

Table 2: Precipitation modelled (mm) (Meteoblue)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
84	70	33	14	6	4	4	2	9	14	50	80	370

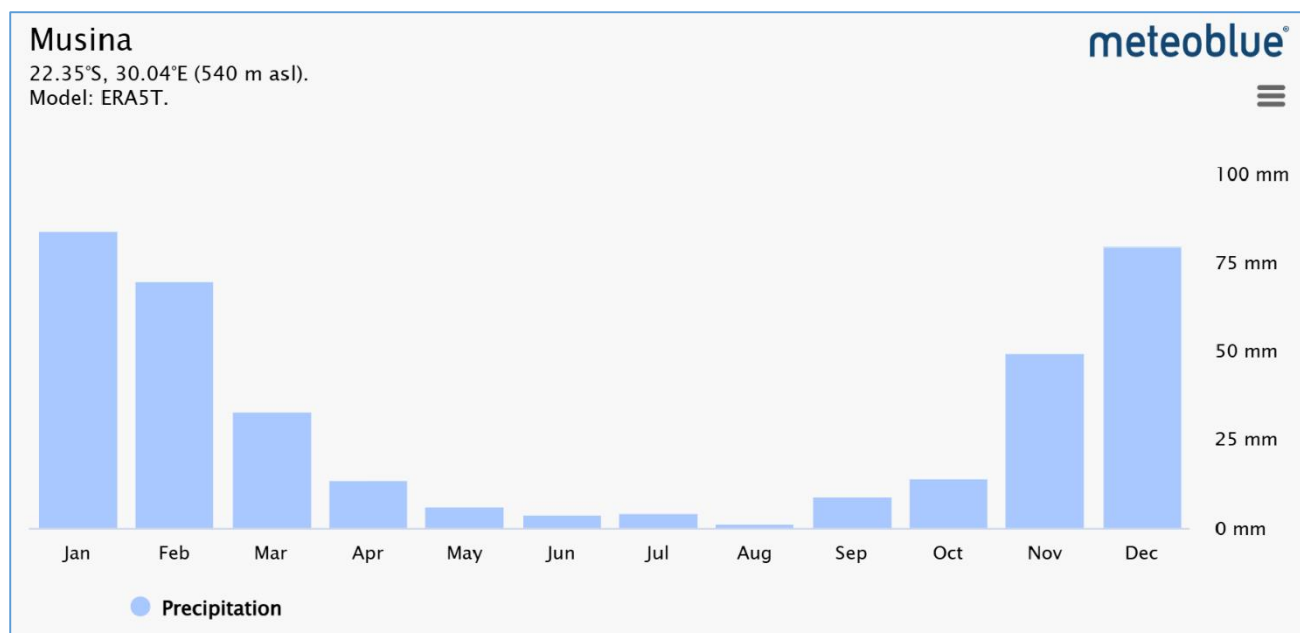


Figure 4: Precipitation modelled (Meteoblue)

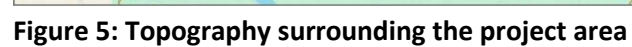
The data shows average total annual precipitation of 370 mm for the modelled data, with the bulk of precipitation falling between October and March (i.e. during the summer months) with an average of 55 mm per month, over these six months in the form of convectional thunderstorms.

The months of April to September (winter i.e. the dry season) typically experience lower precipitation levels with an average 6.5 mm per month.

3.2. Topography

The area is located approximately 720 m above sea level on a fairly flat area. The project area slopes predominantly from the south (approximately 740 mamsl) to the north (approximately 680 mamsl) with a gradient of 0.01.

The proposed operational activities are on a flat plain approximately 700 m above sea level. The image below depicts the topography of the project area as well as the location of the infrastructure for the proposed operation.



3.3. Ecoregion

According to the delineation of Ecoregions within South Africa, the area falls within the Limpopo Plain Ecoregion (Level 1 Ecoregion). Plains and lowlands characterize this ecoregion with a low to moderate relief and vegetation consisting mostly of Bushveld types and Mopane veld, characterises this region. This is generally a low laying, dry to arid, hot region with virtually no perennial streams originating in the area itself. Perennial rivers that traverse this region include the Crocodile (west), Marico, Mokolo, Lephala, and Mogalakwena.

Other general characteristics of the Ecoregion are as follows:

- Mean annual precipitation: Low to arid.
- Coefficient of variation of annual precipitation: Moderately high to high
- Drainage density: Mostly low but with some areas in the north having a high drainage density.
- Stream frequency: Mostly low to medium, but high in northeastern areas.
- Slopes <5%: Generally, >80% of the area.
- Median annual simulated runoff: Very low to low.
- Mean annual temperature: High to very high
- Size = 39383.5 km²

Table 3: Ecoregion attributes (Department of Water Affairs, 2005)

Main attributes	Limpopo Plain Ecoregion
Terrain Morphology: Broad division (dominant types in bold) (Primary)	Plains; Low Relief; Plains; moderate relief; Lowlands; Hills and Mountains; moderate and high relief; Closed hills; Mountains; moderate and high relief (limited)
Vegetation types (dominant types in bold) (Primary)	Mopane Bushveld; Sweet Bushveld; Mixed Bushveld; Waterberg Moist Mountain Bushveld; Clay Thorn Bushveld; Kalahari Plains Thorn Bushveld
Altitude (mamsl)	300-1100 (1100-1300 limited)
MAP (mm)	200 to 600
Coefficient of variation (% of annual precipitation)	25 to 40
Rainfall concentration index	60 to >65
Rainfall seasonality	Early to mid-summer
Mean annual temp (°C)	18 to 22
Mean daily max temp (°C) Feb.	26 to 32
Mean daily max temp (°C) July	20 to 24
Mean daily min temp (°C) Feb.	16 to 20
Mean daily min temp (°C) July	2 to >10
Median annual simulated runoff (mm) for quaternary catchment	<5 to 60 (60 - 100 limited)

The image below depict the operation in relation to the Highveld Ecoregion.

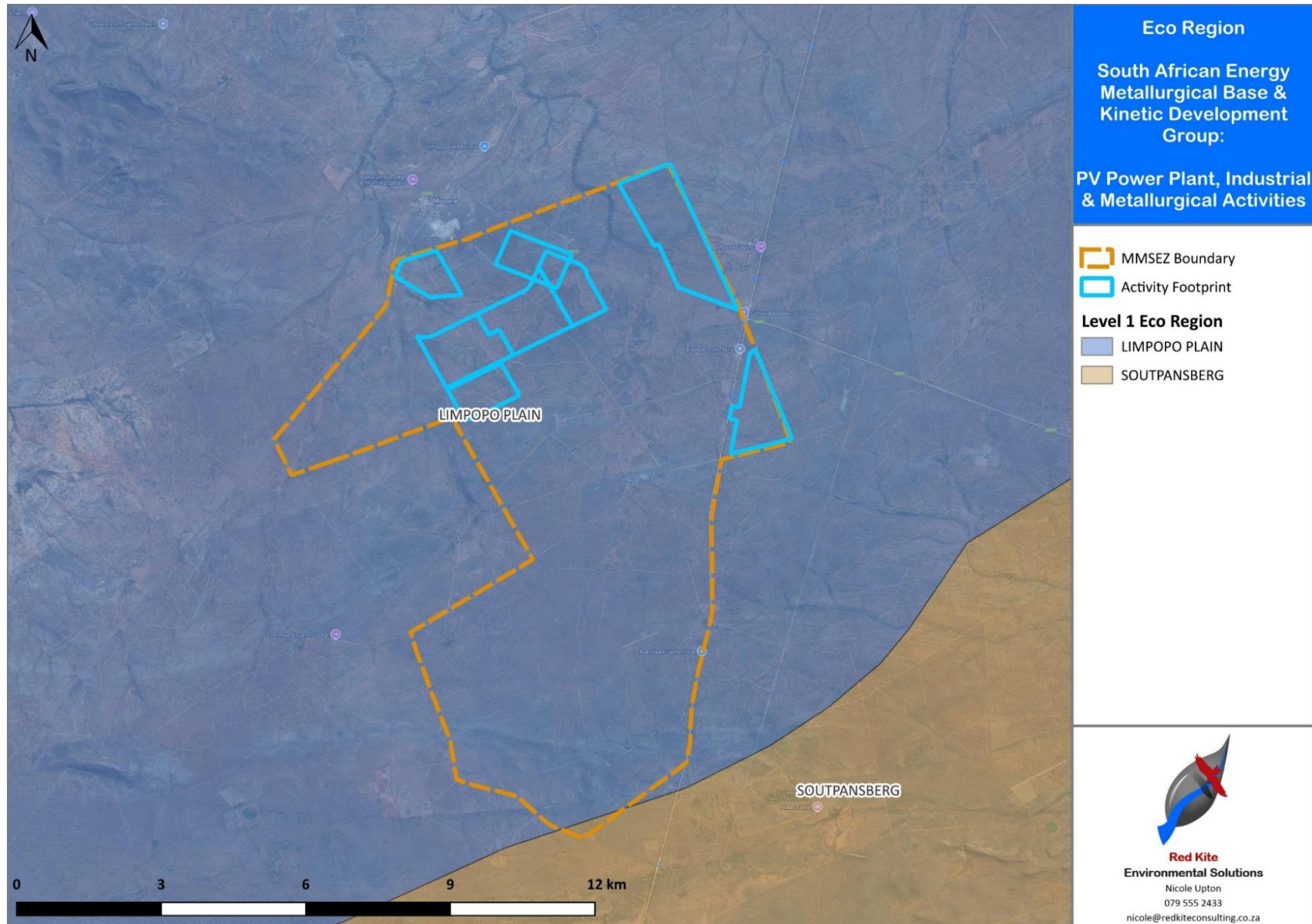


Figure 6: Eco Region for the project area

3.4. Freshwater Ecosystem Priority Areas

The National Freshwater Ecosystem Priority Areas (NFEPA) project is a multi-partner project between the Council for Scientific and Industrial Research (CSIR), the Water Research Commission, the South African National Biodiversity Institute, the Department of Forestry, Fisheries and the Environment, the South African Institute of Aquatic Biodiversity and South African National Parks. The project responds to the reported degradation of freshwater ecosystem condition and associated biodiversity, both globally and in South Africa. It uses systematic conservation planning to provide strategic spatial priorities for conserving South Africa's freshwater biodiversity, within the context of equitable social and economic development (Nel, et al., 2011).

The FEPA project has three inter-related components:

- A technical component to identify a national network of freshwater conservation areas;
- A national governance component to align DFFE and DWS policies and approaches for conserving freshwater ecosystems; and
- A sub-national governance and management component that conducts case studies to demonstrate how NFEPA outcomes can be implemented (Nel *et al*, 2011).

The project area is located in the A71K quaternary catchment, which is designated as a Freshwater Ecosystem Priority Area (FEPA).

Fish sanctuaries for rivers in a good condition (A or B ecological category) were identified as FEPAs, and the whole sub-quaternary catchment was included. Phase 2 FEPAs in moderately modified rivers (C ecological category) were identified for those river ecosystem types that could not achieve a biodiversity target in good condition rivers. The condition of these Phase 2 FEPAs should not be degraded further, as they may in future be considered for rehabilitation once good condition FEPAs (in an A or B ecological category) are considered fully rehabilitated.

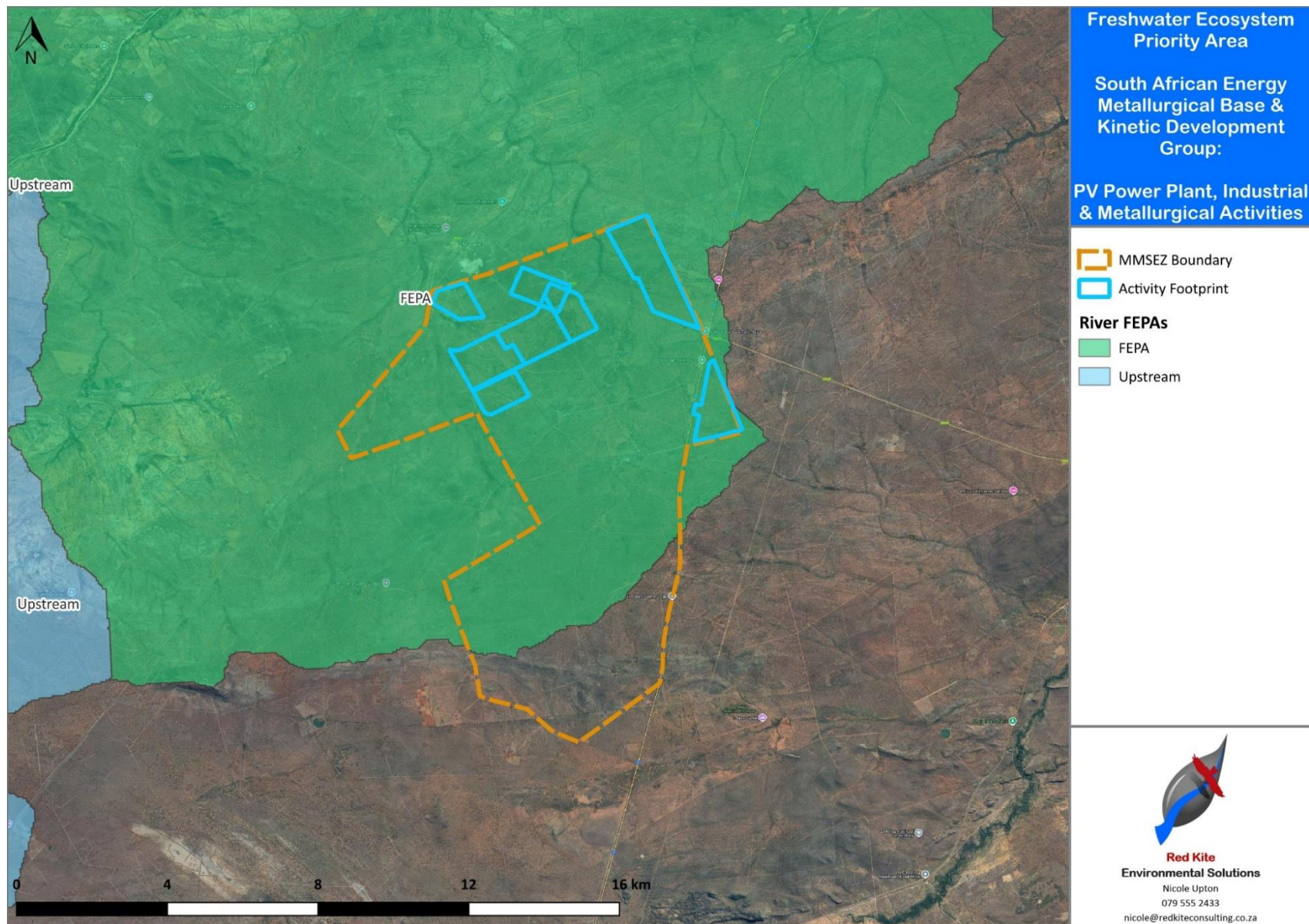


Figure 7: Freshwater Ecosystem Priority Areas for the project area

3.5. Strategic Water Source Areas

Strategic Water Source Areas (SWSAs) are defined as areas of land that either:

- a) supply a disproportionate (i.e. relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important; or
- b) have high groundwater recharge and where the groundwater forms a nationally important resource; or
- c) areas that meet both criteria (a) and (b).

SWSAs include transboundary Water Source Areas that extend into Lesotho and Swaziland. All surface water SWSAs are located in high rainfall areas where baseflow is at least 1125 mm/a, which is evidence of a strong link between groundwater and surface water in the SWSAs.

The aquifers sustain baseflow, contribute to runoff and, especially, contribute to dry season flows. Sustained river flows are important as they support people and communities who depend directly on rivers for their water, especially during the dry season and droughts.

The project area is not located in any surface water Strategic Water Source Area (SWSA).

3.6. Catchment

The project area is located in the A71 tertiary catchment within the Limpopo Water Management Area (WMA) North, specifically in the A71K quaternary catchment.

The major river in catchment A71K is the Sand River. The Sand River flows from south to north and drains into the Limpopo River at the South African and Zimbabwe border, 7 Km east of Musina.

The Limpopo WMA forms part of the Limpopo River basin, which spans the four countries of Botswana, Zimbabwe, South Africa and Mozambique. The WMA includes the following major rivers: the Limpopo River, Matlabas River, Mokolo River, Lephalala River, Mogalakwena River, Sand River and Nzhelele River and includes the following major dams:

- Cross Dam, in the Nwanedi River
- Doorndraai Dam, in the Sterk River
- Glen Alpine Dam, in the Mogalakwena River
- Luphephe Dam, in the Luphephe River
- Mokolo Dam, in the Mokolo River
- Mutshedzi Dam, in the Mutshedzi River
- Nwanedi Dam, in the Nwanedi River
- Nzhelele Dam, in the Nzhelele River

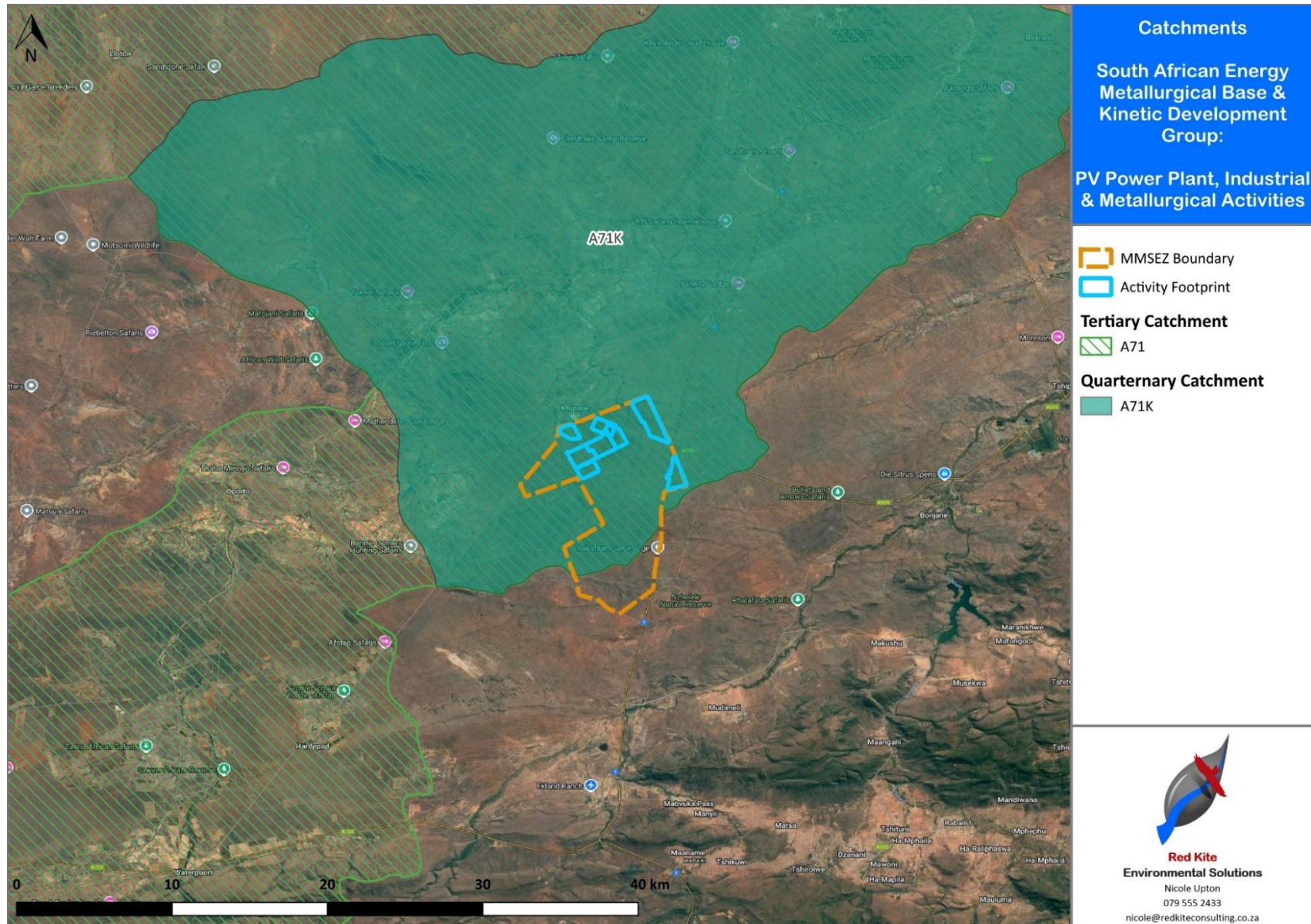


Figure 8: Catchments

3.7. Resource Classification

Integrated Units of Analysis (IUAs) are classified in terms of their extent of permissible utilisation and protection as either Class I: indicating high environmental protection and minimal utilisation; or Class II: indicating moderate protection and moderate utilisation; and Class III: indicating sustainable minimal protection and high utilisation.

Secondary catchments A5 to A9, forming the Limpopo WMA North, do not have any resource classification available at the time of writing this report. A project is underway for the determination of water resource classes, reserve and resource quality objectives including these secondary catchments (DWS, March 2024).

3.8. Present Ecological State, Importance and Reserve

Studies undertaken by the Department of Water and Sanitation assessed all quaternary catchments as part of the Resource Directed Measures for Protection of Water Resources.

The details are summarised in the table below were sourced from the Determination of Water Resource Classes, Reserve and Resource Quality Objectives for Secondary Catchments A5-A9 within the Limpopo Water Management Area (WMA 1) and Secondary Catchment B9 in the Olifants Water Management Area (WMA 2), Department of Water and Sanitation (March 2024). Not all aspects of the quaternary catchment have been identified and classified as this is an ongoing DWS project.

Table 4: PES, EIS and reserve data for Catchment (DWS, 20247)

Component	A71K
River	Sand
EWR Site	SAND-A71K-R508B
Present Ecological Status (PES)	Class C
Recommended Ecological Status (REC)	Class C

Table 5: Classification of River Health Assessment Classes

Class	Description	% Change from Natural
A	Still in a natural condition.	>92 -100
A/B		>88 - 92
B	Slightly modified. A small change in natural habitats and biota has taken place but the ecosystem functions are essentially unchanged from natural.	>82 - 88
B/C		>78 - 82
C	Moderately modified from natural. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still unchanged.	>62 - 78
C/D		>58 - 62
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	>42 - 58
D/E		>38 - 42
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20 - 38

Class	Description	% Change from Natural
F	Critically/Extremely modified. The system has been critically modified with an almost complete loss of natural habitat and biota. In the worst instances, basic ecosystem functions have been destroyed, and the changes are irreversible.	<20

3.9. Surface Water Quality

This is an assessment, and no surface water samples were taken and analysed to form a baseline. As with the classification and reserve determination, quality objectives are yet to be set for the catchment by DWS.

Instead, the South African Water Quality Guidelines Volume 7, Aquatic Ecosystems (DWAf, 1996) was used as a baseline Target Water Quality Range (TWQR) until the Resource Quality Objectives are identified by DWS.

Table 6: Target Water Quality Range (TWQR) - Aquatic Ecosystems (DWAf, 1996)

Variable	Unit	Aquatic Ecosystems
Aluminium (Al)	mg/l	<0.01
Ammonia (NH ₃)	mg/l	<0.007
Arsenic (As)	mg/l	<0.01
Cadmium (Cd)	mg/l	<0.0004
Chlorine (Cl ₂)	mg/l	<0.0002
Trivalent Chromium (Cr III)	mg/l	<0.012
Hexavalent Chromium (Cr VI)	mg/l	<0.007
Copper (Cu)	mg/l	<0.0014
Cyanide (CN)	mg/l	<0.001
Fluoride (F)	mg/l	<0.75
Iron (Fe)	mg/l	<10% Variation
Lead (Pb)	mg/l	<0.0012
Manganese (Mn)	mg/l	<0.18
Mercury	mg/l	<0.00004
Nitrate (NO ₃) and Nitrite (NO ₂)	mg/l	<0.5
pH - Value	@ 25°C	<5% Variation
Phenol	mg/l	0.03
Orthophosphate (PO ₄)	mg/l	<15% Variation
Selenium (Se)	mg/l	<0.002
Temperature	°C	<10% Variation
Total Dissolved Solids (TDS)	mg/l	<15% Variation
Total Suspended Solids (TSS)	mg/l	<10% Variation
Zinc (Zn)	mg/l	<0.002

3.10. Surface Water Resources and Drainage Systems

Multiple drainage lines were identified within and around the project site. Activities were planned to avoid the major drainage lines and farm dams. All drainage lines in and around the activities are non-perennial.

The site drains through two non-perennial unnamed tributaries of the Sand River on the northeastern and northwestern sections of the site. These drainage lines converge north of Mopane before the confluence with the Sand River further north.

The Sand River continues north-east for approximately 40 km before draining into the Limpopo River at the South Africa and Zimbabwe border. The Limpopo River continues as the South African border up to Mozambique, where it continues south-east through Mozambique and drains into the Indian Ocean.

Figure 9 below, depicts the surface water resources surrounding the operation footprint.

3.1. Current Surface Water Users

The area is largely undeveloped with limited mining and livestock being the main uses in the areas surrounding the sites. On a macro level, agriculture developments are found next to the Sand River. Overall, the current surface water uses in the area are very limited.

3.1. Wetlands

From the assessment, there appears to be no wetlands within 500 m of the project footprint, which is supported by the 1:50,000 ortho-maps, as well as the NFEPA database.

3.2. Sensitivity

The drainage lines found on site are all non-perennial, and are expected to only containing water during and shortly after heavy rain events. Due to the limited rainfall and high evaporation in the area, riparian and wetland areas will be unlikely. Drainage lines are expected to only have denser vegetation consistent with the surrounding areas.

Scattered, man-made, in stream farm dams were found on the property using satellite maps. A site survey will be required to assess the sensitivity of the areas surrounding these farm dams. The proposed activity locations were placed to avoid potentially sensitive areas as seen in figure 9 below.

No significant watercourses, riparian areas or wetlands are located within 100 m of the project footprint, based on the study. Impacted drainage lines are non-perennial and are expected to be of medium sensitivity. Therefore, in terms of surface water features, the entire project footprint and 100 m project area buffer is expected to be of medium sensitivity. However, this will need to be verified through a site survey.

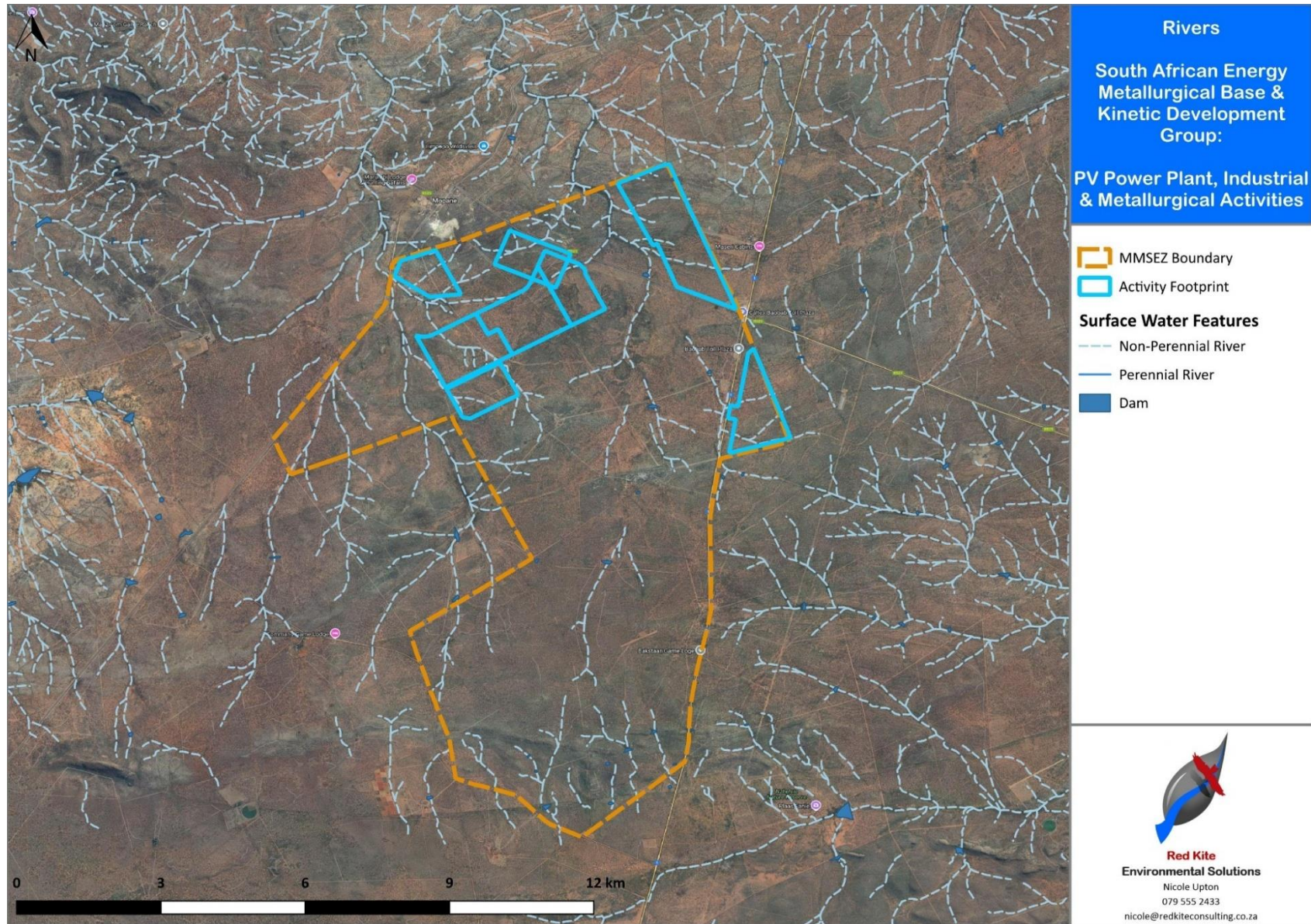


Figure 9: Surrounding watercourses and other surface water resources

4. ASSESSMENT OF POTENTIAL SURFACE WATER IMPACTS

All forms of development, albeit for mining, industrial, urban or residential purposes, will have an immediate effect on the natural environment. It is therefore of utmost importance to provide information on the environmental consequences these activities will have and to inform the decision-makers thereof.

4.1. Methodology

The methodology utilised to determine the risk of the activities to the environment is explained below.

4.1.1. Assessment Criteria

The criteria for the description and assessment of environmental impacts were drawn from the EIA Guidelines, National Environmental Management Act (Act No. 107 of 1998): EIA Regulations (2014) [as amended].

The level of detail as depicted in the EIA Guidelines was refined by assigning specific values to each impact. In order to establish a coherent framework within which all impacts could be objectively assessed, it was necessary to establish a rating system, which was applied consistently to all the criteria. For such purposes, each aspect was assigned a value, ranging from one (1) to five (5), depending on its definition. This assessment is a relative evaluation within the context of all the activities and the other impacts within the framework of the project.

An explanation of the impact assessment criteria is defined below.

Table 7: Impact Assessment Criteria

EXTENT	
Classification of the physical and spatial scale of the impact	
Footprint	The impacted area extends only as far as the activity, such as footprint occurring within the total site area.
Site	The impact could affect the whole, or a significant portion of the site.
Regional	The impact could affect the area including the neighbouring farms, the transport routes and the adjoining towns.
National	The impact could have an effect that expands throughout the country (South Africa).
International	Where the impact has international ramifications that extend beyond the boundaries of South Africa.
DURATION	
The lifetime of the impact that is measured in relation to the lifetime of the proposed development.	
Short term	The impact will either disappear with mitigation or will be mitigated through a natural process in a period shorter than that of the construction phase.
Short to Medium term	The impact will be relevant through to the end of a construction phase (1.5 years).
Medium term	The impact will last up to the end of the development phases, where after it will be entirely negated.

Long term	The impact will continue or last for the entire operational lifetime i.e. exceed 30 years of the development, but will be mitigated by direct human action or by natural processes thereafter.
Permanent	This is the only class of impact, which will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient.
INTENSITY	
The intensity of the impact is considered by examining whether the impact is destructive or benign, whether it destroys the impacted environment, alters its functioning, or slightly alters the environment itself. The intensity is rated as	
Low	The impact alters the affected environment in such a way that the natural processes or functions are not affected.
Medium	The affected environment is altered, but functions and processes continue, albeit in a modified way.
High	Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.
PROBABILITY	
This describes the likelihood of the impacts actually occurring. The impact may occur for any length of time during the life cycle of the activity, and not at any given time. The classes are rated as follows:	
Improbable	The possibility of the impact occurring is none, due either to the circumstances, design or experience. The chance of this impact occurring is zero (0 %).
Possible	The possibility of the impact occurring is very low, due either to the circumstances, design or experience. The chances of this impact occurring is defined as 25 %.
Likely	There is a possibility that the impact will occur to the extent that provisions must therefore be made. The chances of this impact occurring is defined as 50 %.
Highly Likely	It is most likely that the impacts will occur at some stage of the development. Plans must be drawn up before carrying out the activity. The chances of this impact occurring is defined as 75 %.
Definite	The impact will take place regardless of any prevention plans, and only mitigation actions or contingency plans to contain the effect can be relied on. The chance of this impact occurring is defined as 100 %.

The status of the impacts and degree of confidence with respect to the assessment of the significance must be stated as follows:

- **Status of the impact:** A description as to whether the impact would be positive (a benefit), negative (a cost), or neutral.
- **Degree of confidence in predictions:** The degree of confidence in the predictions, based on the availability of information and specialist knowledge.

Other aspects to take into consideration in the specialist studies are:

- Impacts should be described both before and after the proposed mitigation and management measures have been implemented.
- All impacts should be evaluated for the full lifecycle of the proposed development, including construction, operation and decommissioning.

- The impact evaluation should take into consideration the cumulative effects associated with this and other facilities which are either developed or in the process of being developed in the region.
- The specialist studies must attempt to quantify the magnitude of potential impacts (direct and cumulative effects) and outline the rationale used. Where appropriate, national standards are to be used as a measure of the level of impact.

4.1.2. Mitigation

The impacts that are generated by the development can be minimised if measures are implemented in order to reduce the impacts. The mitigation measures ensure that the development considers the environment and the predicted impacts in order to minimise impacts and achieve sustainable development.

4.1.2.1. Determination of Significance-Without Mitigation

Significance is determined through a synthesis of impact characteristics as described in the above paragraphs. It provides an indication of the importance of the impact in terms of both tangible and intangible characteristics. The significance of the impact “without mitigation” is the prime determinant of the nature and degree of mitigation required. Where the impact is positive, significance is noted as “positive”. Significance is rated on the following scale:

Table 8: Significance-Without Mitigation

NO SIGNIFICANCE	The impact is not substantial and does not require any mitigation action.
LOW	The impact is of little importance but may require limited mitigation.
MEDIUM	The impact is of importance and is therefore considered to have a negative impact. Mitigation is required to reduce the negative impacts to acceptable levels.
HIGH	The impact is of major importance. Failure to mitigate, with the objective of reducing the impact to acceptable levels, could render the entire development option or entire project proposal unacceptable. Mitigation is therefore essential.

4.1.2.2. Determination of Significance- With Mitigation

Determination of significance refers to the foreseeable significance of the impact after the successful implementation of the necessary mitigation measures. Significance with mitigation is rated on the following scale:

Table 9: Significance- With Mitigation

NO SIGNIFICANCE	The impact will be mitigated to the point where it is regarded as insubstantial.
LOW	The impact will be mitigated to the point where it is of limited importance.
LOW TO MEDIUM	The impact is of importance, however, through the implementation of the correct mitigation measures such potential impacts can be reduced to acceptable levels.
MEDIUM	Notwithstanding the successful implementation of the mitigation measures, to reduce the negative impacts to acceptable levels, the negative impact will remain of significance. However, taken within the overall context of the project, the persistent impact does not constitute a fatal flaw.
MEDIUM TO HIGH	The impact is of major importance but through the implementation of the correct mitigation measures, the negative impacts will be reduced to acceptable levels.

HIGH	The impact is of major importance. Mitigation of the impact is not possible on a cost-effective basis. The impact is regarded as high importance and taken within the overall context of the project, is regarded as a fatal flaw. An impact regarded as high significance, after mitigation could render the entire development option or entire project proposal unacceptable.
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4.1.3. Assessment Weighting

Each aspect within an impact description was assigned a series of quantitative criteria. Such criteria are likely to differ during the different stages of the project's life cycle. In order to establish a defined base upon which it becomes feasible to make an informed decision, it was necessary to weigh and rank all the criteria.

4.1.3.1. Ranking, Weighting and Scaling

For each impact under scrutiny, a scaled weighting factor is attached to each respective impact (table below). The purpose of assigning weights serves to highlight those aspects considered the most critical to the various stakeholders and ensure that each specialist's element of bias is taken into account. The weighting factor also provides a means whereby the impact assessor can successfully deal with the complexities that exist between the different impacts and associated aspect criteria.

Simply, such a weighting factor is indicative of the importance of the impact in terms of the potential effect that it could have on the surrounding environment. Therefore, the aspects considered to have a relatively high value will score a relatively higher weighting than that which is of lower importance.

Table 10: Description of assessment parameters with its respective weighting

EXTENT		DURATION		INTENSITY		PROBABILITY		WEIGHTING FACTOR (WF)		SIGNIFICANCE RATING (SR)	
Footprint	1	Short term	1	Low	1	Improbable	1	Low	1	Low	0-19
Site	2	Short to Medium	2			Possible	2	Low to Medium	2	Low to Medium	20-39
Regional	3	Medium term	3	Medium	3	Likely	3	Medium	3	Medium	40-59
National	4	Long term	4			Highly Likely	4	Medium to High	4	Medium to High	60-79
International	5	Permanent	5	High	5	Definite	5	High	5	High	80-100
MITIGATION EFFICIENCY (ME)						SIGNIFICANCE FOLLOWING MITIGATION (SFM)					
High			0.2			Low			0 - 19		
Medium to High			0.4			Low to Medium			20 - 39		
Medium			0.6			Medium			40 - 59		
Low to Medium			0.8			Medium to High			60 - 79		
Low			1.0			High			80 - 100		

4.1.3.2. Identifying the Potential Impacts Without Mitigation Measures (WOM)

Following the assignment of the necessary weights to the respective aspects, criteria are summed and multiplied by their assigned weightings, resulting in a value for each impact (prior to the implementation of mitigation measures).

Equation 1:

Significance Rating (WOM) = (Extent + Intensity + Duration + Probability) x Weighting Factor

4.1.3.3. Identifying the Potential Impacts With Mitigation Measures (WM)

In order to gain a comprehensive understanding of the overall significance of the impact, after implementation of the mitigation measures, it was necessary to re-evaluate the impact.

4.1.3.4. Mitigation Efficiency (ME)

The most effective means of deriving a quantitative value of mitigated impacts is to assign each significance rating value (WOM) a mitigation efficiency (ME) rating. The allocation of such a rating is a measure of the efficiency and effectiveness, as identified through professional experience and empirical evidence of how effectively the proposed mitigation measures will manage the impact.

Thus, the lower the assigned value the greater the effectiveness of the proposed mitigation measures and subsequently, the lower the impacts with mitigation.

Equation 2:

Significance Rating (WM) = Significance Rating (WOM) x Mitigation Efficiency
or WM = WOM x ME

4.1.3.5. Significance Following Mitigation (SFM)

The significance of the impact after the mitigation measures are taken into consideration. The efficiency of the mitigation measure determines the significance of the impact. The level of impact is therefore seen in its entirety with all considerations taken into account.

4.2. Environmental Risk Assessment

The following section focuses on the potential impacts that the activity and associated activities, as per the proposed projects, may have on the surface water in the area. Potential impacts as a result of the proposed activities will be investigated for three phases of development: construction phase, operational phase and decommissioning phase.

The following activities will be included as activities and assessed:

- Ferrochrome plant
- Coal washery plant
- Coke plant
- Heat recovery plant
- Lime plant
- Solar power plant
- Administrative centre
- Supporting infrastructure

4.2.1. Phase Activities

The following activities, relevant to surface water impacts, are expected during the lifetime of the proposed PV Power Plant, Industrial and Metallurgical Project:

- **Construction Phase:**
 - Site clearing – removal of vegetation groundworks
 - Construction of infrastructure:
 - Road infrastructure
 - Power infrastructure
 - Solar power plant
 - Perimeter fencing and security facilities
 - Offices, parking and staff facilities
 - Processing plants
 - Water storage, pipelines and boreholes
 - Water Treatment Plant
 - Stormwater management infrastructure
- **Operational Phase:**
 - Ongoing utilization and maintenance of the above infrastructure
 - Hauling of raw materials and products
 - Storage of raw materials and products
 - Storage and treatment of wastewater and residue materials
 - Stormwater management and storage/reuse of “dirty” area runoff
 - Discharge of treated water
- **Decommissioning Phase:**
 - Demolition and removal of all structures including transporting of waste materials off site.
 - Removing of road, power and water infrastructure.
 - Removal of stormwater containment infrastructure.
 - Rehabilitation, including shaping, spreading of soil and re-vegetation.

4.2.2. Potential Impacts and Mitigation Measures

Surface water impacts are normally either an impact to quantity (the volume, flow and velocity) or quality (organic and inorganic makeup of the water). It should be noted that the quantity of the water can have an adverse effect upon the quality, as concentration levels of pollutants are related to dilution, and dilution in return related to quantity.

Potential impact descriptions:

- The removal of vegetation for site clearance for the development of infrastructure during the construction phase will expose soils which may lead to erosion. Eroded material may cause sedimentation in downstream surface water resources.
- During closure the rehabilitation process will require the loosening of soil for revegetation, this will also increase the potential for erosion of topsoil until sufficient vegetation is established.
- Movement of heavy machinery during construction, operation and closure phases will compact the soil surface and will reduce infiltration and increase surface flow velocity that may cause erosion and sedimentation of the downstream surface water resources.

- Additionally, impermeable surfaces are created from infrastructure such as offices, staff facilities and processing facilities, reduce infiltration and increase runoff quantity and runoff velocity that may impact downstream surface water resources if not properly managed and contained.
- Alteration of natural drainage patterns from storm water separation of “clean” and “dirty” surface water runoff through diversion, may increase runoff velocity and subsequently erosion and sedimentation of downstream surface water resources.
- Containing surface water from “dirty” areas reduce the quantity of surface water received (catchment yield) by downstream surface water resources, reducing dilution and potentially reducing the quality of downstream surface water resources.
- Increased erosion means that the run-off contains a higher silt or sediment load, which is discharged to the major rivers. A component of this sediment load is particles fine enough to remain in suspension, ‘clouding’ or ‘muddying’ the water.
- If there are too many suspended solids in the water this can negatively affect biological life. In addition, a changed sediment load could have similar morphological effects to the river as changing peak flow rates, such as changes in channel character or dimensions and changes to bed roughness. All of these changes could potentially affect biological life.
- The utilisation, maintenance and refuelling of vehicles and machinery during construction, operation, as well as closure phases, may result in hydrocarbon spills that may contaminate surface water runoff and subsequently, impact the quality of downstream surface water resources.
- Hauling and storing of raw materials for processing, as well as the storage and hauling of waste and products after processing may contaminate runoff, if not properly contained and managed.
- Washing and burning coal on site pose a high risk as pyrite exposed to air and water will oxidize and form sulfuric acid and dissolved iron, known as Acid Mine Drainage (AMD). If this is not properly contained AMD will severely impact downstream surface water resources.
- Wastewater from the coal wash plant contain coal particles, ash, heavy metals and non-biodegradable pollutants that can have lasting effects if released into the natural environment.
- Ferrochrome processing releases dust and gas especially the carcinogenic hexavalent chrome (Cr (VI)) and poisonous carbon monoxide captured in water/filters will severely impact aquatic ecosystems if released/spilled.
- Additionally, ferrochrome slag, a byproduct of the processing, also poses a risk to surface water resources if not properly contained.
- As with the other processing plants, the coke plant wastewater can contain pollutants like ammonia, phenols and heavy metals that can severely impact downstream surface water resources if spilled or discharged.
- With staff on site the risk of litter and sewage spills increase that may negatively impact surface water quality of downstream surfaces water resources.
- Prolonged activities in the area, especially within and in proximity to watercourses and sensitive zones, may lead to loss of biodiversity, proliferation of alien invasive plant species, and loss of ecological function of surface water features, impacting water quality of surface water resources.

The table below show the impact assessment, rating identified impact with and without mitigation measures. This is followed by the table, detailing the mitigation measures recommended for each impact identified.



Cumulative risk assessment:

Section 2 of the NEMA requires the consideration of cumulative impacts as part of any environmental assessment process. EIAs have generally, however, failed to fully identify and assess such impacts, largely as a result of the following considerations:

- Cumulative effects may be local, regional or global in scale and dealing with such impacts requires coordinated institutional arrangements; and
- EIA's or surface water assessments are typically carried out on specific development area, whereas cumulative impacts result from broader biophysical, social and economic considerations, which typically cannot be addressed at the project level.

The cumulative impacts associated with the proposed project are the same as discussed above for the aspects of the activities being undertaken. With surface water assessments the impacts are not specific to the site, instead take into account all downstream surface water resources.

The rating will be higher compared to the individual component ratings as the landscape alterations are permanent features and water quality impacts will most likely have long-term impacts over a greater spatial extent.

Due to the high risk with the activities, high extent, as well as the potential intensity of the impacts, and taking into account the implementation of the recommended mitigation measures the cumulative risk should be in the region of medium to high significance.

Table 11: Identification and quantification of potential impacts on the surface water environment

No	Phases	Activity	Aspect	Impact	Extent	Duration	Intensity	Probability	Weighting Factor	Significance	Mitigation Efficiency	Significance
										Pre-Mitigation		Post-Mitigation
1	Co, Cl	Site/vegetation clearance and soil exposure	Clearance of vegetation / topsoil for the purpose of construction and rehabilitation of the disturbed areas.	Exposed surfaces could result in increased erosion and associated runoff which in turn may result in increased siltation of surface streams.	3	4	3	4	2	28	0,6	17
2	Co, O, Cl	Operation of vehicles, heavy vehicles and machinery and construction of infrastructure as well as, construction and use of buildings and infrastructure.	Movement of heavy machinery compacting soils and infrastructure increasing impermeable surfaces. Buildings, parking structures and roads also add impermeable surfaces.	Compacted and impermeable surfaces reduce infiltration and increase surface flow velocity that may cause erosion and sedimentation of the downstream surface water resources.	3	4	3	4	2	28	0,6	17
3	Co, O, Cl	Alteration of drainage patterns	Diversion and funnelling of surface water flow to separate "clean" and	Increased quantity and velocity of surface water runoff in streams will increase erosion and sedimentation.	3	4	3	4	2	28	0,6	17

No	Phases	Activity	Aspect	Impact	Extent	Duration	Intensity	Probability	Weighting Factor	Significance	Mitigation Efficiency	Significance
										Pre-Mitigation		Post-Mitigation
			"dirty" water runoff.									
4	Co, O, Cl	Containment of surface water flow	Containment of "dirty" surface water runoff in a PCD.	Reduction in catchment yield and reducing dilution and potentially reducing the quality of downstream surface water resources.	3	4	3	5	1	15	0,8	12
5	O	Operation of processing plants	Hauling and storing of raw material to be processed and processed products on site.	Run-off from areas storing or used for transporting raw and processed materials may cause contamination of the downstream surface water resources.	3	4	3	4	5	70	0,8	56
6	O		Storing, washing and processing coal.	Pyrite exposure to water and air leads to Acid Mine Drainage (AMD). Wastewater generated may contain heavy metals, non-biodegradable pollutants and various impurities.	4	4	5	4	5	85	0,8	68

No	Phases	Activity	Aspect	Impact	Extent	Duration	Intensity	Probability	Weighting Factor	Significance	Mitigation Efficiency	Significance
										Pre-Mitigation		Post-Mitigation
				Runoff not contained, discharge and spills from wastewater containment may seriously impact downstream surface water resources.								
7	O		Ferrochrome processing.	Capturing of dust and hazardous gas containing chromium (especially hexavalent chrome) and carbon monoxide with water, as well as the slag byproduct created from the smelting process, can severely impact surface water resources if not properly contained, recycled and disposed of.	4	4	5	4	5	85	0,8	68
8	O		Coke/Steel processing.	Wastewater from the coke plant contains ammonia,	4	4	5	4	5	85	0,8	68

No	Phases	Activity	Aspect	Impact	Extent	Duration	Intensity	Probability	Weighting Factor	Significance	Mitigation Efficiency	Significance
										Pre-Mitigation		Post-Mitigation
				phenols and heavy metals that will negatively impact surface water quality if released into the environment.								
9	Co, O,	Human movement and activities	Containment and disposal of litter and sewage.	Litter and sewage spills increase that may negatively impact surface water quality of downstream surfaces water resources.	3	4	3	4	3	42	0,8	34
10	Co, O, Cl		Utilisation of vehicles and heavy vehicles for transporting of staff, materials and products.	Hydrocarbon spills and contaminated runoff from roads may contaminate downstream surface water resources.	3	4	3	4	3	42	0,8	34
11	Co, O, Cl		Movement and human activities in proximity to sensitive areas.	Disturbing the natural environment may lead to loss of biodiversity, proliferation of alien invasive plant species, and loss of ecological function of surface water	3	4	3	4	3	42	0,8	34

No	Phases	Activity	Aspect	Impact	Extent	Duration	Intensity	Probability	Weighting Factor	Significance	Mitigation Efficiency	Significance
										Pre-Mitigation		Post-Mitigation
				features, impacting water quality of surface water resources.								
12	O	Operation of the solar power plant	Local electricity generation.	Positive Impact: Green energy eliminates the need for the use of hydrocarbons and fossil fuels for energy generation.	2	4	3	5	1	14	0,6	8
13	O	Operation of heat recovery plant	Reducing plant heat loss for the smelting process.	Positive Impact: Minimising wasted heat significantly reduce fuel required for the smelting process and potential waste generated.	2	4	3	5	1	14	0,6	8

Table 12: Mitigation measures proposed for the activities

No	Phases	Impact	Control/Mitigation Measures
1	Co, Cl	Exposed surfaces could result in increased erosion and associated runoff which in turn may result in increased siltation of surface streams.	Development of the storm water management structures to ensure that sediment generated during the construction, operation and closure phases is conveyed to the silt trap and contained in the PCD, and clean water is diverted away from dirty water areas.
			Ensure that effective separation of clean and dirty water systems is implemented, as designed by an engineer. No contaminated (“dirty”) water should be allowed to enter the natural environment, clean water systems or water resources.
			Ensure that all the dirty water emanating from the dirty water areas is collected via silt traps before entering the PCD for re-use within the mine, to prevent unnecessary discharge into the environment.
			Storm water management structures should be inspected after large storm events to ensure that there are no blockages or damage. Should blockages or damage occur, immediate action should be undertaken to remove debris or to repair damaged areas.
			If excessive erosion is observed, soil management and erosion protected structures and measures should be implemented.
			Leaving the storm water management structures in place during the decommissioning and post closure phase until the rehabilitation process is completed, will ensure that sediment generated during this phase is captured.
			Vegetation removal should be limited to the footprint of the proposed project.
2	Co, O, Cl	Compacted and impermeable surfaces reduce infiltration and increase surface flow velocity that may cause erosion and sedimentation of the downstream surface water resources.	Mitigation measures provided in point 1 will apply for this impact.
			Roads should be maintained regularly to ensure that surface water drains freely off the road preventing erosion.
			Soils compacted by heavy machinery in areas that are not utilised post construction and during closure phases can be ripped to allow infiltration.
			Cleared areas should be ripped, ploughed and seeded with indigenous, endemic plant species during rehabilitation

No	Phases	Impact	Control/Mitigation Measures
3	Co, O, Cl	Increased quantity and velocity of surface water runoff in streams will increase erosion and sedimentation.	Implement erosion control and flow impedance measures for diverted "clean" water channels to reduce erosion and capture sediment.
4	Co, O, Cl	Reduction in catchment yield and reducing dilution and potentially reducing the quality of downstream surface water resources.	Continuously reduce and rehabilitate the footprint of the dirty water area where possible to reduce the extent of the impacts. Rehabilitation processes such as restoring the topography to a pre-activity state, and re-vegetation of disturbed areas will assist in returning natural surface water drainage patterns (Establish free-draining final landform).
5	O	Run-off from areas storing or used for transporting raw and processed materials may cause contamination of the downstream surface water resources.	Mitigation measures provided in point 1 will apply for this impact to contain runoff from raw material stockpiles in the "dirty" water area.
			Runoff from dirty water areas should be contained and recycled/reused, never discharged.
			Bund walls should be created around stockpiles to contain the materials to reduce the chances of spills into the natural environment.
			Stockpiling/storage areas need to be licenced and constructed as per the requirements of the Competent Authority.
6	O	Pyrite exposure to water and air leads to Acid Mine Drainage (AMD). Wastewater generated may contain coal fines, heavy metals, non-biodegradable pollutants and various impurities. Runoff not contained, discharge and spills may seriously impact downstream surface water resources.	Mitigation measures provided in point 1 and 5 will apply for this impact.
			Seepage or discharge of wastewater from the wastewater containment facilities should be prevented to reduce pollution of surface water resources as well as to improve water conservation. Dirty water containment facilities and residue stockpiles should be appropriately lined as per the recommendations of the Geohydrological and/or Waste Classification Study.
7	Co, O, Cl	Capturing of dust and hazardous gas containing chromium (especially hexavalent chrome) and carbon monoxide with water, as well as the slag byproduct created from the smelting process, can severely impact surface water resources if	Mitigation measures provided in point 1, 5 and 6 will apply for this impact.
			Slag generated should be recycled and byproducts properly disposed of through licenced facilities.

No	Phases	Impact	Control/Mitigation Measures
		not properly contained, recycled and disposed of.	
8	Co, O, Cl	Wastewater from the coke plant contain ammonia, phenols and heavy metals that will negatively impact surface water quality if released into the environment.	Mitigation measures provided in point 1, 5 and 6 will apply for this impact.
9	Co, O,	Litter and sewage spills increase that may negatively impact surface water quality of downstream surfaces water resources.	Staff should be educated on the requirement for trash disposal and the facilities should be available in key areas to ensure efficient disposal of trash. The processes for removal of litter/trash from site on a regular should be implemented to be properly disposed of. The processes for removal or treatment and recycling of sewage should be implemented.
10	Co, O, Cl	Hydrocarbon spills and contaminated runoff from roads may contaminate downstream surface water resources.	The required processes should be in place to remove and properly dispose of waste hydrocarbons and chemicals as well as contaminated water and soils in the event of a spill, through a licenced facility. Limit refuelling, washing and maintenance of machinery and vehicles to specified locations and ensure the appropriate spill prevention and incident management measures are in place. In case of accidental spillages, specialized equipment should be available on site to mop up and or nullify the pollutants.
11	Co, O, Cl	Disturbing the natural environment may lead to loss of biodiversity, proliferation of alien invasive plant species, and loss of ecological function of surface water features, impacting water quality of surface water resources.	Avoid encroaching on natural areas directly adjacent to proposed activities Proliferation of alien and invasive species is expected within any disturbed areas. AIP species should be eradicated and controlled to prevent their spread within or beyond the footprint. An AIP Control Plan should be compiled and implemented for the proposed project.

No	Phases	Impact	Control/Mitigation Measures
12	O	Positive Impact: Green energy eliminates the need for the use of hydrocarbons and fossil fuels for energy generation.	Mitigation not required.
13	O	Positive Impact: Minimising wasted heat significantly reduce fuel required for the smelting process and potential waste generated.	Mitigation not required.

5. ENVIRONMENTAL MANAGEMENT

The following measures should be followed to minimise the impact from project activities:

- Quantitative and qualitative assessment of the water resources on the project property to effectively conduct Integrated Water Resource Management.
- Surface water management:
 - Identify any potential risks from the project on the surface water resources.
 - Strive for zero effluent discharge site.
 - Keep clean water clean and collect and contain dirty water.
 - Ensure sustainable storm water management over the project life cycle.
- Implement an environmental management programme to adhere to the suggested mitigation measures as provided above with the goal to:
 - Protect and conserve the aquatic and surface water environment from any impacts.
 - Prevent the aquatic and surface water environment from degrading due to the activities of the project.
 - Minimisation and, where possible, prevention of water pollution stemming from activities.
- Create a Water Conservation and Demand Management plan to:
 - Track efficiency of water use for the operation.
 - Identify and validate potential water conservation measures to minimise waste and maximise reuse and recycling.
 - Track implementation and success of water conservation measures.
- Implement a rehabilitation programme to ensure the site is returned to a natural state once activities have ceased.
- Monitoring:
 - Surface water monitoring should be attempted on a monthly basis to establish a baseline and any changes to this baseline due to the project activities. For this site, effective surface water monitoring will be difficult as all surrounding watercourses are non-perennial.
 - In addition, monitoring of the water quality in the pollution control dam/s and waste water containment facilities should be undertaken on a monthly basis to identify potential impacts in the event of an incident that result in a spill/discharge.
 - Monitoring should start in the construction phase and continue during operation. The monitoring plan will need to be updated for the decommissioning/closure phase based on specialist finding and specific closure objectives

6. CONCLUSIONS AND RECOMMENDATIONS

Key baseline datapoints utilized for interpretation and assessment included the following:

The following key activities are part of the proposed project:

- **Construction Phase:**
 - Site clearing – removal of vegetation groundworks
 - Construction of infrastructure:
 - Road infrastructure
 - Power infrastructure
 - Solar power plant
 - Perimeter fencing and security facilities
 - Offices, parking and staff facilities
 - Processing plants
 - Water storage, pipelines and boreholes
 - Water Treatment Plant
 - Stormwater management infrastructure
- **Operational Phase:**
 - Ongoing utilization and maintenance of the above infrastructure
 - Hauling of raw materials and products
 - Storage of raw materials and products
 - Storage and treatment of wastewater and residue materials
 - Stormwater management and storage/reuse of “dirty” area runoff
 - Discharge of treated water
- **Decommissioning Phase:**
 - Demolition and removal of all structures including transporting of waste materials off site.
 - Removing of road, power and water infrastructure.
 - Removal of stormwater containment infrastructure.
 - Rehabilitation, including shaping, spreading of soil and re-vegetation.

Region and Climate:

- The study area falls within the Level 1 Ecoregions: Limpopo Plain.
- The area has a hot semi-arid climate (Classification: BSh).
- The annual average precipitation is approximately 370 mm/year.
- The proposed operational activities are on a flat plain approximately 700 m above sea level.
- The project area slopes predominantly from the south (approximately 740 mamsl) to the north (approximately 680 mamsl) with a gradient of 0.01.

Surface water features and uses:

- The project area is located in the A71 tertiary catchment within the Limpopo Water Management Area (WMA) North, specifically in the A71K quaternary catchment.
- Secondary catchments A5 to A9, forming the Limpopo WMA North, does not have any resource classification available at the time of writing this report. A project is underway for the determination



of water resource classes, reserve and resource quality objectives including these secondary catchments (DWS, March 2024).

- PES and reserve data for A71K catchment:

Component	A71K
River	Sand
EWR Site	SAND-A71K-R508B
Present Ecological Status (PES)	Class C
Recommended Ecological Status (REC)	Class C

- The project area is located in the A71K quaternary catchment, which is designated as a Freshwater Ecosystem Priority Area (FEPA).
- The project area is not located in a Strategic Water Source Area (SWSA).
- Multiple drainage lines were identified within and around the project site. Activities were planned to avoid the major drainage lines and farm dams.
- All drainage lines in and around the activities are non-perennial.
- The site drains through two non-perennial unnamed tributaries of the Sand River on the northeastern and northwestern sections of the site. These drainage lines converge north of Mopane before the confluence with the Sand River further north.
- The area is largely undeveloped with limited mining and livestock being the main uses in the areas surrounding the sites.
- From the assessment, there appears to be no wetlands within 500 m of the project footprint, which is supported by the 1:50,000 ortho-maps, as well as the NFEPA database.

Site sensitivity:

No significant watercourses, riparian areas or wetlands are located within 100 m of the project footprint, based on the study. Impacted drainage lines are non-perennial and expected to be of medium sensitivity. Therefore, in terms of surface water features, the entire project footprint and 100 m project area buffer is expected to be of medium sensitivity. However, this will need to be verified through a site survey.

Impact Assessment and Mitigation:

The potential impacts on surface water resources are summarised as follow:

- Erosion and sedimentation from exposed soils, alteration of drainage patterns and creation of compacted and impermeable surfaces.
- Contamination from transportation, storage and processing of raw materials and products.
- Contamination from waste/byproducts and wastewater generated from processing.
- Contamination from litter and sewage spills.
- Contaminated runoff due to the use of vehicles, heavy vehicles and machinery.
- Disturbing the natural environment that may lead to loss of biodiversity, proliferation of alien invasive plant species, and loss of ecological function of surface water features.

Key management and mitigation measures may be summarised as follow:

- Implement and maintain stormwater management infrastructure as well as flow impedance, erosion-, and sedimentation controls. Ensure a zero-discharge policy.

- Stockpiling/storage areas need to be licenced and constructed as per the requirements of the Competent Authority.
- Wastewater and byproduct/waste should be stored in containments, licenced, constructed based on requirements and continuously be inspected and maintained.
- Ensure spill prevention and incident management measures and equipment are in place.
- Ensure waste removal agreements are in place with a licenced service provider.
- Avoid natural, sensitive areas where possible and implement an Alien Invasive Plant Species Management Plan to eradicate AIPs.
- Implement / maintain environmental management, water conservation and rehabilitation programmes.

Assessment Conclusion:

Due to the high risk with the activities, high extent, as well as the potential intensity of the impacts, and taking into account the implementation of the recommended mitigation measures the cumulative risk should be in the region of medium to high significance.



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APPENDIX A: SPECIALIST CURRICULUM VITAE
