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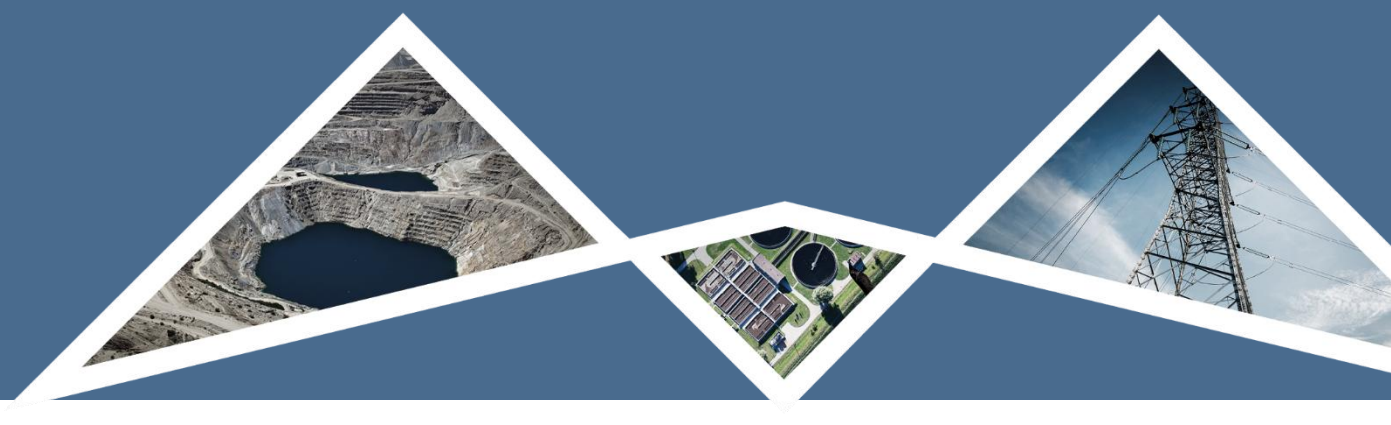
BASIC ASSESMENT REPORT

Char Technology VCN Furnace



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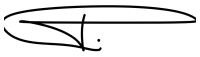
COMPILED:	Qaphela Magaqa		2026/02/11
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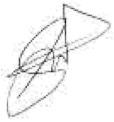
AUTHORIZED:	Liam Whitlow		2026/02/11

REVISION AND AMENDMENTS

REVISION DATE:	REV #	DESCRIPTION
2026/02/12	ORIGINAL DOCUMENT	Basic Assessment Report for Applicant Review
2026/02/18	REVISION 1	Basic Assessment Report for Public Review

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ACRONYMS AND ABBREVIATIONS

ACM	Africa Carbon Manufacture
ACU	African Carbon Union
AEL	Atmospheric Emission Licence
AQIA	Air Quality Impact Assessment
AQMS	Air Quality Monitoring Station
ASTM	American Standard Testing Methodology
BA	Basic Assessment
BAR	Basic Assessment Report
CBA	Critical Biodiversity Area
CMA	Catchment Management Agency
CMS	Catchment Management Strategy
CO	Carbon Monoxide
CR	Critically Endangered
CV	Curriculum Vitae
CWP	Community Work Programme
DD	Data Deficient
DEA	Department of Environmental Affairs (former name)
DFFE	Department of Forestry, Fisheries and the Environment
DM	District Municipality
DMRE	Department of Mineral Resources and Energy
DTIC	Department of Trade, Industry and Competition
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EAPASA	Environmental Assessment Practitioners Association of South Africa
ECA	Environment Conservation Act
EIA	Environmental Impact Assessment
EIMS	Environmental Impact Management Services
ELM	Emalahleni Local Municipality
ELWU	Existing Lawful Water Use
EMPr	Environmental Management Programme
EN	Endangered
EPWP	Expanded Public Works Programme
ERMP	Emissions Reduction and Management Plan
FDA	Development Facilitation Act
FRP	Financial Recovery Plan

FSE	Federation for a Sustainable Environment
GA	General Authorisation
GHG	Greenhouse Gas
GIS	Geographic Information Systems
GLADA	Global Assessment of Land Degradation
GN / GNR	Government Notice / Government Notice Regulation
GN	Government Notice
HDI	Human Development Index
HPA	Highveld Priority Area
HSE	Health, Safety and Environment
I&AP	Interested and Affected Party
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
ISRIC	International Soil Reference and Information Centre
IWMP	Integrated Waste Management Plan
KPI	Key Performance Indicator
kVA	Kilovolt-ampere
kWh	Kilowatt-hour
LBPL	Lower-Bound Poverty Line
LC	Leachable Concentration
LED	Local Economic Development
LOCMA	Limpopo–Olifants Catchment Management Agency
LRA	Labour Relations Act
LUS	Land Use Scheme
MACUA	Mining Affected Communities United in Action
MBSP	Mpumalanga Biodiversity Sector Plan
MES	Minimum Emission Standards
MHI	Major Hazard Installation
MPDEDT	Mpumalanga Department of Economic Development and Tourism
MPRDA	Mineral and Petroleum Resources Development Act
MPTA	Mpumalanga Tourism and Parks Agency
MW	Megawatt
NAAQS	National Ambient Air Quality Standards
NCRs	National Noise Control Regulations
NEM:AQA	National Environmental Management: Air Quality Act
NEMA	National Environmental Management Act
NEMA	National Environmental Management Act (Act No. 107 of 1998)

NEMBA	National Environmental Management Biodiversity Act
NEMWA	National Environmental Management Waste Act
NERSA	National Energy Regulator of South Africa
NFA	National Forests Act
NFEPA	National Freshwater Ecosystem Priority Areas
NH3	Ammonia
NHRA	National Heritage Resources Act
NO_2 / NOx	Nitrogen Dioxide / Nitrogen Oxides
NUMSA	National Union of Metalworkers of South Africa
NWA	National Water Act
OHSA	Occupational Health and Safety Act
OLEMF	Olifants River Ecological Management Framework
PF	Prioritisation Factor
PM_{10} / $PM_{2.5}$	Particulate Matter ≤10 µm / ≤2.5 µm
PPP	Public Participation Process
PPP	Public Participation Process
PSA	Pressure Swing Adsorption
RLE	Red List of Ecosystems
ROD	Record of Decision
S&EIA	Scoping and Environmental Impact Assessment
SACAA	South African Civil Aviation Authority
SACNASP	South African Council for Natural Scientific Professions
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency
SANS	South African National Standard
SAWS	South African Weather Service
SDF	Spatial Development Framework
SMME	Small, Medium and Micro Enterprise
SO_2	Sulphur Dioxide
SOP	Standard Operating Procedure
SPLUMA	Spatial Planning and Land Use Management Act
SSVR	Site Sensitivity Verification Report
t	tonne
TC	Total Concentration
V_2O_5 / V_2O_3	Vanadium Pentoxide / Vanadium Trioxide
VCN	Vanadium Carbon-Nitride
VU	Vulnerable

WESSA	Wildlife and Environment Society of South Africa
WTP	Water Treatment Plant
WUL	Water Use Licence
WULA	Water Use Licence Application
WWTP / WWTW	Wastewater Treatment Plant / Works
WWW	World Wide Web

EXECUTIVE SUMMARY

Char Technology (Pty) Ltd proposes to install and operate a Vanadium Carbon-Nitride (VCN) Furnace within its existing licensed industrial facility located on Erf 43 and 44, Ferrobank Industrial Park, Emalahleni Local Municipality, Mpumalanga. The project requires an Environmental Authorisation (EA) in terms of the National Environmental Management Act (NEMA), triggered by GN R983 Activity 34, as well as an amendment to the existing Atmospheric Emission Licence (AEL) issued under the National Environmental Management: Air Quality Act (NEM:AQA). The development is entirely brownfield, occurring within an existing industrial building with no expansion into previously undisturbed land.

ASSESSMENT OF IMPACTS

A comprehensive review of environmental sensitivities confirmed that the site is heavily modified, with no natural vegetation, no wetlands within 500 m, no heritage resources, and no significant biodiversity features remaining. Although the region falls within the Endangered Eastern Highveld Grassland, the project footprint consists solely of hardstand, concrete floors, and existing infrastructure, resulting in negligible impact on terrestrial or aquatic ecosystems. The Department of Forestry, Fisheries and the Environment (DFFE) Screening Tool indicated several “High” and “Very High” sensitivities, but these were systematically dismissed by a Site Sensitivity Verification (SSVR) due to the transformed nature of the site. As a result, no specialist studies besides air quality (including a Human Health Impact Assessment) were required.

The Air Quality Impact Assessment (AQIA), attached as Appendix E of this BAR, found that emissions from the proposed furnace, managed through an enclosed off-gas system, carbon monoxide (CO) flaring, and baghouse filtration, will comply with the Minimum Emission Standards (MES) and National Ambient Air Quality Standards (NAAQS). No exceedances at sensitive receptors are predicted, and cumulative impacts on the Highveld Priority Area are manageable. All other environmental impacts were assessed qualitatively and found to be low to very low, both before and after mitigation, due to the confined industrial nature of activities.

The project is aligned with the Emalahleni Integrated Development Plan (IDP), Spatial Development Framework (SDF), Land Use Scheme, and broader national beneficiation and industrial development objectives. The VCN Project supports local economic stability, facilitates job retention, and provides additional limited employment opportunities, contributing positively to local livelihoods and industrial diversification. No additional demand on municipal services is anticipated.

The only feasible alternatives considered related to process and technology, and the preferred option, a continuous electric pusher furnace with integrated emissions control, was taken forward following screening of less efficient or higher-impact alternatives. The No-Go Alternative would avoid limited short-term construction impacts but would result in the loss of socio-economic benefits, underutilisation of existing infrastructure, and missed opportunities for local beneficiation. It is therefore not preferred.

PUBLIC PARTICIPATION PROCESS

Public participation was conducted in accordance with NEMA, including distribution of notices in English and isiZulu, newspaper advertisements, site notices, and direct engagement with authorities, neighbouring landowners, and interested and affected parties (I&APs). Issues raised were predominantly related to air quality, community benefits, and assurance of environmental protection, all of which are addressed through the AQIA, EMPr, and regulatory compliance mechanisms. The detailed PPR is attached as Appendix D.

CONCLUSIONS

Overall, the Basic Assessment concludes that the proposed VCN Furnace does not present any fatal flaws, will operate within the limits of applicable legislation, given the brownfield footprint, limited environmental risk, and socio-economic benefits. The project can therefore be authorised, subject to implementation of mitigation and monitoring measures specified in the Environmental Management Programme (EMPr)

1 INTRODUCTION

Char Technology (Pty) Ltd (hereafter referred to as the applicant/CharTech) has appointed Environmental Impact Management Services (Pty) Ltd (EIMS) as the Environmental Assessment Practitioner (EAP) to assist with undertaking the required authorisation processes (including the statutory public participation), and to compile and submit the required documentation in support of application for:

- Environmental Authorisation (EA) in accordance with the National Environmental Management Act (NEMA- Act 107 of 1998) - Listed activity:
    - GN R983, Activity 34 – "*The expansion of existing facilities or infrastructure for any process or activity where such expansion will result in the need for a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the release of emissions, effluent or pollution, excluding-*

        (i) where the facility, infrastructure, process or activity is included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies;

        (ii) the expansion of existing facilities or infrastructure for the treatment of effluent, wastewater, polluted water or sewage where the capacity will be increased by less than 15 000 cubic metres per day; or

        (iii) the expansion is directly related to aquaculture facilities or infrastructure where the wastewater discharge capacity will be increased by 50 cubic meters or less per day."

- Atmospheric Emissions Licence (AEL) amendment in accordance with the requirements of the National Environmental Management: Air Quality Act (NEM:AQA - Act No. 39 of 2004) – Listed Activities:
    - GN R893, Category 4-
        - Subcategory 4.1: "Drying and Calcining - Drying and calcining of mineral solids including ore."
        - Subcategory 4.18: "Vanadium ore processing - The processing of vanadium-bearing ore or slag for the production of vanadium oxides or vanadium carbide by the application of heat.

The applicant operates a fully licensed, multi-process carbon and tar processing facility The facility comprises four primary operational units that fall under the existing Atmospheric Emission Licence (AEL No. NDM/AEL/MP312/13/06): the African Carbon Union (ACU), African Carbon Manufacturer (ACM), the Electrode Paste Plant, and the Tar Dehydration Plant. These operations work together to manufacture char, electrode paste, and refined tar products.

Together, these operations constitute CharTech's authorised industrial activities, which are currently under care and maintenance but remain fully permitted under the AEL. The proposed Vanadium Carbon-Nitride (VCN) Furnace will be incorporated as an additional listed activity within this existing licensed industrial complex.

The applicant proposes the Char Technology VCN Project, which entails the installation and operation of a continuous, zoned hydraulic pusher furnace designed to produce VCN with a capacity of up to 6 tonnes per day. Raw vanadium-bearing materials (V_2O_5 flakes and V_2O_3), carbon powder, and a small amount of iron powder will be mixed and briquetted (of ~45mm in size) and supplied to Char Technology from an external licensed facility (not part of this application). These briquettes will be the input raw material for the VCN Project and will be preheated to remove moisture (in a subsidiary furnace), then processed through the primary furnace under a controlled high-temperature profile (~600–1,500°C) in an excess nitrogen atmosphere to enable reduction and carbonitriding. The product will then be cooled (including rapid water-assisted cooling), packaged to customer specifications, and dispatched.

Together, these operations constitute CharTech's authorised industrial activities, which are currently under care and maintenance but remain fully permitted under the AEL. The proposed VCN Furnace will be incorporated as an additional listed activity within this existing licensed industrial complex.

The proposed VCN furnace will not involve any new buildings or significant top structures on site but will be assembled and installed on the existing structural footprint, requiring minor refurbishment of current structures and paving of a short internal road section between the gate and loading area. The introduction of the new furnace/process constitutes a Listed Activity and presents a change to the approved operational processes; accordingly, an amendment to the existing AEL will be required to authorise the proposed activity.

The proposed project is located on Erf No 43 and 44, Ferrobank Township, on 9 Noble Road, Ferrobank, Emalahleni Local Municipality, Mpumalanga. The site is approximately 5km North West of eMalahleni Central Business District. The centre point of the site is 25°51'09.01"S; 29° 09'52.59"E, please refer to Section 2 for further locality details and map.

1.1 REPORT STRUCTURE

This report has been compiled in accordance with the NEMA EIA Regulations, 2014, as amended. A summary of the report structure, and the specific sections that correspond to the applicable regulations, is provided in Table 1 below.

Table 1: Report structure

Environmental Regulation	Description – NEMA Regulation 982 (2014) as amended	Section in Report
Appendix 1(1)(a)	Details of – i. The Environmental Assessment Practitioner (EAP) who prepared the report; and ii. The expertise of the EAP, including a curriculum vitae;	Section 1.2 and Appendix A: EAP CV
Appendix 1(1)(b)	The location of the activity. Including – i. The 21-digit Surveyor General code of each cadastral land parcel; ii. Where available, the physical address and farm name; iii. Where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	Section 2
Appendix 1(1)I	A plan which locates the proposed activity or activities applied for at an appropriate scale, or, if it is – i. A linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or ii. On a land where the property has not been defined, the coordinates within which the activity is to be undertaken;	Section 2
Appendix 1(1)(d)	A description of the scope of the proposed activity, including – i. All listed and specified activities triggered and being applied for; and ii. A description of the associated structures and infrastructure related to the development;	Section 3
Appendix 1(1)I	A description of the policy and legislative context within which the development is proposed including- **(1)** an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks, and instruments that are applicable to this activity and have been considered in the preparation of the report; and	Section 4

Environmental Regulation	Description – NEMA Regulation 982 (2014) as amended	Section in Report
	(ii) how the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools frameworks, and instruments	
Appendix 1(1)(f)	A motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;	Section 5
Appendix 1(1)(g)	A motivation for the preferred site, activity and technology alternative	Section 6
Appendix 1(1)(h)	A full description of the process followed to reach the proposed preferred alternative within the site, including: – i. Details of the development footprint alternatives considered; ii. Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs; iii. A summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them; iv. The environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; v. The impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts – a. Can be reversed; b. May cause irreplaceable loss or resources; and c. Can be avoided, managed or mitigated; vi. The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives; vii. Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; viii. The possible mitigation measures that could be applied and level of residual risk;	Sections 6, 7, 8, 9 and 10.3

Environmental Regulation	Description – NEMA Regulation 982 (2014) as amended	Section in Report
	ix. The outcome of the site selection matrix; x. If no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such; and; xi. A concluding statement indicating the preferred alternatives, including preferred location of the activity.	
Appendix 1(1)(i)	A full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity, including – i. A description of all environmental issues and risks that were identified during the environmental impact assessment process; and ii. An assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;	Section 9 and Appendix F
Appendix 1(1)(j)	An assessment of each identified potentially significant impact and risk, including – i. Cumulative impacts; ii. The nature, significance and consequences of the impact and risk; iii. The extent and duration of the impact and risk; iv. The probability of the impact and risk occurring; v. The degree to which the impact and risk can be reversed; vi. The degree to which the impact and risk may cause irreplaceable loss of resources; and vii. The degree to which the impact and risk can be mitigated;	Section 9 and Appendix F
Appendix 1(1)(k)	Where applicable, a summary of the findings and impact management measures identified in any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final report;;	Section 10
Appendix 1(1)(l)	An environmental impact statement which contains – i. A summary of the key findings of the environmental impact assessment;	Section 10.4

Environmental Regulation	Description – NEMA Regulation 982 (2014) as amended	Section in Report
	ii. A map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicting any areas that should be avoided, including buffers; and iii. A summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	
Appendix 1(1)(m)	Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management outcomes for the development for inclusion in the EMPr;	Section 10.5
Appendix 1(1)(n)	Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;	Section 10.5
Appendix 1(1)(o)	A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	Section 11
Appendix 1(1)(p)	A reasoned opinion as to whether the proposed 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;	Section 10.4
Appendix 1(1)(q)	Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised;	N/A – proposed activity includes operational aspects
Appendix 1(1)I	An undertaking under oath or affirmation by the EAP in relation to – iv. The correctness of the information provided in the reports; v. The inclusion of comments and inputs from stakeholders and interested and affected parties; vi. The inclusion of inputs and recommendations from the specialist reports where relevant; and vii. Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;	Section 12
Appendix 1(1)(t)	Any specific information that may be required by the competent authority; and	None

Environmental Regulation	Description – NEMA Regulation 982 (2014) as amended	Section in Report
Appendix 1(1)(u)	Any other matters required in terms of section 24(4)(a) and (b) of the Act.	None

1.2 DETAILS OF THE EAP

EIMS has been appointed by Char Technology as the independent Environmental Assessment Practitioner (EAP) to prepare and submit the EA application, Basic Assessment Report, and undertaking a Public Participation Process (PPP). The contact details of the EIMS consultant and EAP who compiled this Report are as follows:

- Name: Qaphela Magaqa
- Tel No: + 27 11 789 7170
- Fax No: +27 86 571 9047
- E-mail address: CharTech@eims.co.za

In terms of Regulation 13 of the EIA Regulations, 2014, as amended, an independent EAP, must be appointed by the applicant to manage the application. EIMS is compliant with the definition of an EAP as defined in Regulations 1 and 13 of the EIA Regulations, as well as Section 1 of the NEMA. This includes, inter alia, the requirement that EIMS is:

- Objective and independent;
- Has expertise in conducting EIA's;
- Comply with the NEMA, the environmental regulations and all other applicable legislation;
- Considers all relevant factors relating to the application; and
- Provides full disclosure to the applicant and the relevant environmental authority.

EIMS is a private and independent environmental management-consulting firm that was founded in 1993. EIMS has in excess of 30 years' experience in conducting EIA's. Please refer to the EIMS website (www.eims.co.za) for further details of expertise and experience.

Mr Qaphela Magaqa is a Senior Environmental Consultant at Environmental Impact Management Services (EIMS) with five (5) years of professional experience in environmental management and related disciplines. He holds a Bachelor of Science Honours degree in Geographic Information Systems (GIS) (2019) and a Bachelor of Science degree in Geosciences (Geography and Geology) (2019), both obtained from Nelson Mandela University, Gqeberha (formerly Port Elizabeth), South Campus. Mr Magaqa is a registered Environmental Assessment Practitioner (EAP) with the Environmental Assessment Practitioners Association of South Africa (EAPASA) and is also registered with the South African Council for Natural Scientific Professions (SACNASP) as a Certificated Natural Scientist. His professional expertise includes environmental management, GIS analysis and mapping, environmental research, waste management, environmental auditing, and technical reporting. Mr Magaqa has been involved in a wide range of projects, including but not limited to waste management and advisory services, GIS-based environmental analyses, environmental compliance monitoring, Water Use Licence (WUL) monitoring, Water Use Licence Applications (WULA), Environmental Authorisation (EA) applications, legal compliance audits, and public participation processes. He has gained experience across various sectors, including mining, oil and gas, construction, and engineering projects. A detailed CV and copies of professional registration certificates are included as Appendix A to this report.

2 DESCRIPTION OF THE PROJECT AREA

Table 2 indicates the details of the properties on which the proposed project is proposed including details on the project location as well as the distance from to the nearest towns.

Table 2: Locality details

Property Description(s)	Erf Nos. 43 and 44, Ferrobank Township
Property Size (m^2)	35 458 m^2
Development footprint size (m^2):	~ 4000 m^2 (note that the proposed activities will be undertaken within existing buildings).
21 Digit Surveyor General Code(s)	T0JS00140000004300000 T0JS00140000004400000
Magisterial District	Nkangala Magisterial District
District Municipality	Nkangala District Municipality
Local Municipalities	Emalahleni Local Municipality

The locality of the proposed project is shown in **Figure 1**.

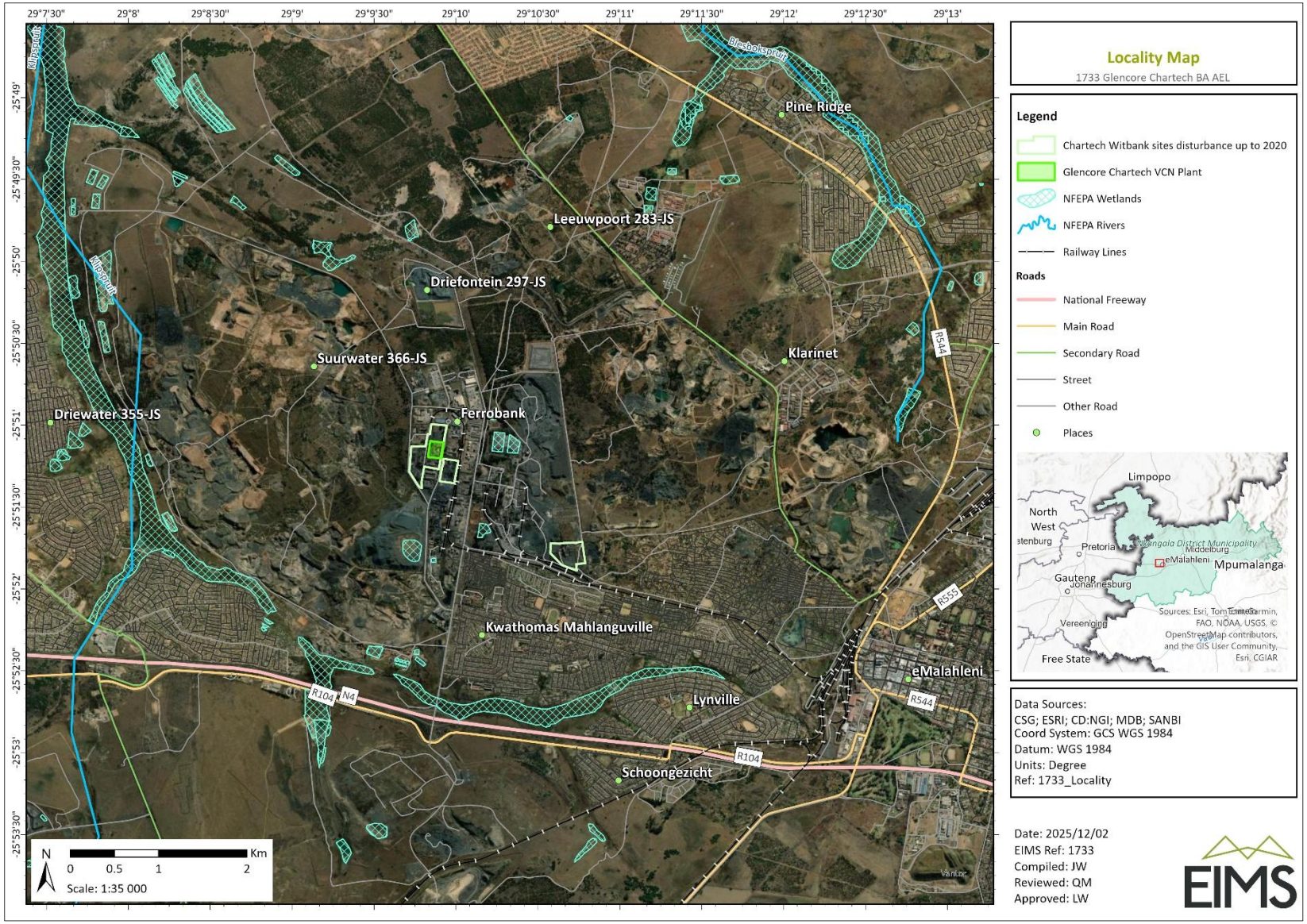


Figure 1: Locality map.

3 DESCRIPTION AND SCOPE OF THE PROPOSED ACTIVITY

3.1 PROJECT DESCRIPTION

3.1.1 PROJECT OVERVIEW

The applicant proposes the Char Technology Vanadium Carbon-Nitride (VCN) Project, which entails the installation and operation of a Vanadium Carbon-Nitride (VCN) furnace at the existing Char Technology facility. The facility currently operates under a valid Atmospheric Emission Licence (AEL) issued in terms of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004- NEM:AQA), with reference number NDM/AEL/MP312/13/06.

The proposed VCN furnace will not involve greenfield development or the construction of new permanent structures. Instead, the furnace will be assembled and installed within the existing licensed industrial footprint, utilising current infrastructure and structural platforms. Minor refurbishment and upgrading of existing structures (see Figure 2 and Figure 3) are required to accommodate the new equipment. As part of the project, it is envisaged that additional laboratory equipment will be installed within the existing laboratory facility to support the VCN project activities. Additionally, paving of the existing internal access road section from the site entrance and construction of a loading bay is required (see Figure 4 and Figure 5). The introduction of the VCN furnace constitutes a change to the approved operational processes and triggers Listed Activities in terms of NEM:AQA. As such, an amendment to the existing AEL is required to authorise the proposed activity.

The VCN furnace will process briquetted raw materials supplied to Char Technology. These briquettes are produced using a mixture of milled vanadium pentoxide (V_2O_5) flakes, vanadium trioxide (V_2O_3), carbon powder, and iron powder, which are pressed into a solid feedstock prior to delivery to the site. These are to be brought in from a supplier from a licensed facility and will not be produced on site.

Figure 2: Western view of the proposed structure into which the VCN furnace will be installed with compacted gravel access roads

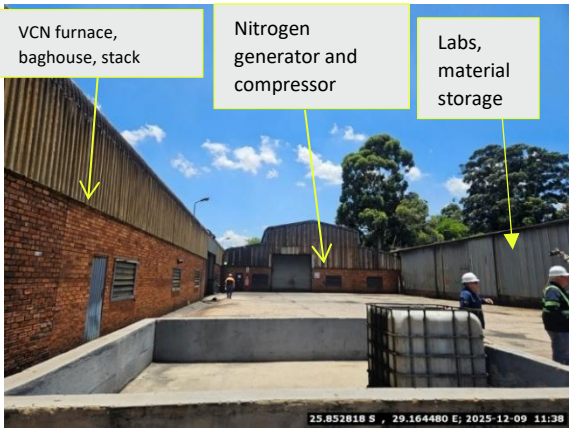


Figure 3: Northward view of the exiting structure onto which the VCN furnace will be installed (Furnace to be installed on the west wing with stack and baghouse, Nitrogen generator and compressor in the north wing of the building, and Labs, material storage on east wing

Figure 4: View of existing gravel site access road (towards noble road, to be paved)

Figure 5: Southward view towards proposed loading bay area

3.1.2 PROCESS DESCRIPTION FOR THE PROPOSED VCN FURNACE

The VCN furnace will process briquetted furnace feed supplied to Char Technology from a licensed facility. These briquettes are produced using a mixture of milled vanadium pentoxide (V_2O_5) flakes, vanadium trioxide (V_2O_3), carbon powder, and iron powder, which are pressed into a solid feedstock prior to delivery to the site.

3.1.2.1 **FACILITY AND PROJECT OVERVIEW**

The project entails installing and operating a new, enclosed continuous pusher (graphite-crucible) furnace to produce VCN at an existing metallurgical site. Briquetted feed materials (vanadium oxides with carbon and a trace of iron) are processed under high-purity nitrogen to form VCN.

The installation comprises a subsidiary (pre-heat) furnace, a primary high-temperature furnace, off-gas handling with CO flaring and fabric filtration (baghouse), recirculating product cooling, and on-site nitrogen generation and purification.

3.1.2.2 **NORMAL PROCESS FLOW (UNIT OPERATIONS)**

This subsection summarises the sequence of unit operations from charging through thermal processing, cooling and packing, including the 24/7 operating regime.

3.1.2.3 **FEED PREPARATION AND CHARGING**

This step covers receipt, internal handling and sealed charging of briquettes to minimise dust and ensure process integrity. Briquettes are produced off-site from a blend of milled V2O5 flakes, V2O3, carbon powder and iron powder, pressed to ~45 mm. At the VCN plant, sealed bags are received, stored indoors on concrete, and loaded into graphite crucibles. No raw material handling conveyors or stockpiles are used; movements are by forklift on paved/concrete surfaces.

3.1.2.4 **PRE-HEATING (SUBSIDIARY FURNACE) – ELECTRIC FURNACE**

This step removes residual moisture to stabilise downstream high-temperature reactions. Crucibles enter a pre-heat / drying zone at approximately 300°C to remove residual moisture

3.1.2.5 **REDUCTION, CARBURISATION AND NITRIDATION (PRIMARY FURNACE) – ELECTRIC FURNACE**

This step effects carbothermal reduction of vanadium oxides and simultaneous carburisation/nitridation in nitrogen to form VCN.

Crucibles are advanced by hydraulic pushers through a zoned, continuous furnace with a controlled temperature profile (~600 to 1 500°C) and excess N2 to prevent oxidation. The dominant reaction pathway is carbothermal reduction of vanadium oxides with simultaneous nitridation in N_2, e.g.: V_2O_3(s) + 3 C(s) + N2(g) -> 2 V(C,N)(s) + 3 CO/CO_2(g).

3.1.2.6 **CONTROLLED COOLING AND DISCHARGE**

This step safely cools product to handling temperature and discharges it with minimal drop height and fugitive dust. Product passes through natural cooling followed by rapid water-assisted cooling to <= 80°C before discharge. A sealed, automated rotator empties the crucible into a skip directly below the discharge (< 0.5 m drop) to minimise dusting; a double seal is fitted between the water-cooling section and the auto rotator.

3.1.2.7 **PACKING AND DISPATCH**

This step packages cooled product into sealed bags for transport, with all vehicle movements confined to paved areas. Cooled VCN is packed in sealed bags (< 20 kg) and palletised in bulk bags for shipment by truck (~30 t per truck; ~2 trucks/week). Internal transfers occur on concrete paved surfaces.

3.1.2.8 **PROCESS TIMING AND REGIME**

Push cycle ~15–20 minutes (crucibles move at ~1.6 m/h). Operation is continuous, 24 h/day, ~348 days/year (allowance for planned maintenance).

3.1.3 SERVICES AND UTILITIES

The proposed VCN Furnace will be supplied with electricity through the existing Eskom connection servicing the CharTech facility, with no requirement for additional electrical infrastructure. To ensure uninterrupted operation, a backup diesel generator will be installed on site for use during power outages. Water requirements for the project are minimal and will be met using the facility's existing authorised water allocation, which accommodates the site's process water and cooling water needs. The VCN Furnace will utilise approximately 2.4 m^3/day of water through the existing closed circuit cooling system, resulting in no increase in the facility's overall licensed water demand.-water and cooling-water needs. The VCN Furnace will utilise approximately 2.4 m^3/day of water through the existing closed-circuit cooling system, resulting in no increase in the facility's overall licensed water demand.

This BA process will identify and assess potential environmental impacts and make recommendations for relevant alternatives, management and mitigation measures. Refer to Appendix H for the Engineering Layout of the proposed development.

4 POLICY AND LEGISLATIVE CONTEXT

This section provides an overview of the governing legislation identified which relates to the proposed project.

4.1 NATIONAL LEGISLATION

4.1.1 CONSTITUTION OF THE REPUBLIC OF SOUTH AFRICA

The constitution of any country is the supreme law of that country. The Bill of Rights in chapter 2 section 24 of the Constitution of South Africa Act (Act No. 108 of 1996) makes provisions for environmental issues and declares that: *"Everyone has the right -*

a) to an environment that is not harmful to their health or well-being; and

b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:

i. *prevent pollution and ecological degradation;*

ii. *promote conservation; and*

iii. secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development".

The Basic Assessment process and associated impact mitigation actions are conducted to fulfil the requirement of the Bill of Rights.

4.1.2 NATIONAL ENVIRONMENTAL MANAGEMENT ACT (NEMA)

The main aim of the National Environmental Management Act, 1998 (Act 107 of 1998 – NEMA) is to provide for co-operative governance by establishing decision-making principles on matters affecting the environment. In terms of the NEMA EIA Regulations, the applicant is required to appoint an EAP to undertake the EIA process, as well as conduct the public participation process towards an application for EA. In South Africa, EIA's became a legal requirement in 1997 with the promulgation of regulations under the Environment Conservation Act (ECA). Subsequently, NEMA was passed in 1998. Section 24(2) of NEMA empowers the Minister and any MEC, with the concurrence of the Minister, to identify activities which must be considered, investigated, assessed and reported on to the competent authority responsible for granting the relevant EA. On 21 April 2006, the Minister of Environmental Affairs and Tourism (now DFFE) promulgated regulations in terms of Chapter 5 of the NEMA. These regulations, in terms of the NEMA, were amended a number of times between 2010 and 2022. The NEMA EIA Regulations, 2014, as amended, are applicable to this project.

The objective of the EIA Regulations is to establish the procedures that must be followed in the consideration, investigation, assessment and reporting of the listed activities that are triggered by the proposed project. The purpose of these procedures is to provide the competent authority with adequate information to make informed decisions which ensure that activities which may impact negatively on the environment to an unacceptable degree are not authorised, and that activities which are authorised are undertaken in such a manner that the environmental impacts are managed to acceptable levels.

NEMA sets out the general objectives of IEM in South Africa, including to (section 23(2)), of which the following two are of relevance for this report:

- Identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage, the risks and consequences and alternatives and options for mitigation of activities. This is to be done with a view to minimising negative impacts, maximising benefits and promoting compliance with the principles of environmental management set out in section 2 (of NEMA).
- Ensure that the effects of activities on the environment receive adequate consideration before actions are taken in connection with them.

4.1.2.1 **LISTED ACTIVITIES**

In accordance with the provisions of Sections 24(5) and Section 44 of the NEMA the Minister has published Regulations (GN R. 982) pertaining to the required process for conducting EIA's in order to apply for, and be considered for, the issuing of an EA. These EIA Regulations provide a detailed description of the EIA process to be followed when applying for EA for any listed activity. The Regulations differentiate between a simpler Basic Assessment Process (required for activities listed in GN R. 983 and GN R. 985) and a more complete EIA process (activities listed in GN R. 984).

In terms of these regulations a Basic Assessment process is required for the proposed project. The Table 3 below identifies the listed activities the proposed project triggers and consequently requires authorisation prior to commencement.

Table 3: NEMA listed activities to be authorised

Activity	Activity Description	Applicability
GN R. 983 (Listing Notice 1) – Activity 34	The expansion of existing facilities or infrastructure for any process or activity where such expansion will result in the need for a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the release of emissions, effluent or pollution, excluding- (i) where the facility, infrastructure, process or activity is included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies; (ii) the expansion of existing facilities or infrastructure for the treatment of effluent, wastewater, polluted water or sewage where the capacity will be increased by less than 15 000 cubic metres per day; or (iii) the expansion is directly related to aquaculture facilities or infrastructure where the wastewater discharge capacity will be increased by 50 cubic meters or less per day.	Char Technology (Pty) Ltd, currently holds an Atmospheric Emissions Licence (AEL) with ref: NDM/AEL/MP312/13/06 signed 05 February 2025, with a validity of 5 years (until 05 February 2030). Condition 4.1(b) of the Char Technology AEL states that: "*No building, plant or site of works related to the listed activity or activities used by the licence holder shall be extended, altered, or added to the listed activity without an environmental authorisation from the competent authority. The investigation, assessment, and communication of potential impact of such an activity must follow the assessment procedure as prescribed in the Environmental Impact Assessment Regulations published in terms of Section 24(5) of the National Environmental Management Act, 1998 (Act No. 107 of 1998)(NEMA), as amended.*" The applicant, wishes to alter an existing building within their existing licensed facility to add a Vanadium Carbon Nitride plant requiring authorisation in terms of the NEM:AQA and as such requires an EA in accordance with this activity and Condition 4.1(b) of their AEL.

The DFFE have published a number of guidelines and protocols which have been considered in the compilation of this report and include but not limited to:

- Public Participation Guideline in terms of NEMA EIA Regulations (2017).

- Need and desirability Guideline in terms of NEMA (2012).
- National guideline on minimum information requirements for preparing Environmental Impact Assessments for mining act activities that require environmental authorisation (2018).
- 2004 Information Series covering various aspects of the EIA process.
- Procedures for assessment and minimum criteria for specialist studies.

4.1.2.2 SCREENING TOOL

A Screening Tool Report was generated from the DFFE Screening tool as per the requirements of Regulation 16 (1)(b)(v) of the EIA Regulations 2014, as amended, and was included in the Application for EA. The screening Tool provided a list of specialist studies for consideration and inclusion in the process. The Screening Tool identified environmental sensitivities are presented in Table 4.

Table 4: Screening Tool environmental sensitivities.

Theme	Sensitivity			
	Very High	High	Medium	Low
Agriculture Theme		X		
Animal Species Theme			X	
Aquatic Biodiversity Theme				X
Archaeological and Cultural Heritage Theme				X
Civil Aviation Theme		X		
Defence Theme				X
Palaeontology Theme	X			
Plant Species Theme				X
Terrestrial Biodiversity Theme	X			

In this regard, as Site Sensitivity Verification Report (SSVR) has been compiled to consider the recommendations of the DFFE Screening Tool Report and to provide a rationale for the selection of specialist studies included in the assessment report.

Pursuant to Regulation 16(1)(b)(v) of the EIA Regulations, 2014 (as amended), and the Protocols under GN 320 of 2020/GN 1150 of 2020, the EAP has undertaken a site sensitivity verification which confirms that the project is wholly within a transformed industrial footprint, involves no greenfield disturbance or deep excavation, and has no credible impact pathways to agricultural, biodiversity, heritage, palaeontological, aquatic, hydrological, traffic, noise or visual receptors beyond normal industrial context. The EAP therefore confirms that the only specialist assessment required is a DFFE-compliant AQIA including a human-health impact screening against the NAAQS; all other specialist studies are not required, with motivations provided.

Please refer to Table 5 for a summary of the verification process. Please refer to Appendix B for the SSVR.

Table 5: SSVR findings and motivation.

Screening Tool Specialist Study Required	Screening Tool Level of Sensitivity	Suggested Sensitivity	Required level of Assessment	Motivation
Agriculture Impact Assessment	High	None	None	The proposed development is to be located within a heavily modified industrial site. The proposed development entails assembly and installation of a VCN furnace into an existing building. The building floors are on concrete foundations. Around The site mostly covered by concrete and compacted gravel and is surrounded by such similar land uses, and mining activities at least 300 m located to the west. Apart from the indirect atmospheric pathways through the facility air emissions, there are no other foreseeable impact pathway to the soil receptors. The air emissions from the facility and alignment with National Emissions Standards will be assessed in detail in the Specialist Air Quality Impact Assessment Report. No agricultural and/or soil impacts are anticipated to emanate from the proposed VCN furnace project, and consequently it is the EAPs opinion that neither a dedicated Agricultural Impact Assessment nor a compliance statement is required for this activity.
Landscape/Visual Impact Assessment	-	None	None	The CharTech VCN Project is located within an established brownfield industrial site surrounded by similar industrial land uses, where the visual environment is already highly modified. The proposed furnace installation will occur within existing industrial structures, with the addition of a baghouse and an approximately 35 m stack that is consistent in form and scale with surrounding infrastructure and is anticipated to be equal to or smaller than existing industrial elements in the area. As such, the proposed development will not alter the existing visual character of the site or its surroundings, and the site is therefore considered to have low landscape and visual sensitivity, with no significant visual impacts anticipated. It is the EAPs opinion that a dedicated Visual Impact Assessment is not warranted for this activity.
Archaeological and Cultural Heritage Impact Assessment	Low	None	None	The proposed project is located within an industrial site, on an existing industrial building and will not change the character of the site. Minor refurbishments of an existing industrial building, including installation of a stack and baghouse. The building on which the furnace will be installed is approximately 35 years old. As such, it does not qualify as a heritage resource and is not considered a heritage feature. All works will be confined to the existing building footprint, and no deep excavations or ground disturbances are planned. The project is therefore excluded from the Chance Finds Protocol. Given that the project will not alter the character of the site and no heritage resources are present or

Screening Tool Specialist Study Required	Screening Tool Level of Sensitivity	Suggested Sensitivity	Required level of Assessment	Motivation
				expected to be impacted, a Heritage Impact Assessment is not required, and no heritage-related impacts are anticipated.
Palaeontology Impact Assessment	Very High	None	None	The proposed project is located within an industrial site, on an existing industrial building and mainly on concrete. Although the proposed project also includes the paving of an existing gravel access road, no excavations will be undertaken for this project and as such, no palaeontology related impacts are anticipated. It is the EAPs opinion that a dedicated Palaeontology Impact Assessment is not warranted for this activity.
Terrestrial Biodiversity Impact Assessment	Very High	None	None	The screening tool has identified the sensitivity of the site as very high due to the Endangered (EN) Eastern Highveld Grassland Ecosystem. This ecosystem is listed in the DFFE's Revised National List of Ecosystems that are Threatened and in Need of Protection published in 2022 under the National Environmental Act: Biodiversity Act (act 10 of 2004). The site sensitivity verification undertaken confirmed that the site exists in a heavily modified environment within an existing industrial park. The proposed project is within an existing building, mainly with concrete floors, existing access roads and will not require any clearance of vegetation/ecosystem disturbance. Apart from the indirect atmospheric pathways through the facility air emissions, there are no other foreseeable impact pathway to the terrestrial biodiversity receptors. The air emissions from the facility and alignment with National Emissions Standards will be assessed in detail in the Specialist Air Quality Impact Assessment Report. It is the EAPs opinion that a dedicated Terrestrial Ecological Impact Assessment is not warranted for this activity.
Aquatic Biodiversity Impact Assessment	Low	None	None	The proposed CharTech Project is located within an established brownfield industrial site, with no wetlands or watercourses located within 500 m of the site, being the regulated area of a watercourse. As a result, no aquatic features occur within or adjacent to the site that could be affected by the proposed installation of the VCN furnace and associated infrastructure. The operation of the VCN furnace will not result in the release of effluent or contaminated runoff, and therefore no interaction with aquatic systems is anticipated. The site is accordingly considered to have no aquatic biodiversity sensitivity, and no aquatic biodiversity impacts are expected to result from the proposed development. It is the EAPs opinion that a dedicated Aquatic and/or Wetland Impact Assessment is not warranted for this activity.

Screening Tool Study Specialist Required	Screening Tool Level of Sensitivity	Suggested Sensitivity	Required level of Assessment	Motivation
Hydrology Assessment	-	None	None	The proposed CharTech Project is located within an established industrial park and involves the installation of a furnace within an existing building, along with paving of existing internal roads and minor refurbishment of current structures. The site is situated approximately 1.6 km from the nearest non-perennial tributary of the Brugspruit, and no surface water features occur within or adjacent to the site. The CharTech site is serviced by an existing formal stormwater management system, which captures and conveys runoff from roofed areas and paved surfaces via kerbing/channelisation and/or stormwater inlets and pipes to designated discharge points. The primary project activities (installation of the furnace and associated infrastructure) will occur within the existing building footprint (under roof), and will therefore not be directly exposed to rainfall-driven hydrological pathways. External works are limited to paving/upgrade of existing internal roads and a loading bay, which will comprise additional or improved hardstanding within an already transformed (brownfield) industrial environment. These works are not expected to significantly alter catchment-scale runoff patterns, nor create pathways to watercourses, given the absence of nearby surface water features and the presence of established stormwater infrastructure. Given the brownfield nature of the site, the absence of nearby watercourses, and the limited extent of additional hard infrastructure, the site is considered to have low hydrological sensitivity, and no significant hydrological impacts are anticipated as a result of the proposed development.
Noise Impact Assessment	-	Low	None	The proposed activities do not involve any significant noise-generating processes. Anticipated noise sources are limited to standard construction activity, light-industrial equipment, and occasional vehicle movement, all of which fall within typical operational parameters for the area. Furthermore, the site is located away from noise-sensitive receptors such as residences, schools, or medical facilities, and the project is expected to operate within the existing acoustic character of the already transformed environment. No material change to the ambient noise climate is anticipated; therefore, a Noise Impact Assessment is not required for the CharTech VCN project.
Traffic Impact Assessment	-	Low	None	The proposed CharTech VCN project will generate negligible traffic volumes during both construction and operation. Construction activities will involve limited vehicle movements associated with material

Screening Tool Specialist Study Required	Screening Tool Level of Sensitivity	Suggested Sensitivity	Required level of Assessment	Motivation
				delivery and contractor access, all of which fall within normal thresholds for small-scale industrial developments. During operation, the facility will have a low staff complement and minimal logistics requirements, resulting in no meaningful increase in daily traffic on the surrounding road network. It is anticipated that during operation the site will receive 3 trucks per week, each delivering 30 tons of briquettes and 2 trucks will be dispatched with 30 tons of product per week (total 5 trucks per week)The project is located within an existing industrial/previously transformed area that is already serviced by adequate road infrastructure, and no congestion or capacity constraints have been identified in proximity to the site.
Health Impact Assessment	-	Unknown	Undertaken as part of the AQIA	A full DFFE compliant Air Quality Impact Assessment (AQIA) will be undertaken and will cover the health risks/aspects associated with the development of the CharTech VCN project human health risk and nuisance impact screening assessment based on NAAQS and dispersion simulation results will form part of the AQIA.
Socio-Economic Assessment	-	Low	None	The proposed VCN project is an addition to the existing CharTech facilities within the Ferrobank Industrial Park. This project is anticipated to maintain existing employment, whilst also providing limited new opportunities during the construction phase. CharTech has an existing stakeholder engagement and communication. As such, a socio-economic study was not deemed necessary for this project. It is the EAPs opinion that a dedicated Socio-economic Impact Assessment is not warranted for this activity.
Ambient Air Quality Impact Assessment	-	Unknown	Undertaken as part of the AQIA	An Air Quality Impact Assessment will be undertaken by a suitably qualified specialist. The ambient air quality will be assessed as part of the Air Quality Impact Assessment/study.
Air Quality Impact Assessment	-	Unknown	Full Assessment	An Air Quality Impact Assessment will be undertaken by a suitably qualified specialist.
Plant Species Assessment	Low	None	None	The site sensitivity verification undertaken confirmed that the site exists in a heavily modified environment within an existing industrial park. The proposed project is within an existing building, mainly with concrete floors, existing access roads and will not require any clearance of

Screening Tool Study Specialist Required	Screening Tool Level of Sensitivity	Suggested Sensitivity	Required level of Assessment	Motivation
				vegetation/ecosystem disturbance. It is the EAP's opinion that there is no sensitivity on the development site. Apart from the indirect atmospheric pathways through the facility air emissions, there are no other foreseeable impact pathway to the terrestrial biodiversity receptors (including flora). The air emissions from the facility and alignment with National Emissions Standards will be assessed in detail in the Specialist Air Quality Impact Assessment Report. It is the EAPs opinion that a dedicated Plant Species Impact Assessment is not warranted for this activity.
Animal Species Assessment	Low	None	None	The site sensitivity verification undertaken confirmed that the site exists in a heavily modified environment within an existing industrial park. The proposed project is within an existing building, mainly with concrete floors, existing access roads and will not require any clearance of vegetation/ecosystem disturbance. It is the EAP's opinion that there is no sensitivity on the development site. Apart from the indirect atmospheric pathways through the facility air emissions, there are no other foreseeable impact pathway to the terrestrial biodiversity receptors (including fauna). The air emissions from the facility and alignment with National Emissions Standards will be assessed in detail in the Specialist Air Quality Impact Assessment Report. It is the EAPs opinion that a dedicated Animal Species Impact Assessment is not warranted for this activity.

4.1.3 NATIONAL ENVIRONMENTAL MANAGEMENT: AIR QUALITY ACT (NEM:AQA)

The National Environmental Management: Air Quality Act (Act No. 39 of 2004 as amended – NEM:AQA) is the main legislative tool for the management of air pollution and related activities. The Object of the Act is:

- To protect the environment by providing reasonable measures for –
    i. the protection and enhancement of the quality of air in the republic;
    ii. the prevention of air pollution and ecological degradation; and
    iii. securing ecologically sustainable development while promoting justifiable economic and social development; and
- Generally, to give effect to Section 24(b) of the constitution in order to enhance the quality of ambient air for the sake of securing an environment that is not harmful to the health and well-being of people.

The NEM:AQA mandates the Minister of Environment to publish a list of activities which result in atmospheric emissions and consequently cause significant detrimental effects on the environment, human health and social welfare. All scheduled processes as previously stipulated under the Air Pollution Prevention Act (APPA) are included as listed activities with additional activities being added to the list. The updated Listed Activities and Minimum National Emission Standards were published on the 22nd of November 2013 (Government Gazette No. 37054).

National Ambient Air Quality Standards (NAAQS) were determined based on international best practice for particulate matter less than 10 and 2.5 µm in aerodynamic diameter (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3), carbon monoxide (CO), lead (Pb) and benzene. The NAAQS were published in the Government Gazette (no. 32816) on 24 December 2009 for PM_{10} and other pollutants (South Africa, 2009). The $PM_{2.5}$ NAAQS were published in 2012 (South Africa, 2012).

The NEM:AQA also provides for the monitoring and reporting of GHG emissions. The National Greenhouse Gas Emission Reporting Regulations (South Africa, 2017) were published in terms of Section 53 (aA), (o) and (p) of NEM: AQA on 3 April 2017 and amended on 11 September 2020 (South Africa, 2020). The purpose of these Regulations is to implement a single national reporting system for the transparent reporting of GHG emissions.

The National Pollution Prevention Plans Regulations were published in March 2014 (Government Gazette 37421) and tie in with the National Greenhouse Gas (GHG) Emission Reporting Regulations which took effect on 3 April 2017. In summary, the Regulations aim to prescribe the requirements that pollution prevention plans of greenhouse gases declared as priority air pollutants, need to comply with in terms of the NEM:AQA. The Regulations specify who needs to comply, and by when, as well as prescribing the content requirements.

The National Dust Control Regulations are promulgated under the NEM:AQA and the purpose of these Regulations is to prescribe general measures for the control of dust in all areas. Dustfall is assessed for nuisance impact and not for inhalation health impact. The National Dust Control Regulations (Department of Environmental Affairs, 2013) prescribes measures for the control of dust in residential and non-residential areas. Acceptable dustfall rates are measured (using American Standard Testing Methodology (ASTM) D1739:1970 or equivalent) at and beyond the boundary of the premises where dust originates. In addition to the dustfall limits, the National Dust Control Regulations prescribe monitoring procedures and reporting requirements. Dust that may be created from the project (including but not limited to the construction phase) will be managed in accordance with these Regulations.

According to the NEM:AQA, air quality management control and enforcement is in the hands of local government with District and Metropolitan Municipalities as the licensing authorities. Provincial government is primarily responsible for ambient monitoring and ensuring municipalities fulfil their legal obligations, with national government primarily as policy maker and co-ordinator. Each sphere of government must appoint an Air Quality Officer (AQO) responsible for co-ordinating matters pertaining to air quality management. Given that air quality management under the old Act was the sole responsibility of national government, local authorities have in the past only been responsible for smoke and vehicle tailpipe emission control.

The proposed VCN Furnace is a Listed Activity under Section 21 of the Air Quality Act (AQA) and requires an AEL to operate. The proposed VCN Furnace will be required to comply with the new plant Minimum Emission Standards (MES). The applicable listed activity is Subcategory 4.1 (Drying and Calcining) and Subsection 4-18 (Vanadium Ore Processing) summarised in Table 6 and Table 7.

Table 6: Listed Activity Subcategory 4.1

Subcategory 4.1 – Drying and Calcining			
Description:	Drying and calcining of mineral solids including ore.		
Application:	Facilities with capacity of more than 100 tons/month product.		
Substance or Mixture of Substances		**Plant Status**	**mg/Nm³ under normal conditions of 273 Kelvin and 101.3 kPa**
Common Name	**Chemical Symbol**		
Particulate matter	PM	New	50
Sulfur dioxide	SO_2		1 000
Oxides of nitrogen	NO_X, expressed as NO_2		400

Table 7: Listed Activity Subcategory 4.18

Subcategory 4.18 – Vanadium Ore Processing			
Description:	The processing of vanadium-bearing ore or slag for the production of vanadium oxides or vanadium carbide by the application of heat.		
Application:	All installations		
Substance or Mixture of Substances		**Plant Status**	**mg/Nm³ under normal conditions of 273 Kelvin and 101.3 kPa**
Common Name	**Chemical Symbol**		
Particulate matter	PM	New	50
Sulfur dioxide	SO_2		1 200
Ammonia	NH_3		30

4.1.3.1 ATMOSPHERIC EMISSION LICENSE (AEL) APPLICATION

The application for an AEL must include all sources of emission, not only those considered listed activities. In terms of the AEL application, the applicant should take into account the following sections of NEM:AQA:

37. Application for atmospheric emission licences:

(1) A person must apply for an AEL by lodging with the licencing authority of the area in which the listed activity is to be carried out, an application in the form required.

(2) An application for an AEL must be accompanied by –

(a) The prescribed processing fee; and

(b) Such documentation and information as may be required by the licencing authority.

38. Procedure for licence applications:

(3) The licencing authority –

(a) May, to the extent that is reasonable to do so, require the applicant, at the applicant's expense, to obtain and provide it by a given date with other information contained in or submitted in connection with the application;

(b) May conduct its own investigation on the likely effect of the proposed licence on air quality;

(c) May invite written comments from any organ of state which has an interest in the matter; and

(d) Must afford the applicant an opportunity to make representations on any adverse statements or objections to the application.

(4) Section 24 of the NEMA and section 22 of the Environmental Conservation Act apply to all applications for atmospheric emission licences, and both an applicant and the licencing authority must comply with those sections and any applicable notice issued or regulations made in relation to those sections.

(5) –

(a) An applicant must take appropriate steps to bring the application to the attention of relevant organs of state, interested persons and the public.

(b) Such steps must include the publication of a notice in at least two newspapers circulating the area in which the listed activity is applied for is or is to be carried out and must-

(i) Describe the nature and purpose of the licence applied for;

(ii) Give particulars of the listed activity, including the place where it is to be carried out;

(iii) State a reasonable period within which written representations on or objections to the application may be submitted and the address or place where it must be submitted; and

(iv) Contain such other particulars as the licencing authority may require.

46. Variation of provisional atmospheric emission licences and atmospheric emission licences

(1) A licensing authority may, by written notice to the holder of a provisional atmospheric emission licence or an atmospheric emission licence, vary the licence –

(a) if it is necessary or desirable to prevent deterioration of ambient air quality;

(b) if it is necessary or desirable for the purposes of achieving ambient air quality standards;

(c) if it is necessary or desirable to accommodate demands brought about by impacts on socioeconomic circumstances and it is in the public interest to meet those demands;

(d) at the written request of the holder of the licence;

(e) if it is transferred to another person in terms of section 44; or

(f) if it is reviewed in terms of section 45.

(2) The variation of a licence includes –

(a) the attaching of an additional condition or requirement to the licence;

(b) the substitution of a condition or requirement;

(c) the removal of a condition or requirement; or

(d) the amendment of a condition or requirement.

(3) If a licensing authority receives a request from the holder of a licence in terms of subsection (1)(d), the licensing authority must require the holder of the licence to take appropriate steps to bring the request to the attention of relevant organs of state, interested persons and the public if –

(a) the variation of the licence will authorise an increase in the environmental impact regulated by the licence;

(b) the variation of the licence will authorise an increase in atmospheric emissions; and

(c) the proposed variation has not, for any reason, been the subject of an authorisation in terms of any other legislation and public consultation.

(4) Steps in terms of subsection (3) must include the publication of a notice in at least two newspapers circulating in the area in which the listed activity authorised by the licence is, or will be, carried out –

(a) describing the nature and purpose of the request;

(b) giving particulars of the listed activity, including the place where it is or will be carried out;

(c) stating a reasonable period within which written representations on or objections to the request may be submitted, and the address or place where representations or objections must be submitted; and

(d) containing such other particulars as the licensing authority may require.

(5) Sections 38 and 40, read with the necessary changes as the context may require, apply to the variation of a licence.

4.1.3.2 ATMOSPHERIC IMPACT REPORT

According to NEM:AQA in terms of Section 30, an AQO may require the submission of an Atmospheric Impact Report (AIR) if:

- The AQO reasonably suspects that a person has contravened or failed to comply with the AQA or any conditions of an AEL and that detrimental effects on the environment occurred or there was a contribution to the degradation in ambient air quality.
- A review of a provisional AEL or an AEL is undertaken in terms of Section 45 of NEM:AQA.

The format of the AIR is stipulated in the Regulations Prescribing the Format of the Atmospheric Impact Report, Government Gazette No. 36904, Notice Number 747 of 2013 (11 October 2013), it's amendment stipulated in Government Gazette No. 38633, No. R284 (2 April 2015). An AIR can be compiled prior to AEL application when plant design is finalised. An AIR has been prepared as part of the BA process, and is attached as Appendix E.

4.1.3.3 ATMOSPHERIC MODELLING REGULATIONS

Air dispersion modelling provides a cost-effective means for assessing the impact of air emission sources, the major focus of which is to determine compliance with the relevant ambient air quality standards. Dispersion modelling provides a versatile means of assessing various emission options for the management of emissions from existing or proposed installations. Regulations regarding Air Dispersion Modelling were promulgated in Government Gazette No. 37804 vol. 589; 11 July 2014, (Government Gazette, 2014) and recommend a suite of dispersion models to be applied for regulatory practices as well as guidance on modelling input requirements, protocols and procedures to be followed. The Regulations regarding Air Dispersion Modelling are applicable –

(a) in the development of an air quality management plan, as contemplated in Chapter 3 of the NEM:AQA;

(b) in the development of a priority area air quality management plan, as contemplated in Section 19 of the NEM:AQA;

(c) in the development of an AIR, as contemplated in Section 30 of the NEM:AQA; and,

in the development of a specialist air quality impact assessment study, as contemplated in Chapter 5 of the NEM:AQA.

Three Levels of Assessment are defined in the Regulations. The three levels are:

- Level 1: where worst-case air quality impacts are assessed using simpler screening models
- Level 2: for assessment of air quality impacts as part of license application or amendment processes, where impacts are the greatest within a few kilometres downwind (less than 50 km)
- Level 3: require more sophisticated dispersion models (and corresponding input data, resources and model operator expertise) in situation:
    - where a detailed understanding of air quality impacts, in time and space, is required;

- where it is important to account for causality effects, calms, non-linear plume trajectories, spatial variations in turbulent mixing, multiple source types & chemical transformations;
- when conducting permitting and/or environmental assessment process for large industrial developments that have considerable social, economic and environmental consequences;
- when evaluating air quality management approaches involving multi-source, multi-sector contributions from permitted and non-permitted sources in an air-shed; or,
- when assessing contaminants resulting from non-linear processes (e.g. deposition, ground-level O3, particulate formation, visibility).

The first step in the dispersion modelling exercise requires a clear objective of the modelling exercise and thereby gives clear direction to the choice of the dispersion model most suited for the purpose. Accordingly, Level 2 was deemed be appropriate for this study.

4.1.3.4 THE HIGHVELD PRIORITY AREA

The Highveld Airshed Priority Area (HPA) was declared the second national air quality priority area (after the Vaal Triangle Airshed Priority Area) by the Minister of Environmental Affairs at the end of 2007 (HPA, 2011). This required that an Air Quality Management Plan for the area be developed. The plan includes the establishment of emissions reduction strategies and intervention programmes based on the findings of a baseline characterisation of the area. The implication of this is that all contributing sources in the area will be assessed to determine the emission reduction targets to be achieved over the following few years.

The DFFE published the management plan for the Highveld Priority Area in September 2011. Included in this management plan are seven goals, each of which has a further list of objectives that has to be met. The seven goals for the Highveld Priority area are as follows:

- **Goal 1:** By 2015, organisational capacity in government is optimised to efficiently and effectively maintain, monitor and enforce compliance with ambient air quality standards.
- **Goal 2:** By 2020, industrial emissions are equitably reduced to achieve compliance with ambient air quality standards and dust fall-out limit values.
- **Goal 3:** By 2020, air quality in all low-income settlements is in full compliance with ambient air quality standards.
- **Goal 4:** By 2020, all vehicles comply with the requirements of the National Vehicle Emission Strategy.
- **Goal 5:** By 2020, a measurable increase in awareness and knowledge of air quality exists.
- **Goal 6:** By 2020, biomass burning and agricultural emissions will be 30% less than current.
- **Goal 7:** By 2020, emissions from waste management are 40% less than current.

A second-generation air quality management plan for the HPA was published in March 2025. The proposed strategies to reduce the emissions from industrial sources within the HPA are summarised in Table 8. The target is to reduce emissions by 40% in 2030.

Table 8: Emission reduction activities for industrial sources

Objectives	Key Activities/ Opportunities	Responsibility
Reduce emissions from industries	Compliance with the minimum emission standards and other atmospheric emission licence conditions.	Identified stakeholders in regulation 3(2)(a) and 3(2)(b).

Objectives	Key Activities/ Opportunities	Responsibility
	Assessment of compliance monitoring reports.	Identified stakeholders in regulation 3(2)(e): DFFE, Provinces, Metros, Districts and Local municipalities.
	Development and implementation of emission reduction plans.	Identified stakeholders in regulation 3(2)(a) and 3(2)(b).
	Monitor and enforce compliance.	Identified stakeholders in regulation 3(2)(e): DFFE, Provinces, Metros, Districts and Local municipalities
	Identify opportunities and incentive schemes to support industries to implement air quality improvement initiatives.	Identified stakeholders in regulation 3(2)(e): DTIC, DFFE, Provinces, Metros, Districts and Local municipalities
	Establish incentive schemes for energy efficiency improvements and fuel switching that directly reduce air emissions.	Identified stakeholders in regulation 3(2)(e): DTIC, DFFE, Provinces, Metros, Districts and Local municipalities
Notes: DTIC – Department of Trade, Industry and Competition, DFFE – Department of Forestry, Fisheries and the Environment The applicant has prepared an Emissions Reduction and Management Plan (ERMP) for the existing licenced operations. If this application for the VCN is authorized, then this ERMP will need to be revised to incorporate the new operations.		

4.1.4 NATIONAL ENVIRONMENTAL MANAGEMENT BIODIVERSITY ACT (NEMBA)

The National Environmental Management Biodiversity Act (Act No. 10 of 2004 – NEMBA) provides for the management and conservation of South Africa's biodiversity within the framework of the NEMA as well as the protection of species and ecosystems that warrant national protection. Within the framework of this act, various regulations are promulgated which provide specific requirements and management measures relating to protecting threatened ecosystems, threatened or protected species as well as the control of alien and invasive species. A summary of these regulations is presented below.

The National List of Ecosystems that are Threatened and Need of Protection (GN 1002 of 2011) are promulgated under the NEMBA and these Regulations provide for listing of threatened or protected ecosystems in one of the following categories:

- Critically Endangered (CR) ecosystems, being ecosystems that have undergone severe degradation of ecological structure, function or composition as a result of human intervention and are subject to an extremely high risk of irreversible transformation;
- Endangered (EN) ecosystems, being ecosystems that have undergone degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems;
- Vulnerable (VU) ecosystems, being ecosystems that have a high risk of undergoing significant degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems or endangered ecosystems; and
- Protected ecosystems, being ecosystems that are of high conservation value or of high national or provincial importance, although they are not listed as critically endangered, endangered or vulnerable.

Further regulations published under the NEMBA are the threatened or protected Species Regulations (GN R 152 OF 2007) which aims to:

(a) further regulate the permit system set out in Chapter 7 of the Biodiversity Act insofar as that system applies to restricted activities involving specimens of listed threatened or protected species;

(b) provide for the registration of captive breeding operations, commercial exhibition facilities, game farms, nurseries, scientific institutions, sanctuaries and rehabilitation facilities and wildlife traders;

(c) provide for the regulation of the carrying out of a specific restricted activity, namely hunting;

(d) provide for the prohibition of specific restricted activities involving specific listed threatened or protected species;

(e) provide for the protection of wild populations of listed threatened species; and

(f) provide for the composition and operating procedure of the Scientific Authority.

The Alien and Invasive Species Lists are promulgated under the NEMBA with the aim of protecting the quality and quantity of arable land in South Africa. Loss of arable land should be avoided and declared Weeds and Invaders in South Africa are categorised according to one of the following categories, and require control or removal:

- Category 1a Listed Invasive Species: Category 1a Listed Invasive Species are those species listed as such by notice in terms of section 70(1)(a) of the Act as species which must be combated or eradicated;
- Category 1b Listed Invasive Species: Category 1b Listed Invasive Species are those species listed as such by notice in terms of section 70(1)(a) of the Act as species which must be controlled;
- Category 2 Listed Invasive Species: Category 2 Listed Invasive Species are those species listed by notice in terms of section 70(1)(a) of the Act as species which require a permit to carry out a restricted activity within an area specified in the Notice or an area specified in the permit, as the case may be; and
- Category 3 Listed Invasive Species: Category 3 Listed Invasive Species are species that are listed by notice in terms of section 70(1)(a) of the Act, as species which are subject to exemptions in terms of section 71(3) and prohibitions in terms of section 71A of Act, as specified in the Notice.

In giving effect to the above, the Alien and Invasive Species Regulations (GNR 1020 of 2020) provide for amongst others, the prevention of the spread or allowing the spread of, any specimen of a listed invasive species. Char Technology has an existing Alien Invasive Species Management Plan for maintenance of their site.

According to the DFFE Screening Tool report (2025), and Mucina and Rutherford (2006) the site is located in a region characterised by the Endangered (EN) Eastern Highveld Grassland Ecosystem. This ecosystem is listed in the DFFE's Revised National List of Ecosystems that are Threatened and in Need of Protection published in 2022 under the National Environmental Act: Biodiversity Act (act 10 of 2004). The site sensitivity verification undertaken by the EAP however, confirmed that the site exists in a heavily modified environment within an existing industrial park. The proposed project is within an existing building, mainly with concrete floors, existing access roads and will not require any clearance of vegetation/ecosystem disturbance. Apart from the indirect atmospheric pathways through the facility air emissions, there are no other foreseeable impact pathways to the terrestrial biodiversity receptors.

4.1.5 THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT (NEMWA)

On 2 June 2014, the NEMWA came into force. The objectives of this Act are:

a) to protect health, well-being and the environment by providing reasonable measures for-

   i. minimising the consumption of natural resources;

   ii. avoiding and minimising the generation of waste;

   iii. reducing, re-using, recycling and recovering waste;

iv. treating and safely disposing of waste as a last resort;

v. preventing pollution and ecological degradation;

vi. securing ecologically sustainable development while promoting justifiable economic and social development;

vii. promoting and ensuring the effective delivery of waste services;

viii. remediating land where contamination presents, or may present, a significant risk of harm to health or the environment; and

ix. achieving integrated waste management reporting and planning;

b) to ensure that people are aware of the impact of waste on their health, well-being and the environment;

c) to provide for compliance with the measures set out in paragraph (a); and

d) generally, to give effect to section 24 of the Constitution in order to secure an environment that is not harmful to health and well-being.

Section 16 of the NEMWA states:

1. A holder of waste must, within the holder's power, take all reasonable measures to-

    a) "*Avoid the generation of waste and where such generation cannot be avoided, to minimise the toxicity and amounts of waste that are generated;*

    b) Reduce, re-use, recycle and recover waste;

    c) Where waste must be disposed of, ensure that the waste is treated and disposed of in an environmentally sound manner;

    d) Manage the waste in such a manner that it does not endanger health or the environment or cause a nuisance through noise, odour, or visual impacts;

    e) Prevent any employee or any person under his or her supervision from contravening the Act; and

    f) *Prevent the waste from being used for unauthorised purposes."*

The NEMWA provides for specific waste management measures to be implemented, as well as providing for the licensing and control of waste management activities. No waste management activities listed under GNR 921 of the NEMWA were identified for the CharTech VCN Project. However, CharTech will be responsible for ensuring that all waste produced at the VCN plant is handled in accordance with the requirements of the Waste Act.

4.1.5.1 **WASTE CLASSIFICATION AND MANAGEMENT REGULATIONS**

The Waste Classification and Management Regulations (GNR 634) are published under the NEMWA. The purpose of these Regulations is to –

- Regulate the classification and management of waste in a manner which supports and implements the provisions of the Act;
- Establish a mechanism and procedure for the listing of waste management activities that do not require a Waste Management Licence;
- Prescribe requirements for the disposal of waste to landfill;
- Prescribe requirements and timeframes for the management of certain wastes; and
- Prescribe general duties of waste generators, transporters and managers.

Waste classification, as presented in Chapter 4 of these regulations, entails the following:

- Wastes listed in Annexure 1 of these Regulations do not require classification in terms of SANS 10234;
- Subject to sub regulation (1), all waste generators must ensure that the waste they generate is classified in accordance with SANS 10234 within one hundred and eighty (180) days of generation;
- Waste must be kept separate for the purposes of classification in terms of sub regulation (2), and must not be mixed prior to classification;
- Waste-must be re-classified in terms of sub regulation (2) every five (5) years, or within 30 days of modification to the process or activity that generated the waste, changes in raw materials or other inputs, or any other variation of relevant factors;
- Waste that has been subjected to any form of treatment must be re-classified in terms of sub regulation (2), including any waste from the treatment process; and
- If the Minister reasonably believes that a waste has not been classified correctly in terms of sub regulation (2), he or she may require the waste generator to have the classification peer reviewed to confirm the classification.

Furthermore, Chapter 8 of the Regulations stipulates that unless otherwise directed by the Minister to ensure a better environmental outcome, or in response to an emergency so as to protect human health, property or the environment –

- Waste generators must ensure that their waste is assessed in accordance with the Norms and Standards for Assessment of Waste for Landfill Disposal set in terms of section 7(1) of the Act prior to the disposal of the waste to landfill;
- Waste generators must ensure that the disposal of their waste to landfill is done in accordance with the Norms and Standards for Disposal of Waste to Landfill set in terms of section 7(1) of the Act; and
- Waste managers disposing of waste to landfill must only do so in accordance with the Norms and Standards for Disposal of Waste to Landfill set in terms of section 7 (1) of the Act.

4.1.5.2 NEMWA NATIONAL NORMS AND STANDARDS FOR THE ASSESSMENT OF WASTE FOR LANDFILL DISPOSAL, 2013 (GN R. 635)

These Norms and Standards prescribe the requirements for the assessment of waste prior to storage or disposal to landfill. The aim of the waste assessment tests is to characterise the material to be deposited or stored in terms of the above-mentioned waste assessment guidelines set by the DFFE. The waste generated at the proposed project which is not listed under Annexure 1 of the Waste Classification and Management Regulations, must be assessed in accordance to these Norms and Standards to determine the waste type. In terms of Regulation 12(1) of GN R 634 with regards to the classification of waste, the potential level of risk associated with disposal or downstream use of waste must be determined by following the prescribed and appropriate analysis protocol as detailed in these Norms and Standards. The assessment of the waste should:

- Identify the chemical substances present in the waste;
- Sampling and analysis to determine the total concentration (TC) and leachable concentration (LC) of the elements and chemical substances that have been identified within the waste according to section 6 of this regulation;
- Based on the TC and LC limits of the identified elements and chemical substances in the analysed waste exceeding the corresponding TC and LC thresholds respectively, the waste type will be determined (Type 0 Waste to Type 4 Waste); and
- The waste type will then be used determine to which landfill class site the waste must be disposed and / or the suitable containment barrier design for storage.

4.1.5.3 NEMWA NATIONAL NORMS AND STANDARDS FOR THE DISPOSAL OF WASTE TO LANDFILL, 2013 (GN R. 636)

Once the waste has been assessed and waste type determined, these Norms and Standards can be used to determine the minimum requirements for the landfill and containment barrier design. This will distinguish between Class A, Class B, Class C, or Class D landfills and the associated containment barrier requirements. Although these Norms and Standards prescribe the containment barrier or liner design for each determined waste type, the recent amendments in chapter 3 of the regulations to the planning and management of residue stockpiles and residue deposits, a competent person must recommend the pollution control measures suitable for a specific residue stockpile or residue deposit on the basis of a risk analysis as contemplated in regulations 4 and 5 of the regulations. The recommendation should be founded on a risk analysis based on the characteristics and classification in regulation 4 and 5 of these Regulations, towards determining the appropriate mitigation and management measures.

4.1.6 THE NATIONAL WATER ACT (NWA) – ACT

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

a) meeting the basic human needs of present and future generations;

b) promoting equitable access to water;

c) redressing the results of past racial and gender discrimination;

d) promoting the efficient, sustainable and beneficial use of water in the public interest;

e) facilitating social and economic development;

f) providing for growing demand for water use;

g) protecting aquatic and associated ecosystems and their biological diversity;

h) reducing and preventing pollution and degradation of water resources;

i) meeting international obligations;

j) promoting dam safety;

k) managing floods and droughts,

and for achieving this purpose, to establish suitable institutions and to ensure that they have appropriate community, racial and gender representation.

4.1.6.1 WATER USE LICENCING

The NWA makes provision for two types of applications for water use licences, namely individual applications and compulsory applications. The NWA also provides that the responsible authority may require an assessment by the applicant of the likely effect of the proposed licence on the resource quality, and that such assessment be subject to the NEMA EIA Regulations. A person may use water if the use is –

- Permissible as a continuation of an existing lawful water use (ELWU);
- Permissible in terms of a general authorisation (GA);
- Permissible under Schedule 1; or
- Authorised by a licence.

The above water use processes are described in Figure 6.

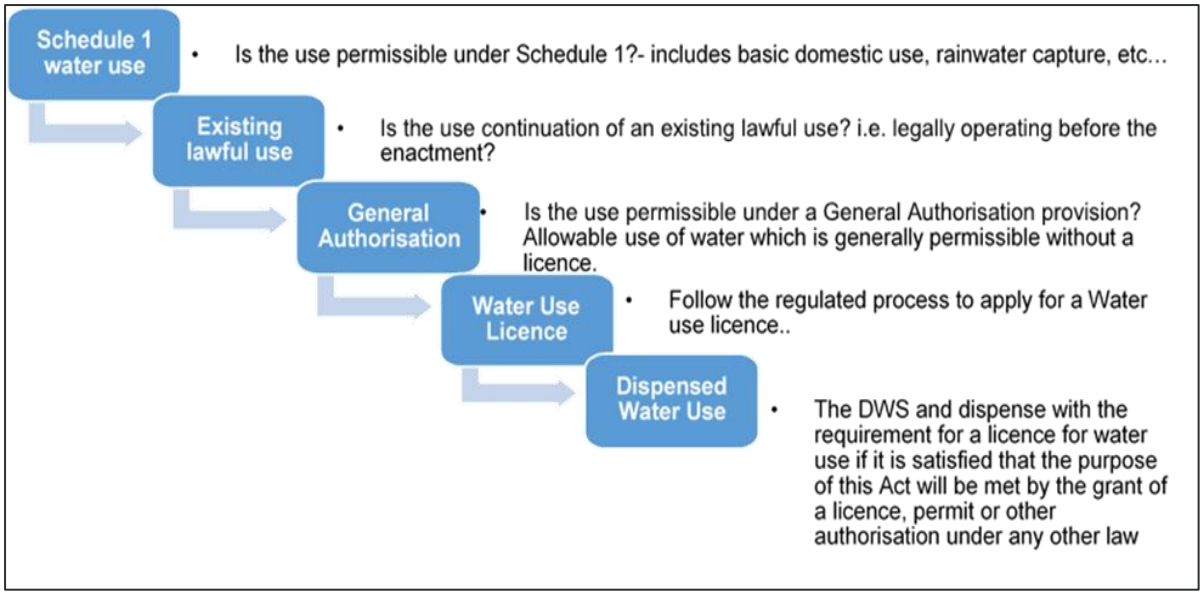


Figure 6: Authorisation processes for new water uses.

The NWA defines 11 water uses in Section 21 of the Act. A water use may only be undertaken if authorised by the DWS. The water uses for which an authorisation or licence can be issued include:

a) Taking water from a water resource;

b) Storing water;

c) Impeding or diverting the flow of water in a watercourse;

d) Engaging in a stream flow reduction activity contemplated in section 36;

e) Engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1);

f) Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduits;

g) Disposing of waste in a manner which may detrimentally impact on a water resource;

h) Disposing 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 for the safety of people; and

k) Using water for recreational purposes.

A watercourse is defined in terms of the Act as follows:

a) a river or spring;

b) a natural channel in which water flows regularly or intermittently;

c) a wetland, lake or dam into which, or from which, water flows; and

d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks;

The regulated area of a watercourse for section 21(c) or (i) of the Act water uses, is similarly defined in terms of the Act as follows:

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.

As part of this EA process, no water uses requiring authorisation were identified. The DWS has identified as a commenting authority to provide comments on the application.

4.1.6.2 CATCHMENT MANAGEMENT STRATEGY AND WATER MANAGEMENT AREA

South Africa is divided into nineteen Water Management Areas (WMAs). The delegation of water resource management from central government to catchment level is achieved by establishing Catchment Management Agencies (CMAs) at WMA level. Each CMA progressively develops a Catchment Management Strategy (CMS) for the protection, use, development, conservation, management and control of water resources within its WMA. This is to ensure that on a regional scale, water is protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner for the benefit of all persons. The main instrument that guides and governs the activities of a WMA is the CMS which, while conforming to relevant legislation and national strategies, provides detailed arrangements for the protection, use, development, conservation, management and control of the region's water resources.

The proposed CharTech VCN project is located within the Olifants–Letaba Water Management Area (WMA), now commonly incorporated into the broader Limpopo–Olifants WMA. This catchment, managed by the Limpopo–Olifants Catchment Management Agency (LOCMA), is characterised by ongoing challenges relating to water quality management, the cumulative impacts of mining and industrial activities, and the protection of ecological reserves in the Olifants and Letaba river systems. According to the Olifants River Ecological Management Framework (OLEMF, 2009), the Govan Mbeki and Msukaligwa municipal areas (Gert Sibande District Municipality), as well as Delmas and large areas of Emalahleni and Steve Tshwete (Nkangala District Municipality), together with parts of Kungwini (Metsweding District Municipality), fall within Management Zone A.

Management Zone A is identified as an area facing considerable pressure owing to over-allocation of available water resources, where water use already frequently exceeds sustainable thresholds. Mining, industrial operations and power stations are widely distributed throughout this zone and collectively exert significant negative impacts on the natural environment. These include deterioration of air quality, pollution of surface and groundwater resources, and widespread transformation of the natural landscape. The zone is further constrained by poorly functioning municipal sewage treatment plants, which continue to discharge partially treated or untreated effluent into nearby rivers, contributing to the degradation of water quality and aquatic ecosystem health.

The sensitive headwaters of the Olifants River occur within this zone, and impacts generated here have far-reaching consequences for downstream ecological functioning and water users. Very limited natural habitat remains within Management Zone A due to extensive mining, agriculture and industrial development. The remaining pans, wetlands and isolated natural vegetation patches serve as important refuges for biodiversity and should be protected wherever feasible. Erosion is also a concern in the zone, largely associated with disturbed or exposed soils from mining activities, contributing to sedimentation and further ecological stress. In addition, the area includes drought-prone regions, adding further pressure to the already stressed water resources and catchment systems.

The local economy within this zone is heavily dependent on mining, which has a finite operational lifespan. As a result, long-term economic resilience will require diversification and investment in alternative economic activities to sustain livelihoods once mining operations cease.

In conclusion, the proposed CharTech VCN project is not anticipated to place additional pressure on natural water resources. This is because:

- it will be constructed within an existing brownfield industrial site, avoiding disturbance of natural habitat or sensitive ecological areas;
- it will not require any additional water allocation beyond what is already authorised and available to CharTech; and
- it is located within an area classified as having low environmental sensitivity, with no direct or indirect impact expected on wetlands, rivers, riparian zones or other sensitive natural features.

Overall, the project is therefore considered unlikely to exacerbate existing environmental pressures within Management Zone A and is aligned with responsible and sustainable development principles.

4.1.7 NATIONAL HERITAGE RESOURCES ACT (NHRA)

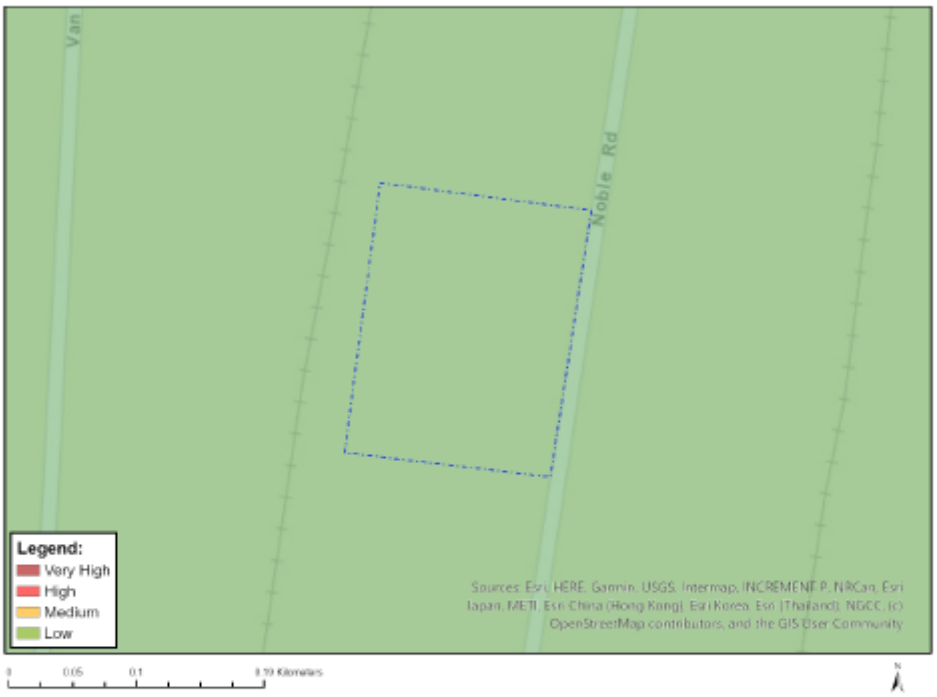
The National Heritage Resources Act (Act 25 of 1999 – NHRA) stipulates that cultural heritage resources may not be disturbed without authorisation from the relevant heritage authority. Section 34(1) of the NHRA states that, "*no person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority…*" The NHRA is utilised as the basis for the identification, evaluation and management of heritage resources and in the case of Cultural Resource Management (CRM) those resources specifically impacted on by development as stipulated in Section 38 of NHRA, and those developments administered through the NEMA, MPRDA and the Development Facilitation Act (FDA) legislation. In the latter cases the feedback from the relevant heritage resources authority is required by the State and Provincial Departments managing these Acts before any authorisations are granted for a development. The last few years have seen a significant change towards the inclusion of heritage assessments as a major component of Environmental Impact Processes required by the NEMA and MPRDA.

The NEMA 23(2)(b) gives effect to the NHRA and states that an integrated environmental management plan should, "*…identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage*". A study of subsections (23)(2)(d), (29)(1)(d), (32)(2)(d) and (34)(b) and their requirements reveals the compulsory inclusion of the identification of cultural resources, the evaluation of the impacts of the proposed activity on these resources, the identification of alternatives and the management procedures for such cultural resources for each of the documents noted in the Environmental Regulations. A further important aspect to be taken into account of in the EIA Regulations under the NEMA relates to the Specialist Report requirements (Appendix 6 of EIA Regulations 2014, as amended) which apply to Heritage Impact Assessments.

The MPRDA also gives effect to the NHRA as this Act defines 'environment' as it is in the NEMA and, therefore, acknowledges cultural resources as part of the environment. Section 39(3)(b) of this Act specifically refers to the evaluation, assessment and identification of impacts on all heritage resources as identified in Section 3(2) of the NHRA that are to be impacted on by activities governed by the MPRDA. Section 40 of the MPRDA requires the consultation with any State Department administering any law that has relevance on such an application through Section 39 of the MPRDA. This implies the evaluation of Heritage Assessment Reports in Environmental Management Plans or Programmes by the relevant heritage authorities.

During the EAP's screening on the project it was determined that the building on which the furnace will be installed is approximately 35 years old. As such, it does not qualify as a heritage resource and is not considered a heritage feature. All works will be confined to the existing building footprint, and no deep excavations or ground disturbances are planned except for installation of paving on existing unpaved roads on site. The project is therefore excluded from the Chance Finds Protocol. Given that the project will not alter the character of the site and no heritage resources (see Figure 7) are present or expected to be impacted, a Heritage Impact Assessment is not required, and no heritage-related impacts are anticipated. A Notification of Intent to Develop (NID), will be submitted to the SAHRA as part of the PP process.

MAP OF RELATIVE ARCHAEOLOGICAL AND CULTURAL HERITAGE THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
			x

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low Sensitivity

Figure 7: DFFE Screening Tool archaeological and cultural heritage sensitivity map

4.1.8 ENVIRONMENT CONSERVATION ACT (ECA)

The ECA (Act 73 of 1989) was, prior to the promulgation of the NEMA, the backbone of environmental legislation in South Africa. To date the majority of the ECA has been repealed by various other Acts, however Section 25 of the Act and the Noise Regulations (GN R. 154 of 1992) promulgated under this section are still in effect. These Regulations serve to control noise and general prohibitions relating to noise impact and nuisance.

In terms of section 25 of the ECA, the National Noise Control Regulations (GN R. 154 – NCRs) published in Government Gazette No. 13717 dated 10 January 1992, were promulgated. The NCRs were revised under GN R. 55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations. Provincial noise control regulations have been promulgated in Gauteng, Free State and Western Cape Provinces.

The NCRs will need to be considered in relation to the potential noise that may be generated mainly during the construction phase of the proposed project. The two key aspects of the NCRs relate to disturbing noise and noise nuisance.

Section 4 of the Regulations prohibits a person from making, producing or causing a disturbing noise, or allowing it to be made produced or caused by any person, machine, device or apparatus or any combination thereof. A disturbing noise is defined in the Regulations as "*a noise level which exceeds the zone sound level or if no zone*

sound level has been designated, a noise level which exceeds the ambient sound level at the same measuring point by 7 dBA or more."

Section 5 of the NCRs in essence prohibits the creation of a noise nuisance. A noise nuisance is defined as "*any sound which disturbs or impairs or may disturb or impair the convenience or peace of any person".* The South African National Standard 10103 also applies to the measurement and consideration of environmental noise and should be considered in conjunction with these Regulations.

There are a few South African National Standards (SANS) relevant to noise from mines, industry and roads. They are:

- South African National Standard (SANS) 10103:2008 – 'The measurement and rating of environmental noise with respect to annoyance and to speech communication';
- SANS 10210:2004 – 'Calculating and predicting road traffic noise';
- SANS 10328:2008 – 'Methods for environmental noise impact assessments';
- SANS 10357:2004 – 'The calculation of sound propagation by the Concave method';
- SANS 10181:2003 – 'The Measurement of Noise Emitted by Road Vehicles when Stationary'; and
- SANS 10205:2003 – 'The Measurement of Noise Emitted by Motor Vehicles in Motion'.

The relevant standards use the equivalent continuous rating level as a basis for determining what is acceptable. The levels may take single event noise into account, but single event noise by itself does not determine whether noise levels are acceptable for land use purposes. With regards to SANS 10103:2008, the recommendations are likely to inform decisions by authorities, but non-compliance with the standard will not necessarily render an activity unlawful per se.

4.1.9 THE CONSERVATION OF AGRICULTURAL RESOURCES ACT (CARA)

The law on Conservation of Agricultural Resources (Act 43 of 1983) aims to provide for the conservation of the natural agricultural resources of the Republic by the maintenance of the production potential of land, by the combating and prevention of erosion and weakening or destruction of the water sources, and by the protection of the vegetation and the combating of weeds and invader plants. In order to achieve the objectives of this Act, control measures related to the following may be prescribed to land users to whom they apply:

- The cultivation of virgin soil;
- The utilisation and protection of land which is cultivated;
- The irrigation of land;
- The prevention or control of waterlogging or salination of land;
- The utilisation and protection of vleis, marshes, water sponges, water courses and water sources;
- The regulating of the flow pattern of run-off water;
- The utilisation and protection of the vegetation;
- The grazing capacity of veld, expressed as an area of veld per large stock unit;
- The maximum number and the kind of animals which may be kept on veld; The prevention and control of veld fires;
- The utilisation and protection of veld which has burned;
- The control of weeds and invader plants;
- The restoration or reclamation of eroded land or land which is otherwise disturbed or denuded;
- The protection of water sources against pollution on account of farming practices;

- The construction, maintenance, alteration or removal of soil conservation works or other structures on land; and
- Any other matter which the Minister may deem necessary or expedient in order that the objects of this Act may be achieved.

Further, different control measures may be prescribed in respect of different classes of land users or different areas or in such other respects as the Minister may determine. Impacts on the soil, biodiversity and water resources have been considered with regards to the proposed VCN Project, and mitigation and management measures, where necessary, have been recommended.

4.1.10 THE NATIONAL FORESTS ACT (NFA)

According to this Act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that "*no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister*."

The proposed development is located within the Ferrobank Industrial site, which is considered as a heavily transformed site. No protected tree species were identified during the site sensitivity screening, and considering the fact that the development will be located within existing structures there is no likelihood of SCC occurring on site.

4.1.11 THE SPATIAL PLANNING AND LAND USE MANAGEMENT ACT (SPLUMA)

The Spatial Planning and Land Use Management Act (Act 16 of 2013 – SPLUMA) is set to aid effective and efficient planning and land use management, as well as to promote optimal exploitation of minerals and mineral resources. The SPLUMA was developed to legislate for a single, integrated planning system for the entire country. Therefore, the Act provides a framework for a planning system for the country and introduces provisions to cater for development principles; norms and standards; inter-governmental support; Spatial Development Frameworks (SDFs) across national, provincial, regional and municipal areas; Land Use Schemes (LUS); and municipal planning tribunals. The proposed VCN project is located within the Ferrobank Industrial Area zoned as Industrial. As such, the proposed activities aligns with the current land-use zoning.

4.1.12 OCCUPATIONAL HEALTH AND SAFETY ACT

The Occupational Health and Safety Act (Act 85 of 1993 - OHSA) provides for the health and safety of persons at work and for the health and safety of persons in connection with the use of plant and machinery; the protection of persons other than persons at work against hazards to health and safety arising out of or in connection with the activities of persons at work; to establish an advisory council for occupational health and safety; and to provide for matters connected therewith. Worker safety will form part of the contractor's safety requirements and be guided by the OHSA. This would entail a full health and safety file including but not limited to pre-mobilization medical assessments, work environment and task specific risk assessments and method statements etc. The VCN Plant will be required comply with CharTech's safety philosophy, risk assessments and Standard Operating Procedures which are all required to comply with the OHSA Therefore safety of all personnel will be guided by overarching South African legislation.

The Major Hazard Installation Regulations (GNR 692 of 30 July 2001) are promulgated under the OHSA and apply to employers, self-employed persons and users, who have on their premises, either permanently or temporarily, a major hazard installation or a quantity of a substance which may pose a risk that could affect the health and safety of employees and the public.

A "major hazard installation" means an installation-

a) where more than the prescribed quantity of any substance is or may be kept, whether permanently or temporarily; or

b) where any substance is produced, processed, used, handled or stored in such a form and quantity that it has the potential to cause a major incident.

The proposed VCN Furnace will not trigger an MHI.

4.1.13 THE NATIONAL ROAD TRAFFIC ACT

The National Road Traffic Regulations (1999) promulgated under Section 75 of the National Road Traffic Act (Act No. 93 of 1996) regulate the conveyance of abnormal loads and dangerous goods on public roads.

The National Road Traffic Act (1996) seeks to ensure that unintentional incidents are prevented and managed in a responsible way, and it makes persons accountable for their actions. Some of the requirements in the legislation include:

- Registration of operators: All dangerous goods operators who are operating vehicles whose gross vehicle mass is in excess of 3500 kilograms are required to register with the Department of Transport as dangerous goods operators.
- Driving licence: A special category D professional driving licence will be required. Signage on vehicles: All operators transporting dangerous goods will be required to identify their vehicles accordingly. This will include an orange diamond in front of the vehicle, placards on the sides and rear of the vehicle;
- Documentation: The driver of the vehicle will be required to carry at least 3 different documents, including a route plan, a transport emergency card and a document known as the dangerous goods declaration. The dangerous goods declaration will contain details of the consignor, consignee, the operator, the correct name of the product and the hazards associated with the chemical. The operator is also required to inform the emergency services situated along the routes which he will travel, what will be transported and the quantities so that appropriate measures will be taken to deal with an emergency;
- Responsibility of consignors and consignees: The legislation requires operators, consignors and consignees to take responsibility for their actions within each phase of the transport process. Each Party will be required by law to sign an operational agreement confirming the responsibility attached to them. In this way the responsible person could be held accountable in the event of an incident arising out of negligence.

It is understood that transportation of the raw materials and final product and waste will be undertaken via road transport. CharTech will need to ensure that all service providers abide by the provisions of the National Traffic Act.

4.1.14 LABOUR RELATIONS ACT, 1995 (LRA)

The reference to the facility being placed under “Section 189 care and maintenance” relates to Section 189 of the Labour Relations Act 66 of 1995, which governs retrenchments and operational-requirements restructuring. When an operation is placed under “care and maintenance,” employers may initiate a Section 189 process to consult with employees and trade unions regarding potential retrenchments due to the temporary shutdown or scaling-down of operations. This is a labour-law process, not an environmental authorisation requirement, and is triggered when operational changes create a risk of job losses.

4.2 MUNICIPAL POLICY AND PLANNING CONTEXT

4.2.1 EMALAHLENI LOCAL MUNICIPALITY INTEGRATED DEVELOPMENT PLAN (IDP)

The Emalahleni Local Municipality (ELM) Integrated Development Plan (IDP) 2025/26 provides the overarching strategic framework guiding planning, service delivery, infrastructure investment, environmental management, and socio-economic development within the municipal area. The IDP identifies Emalahleni as a highly industrialised, mining-energy dominated municipality facing significant pressures linked to population growth, ageing infrastructure, pollution (air and water), and increasing service delivery demands.

The IDP highlights that Emalahleni’s population growth and settlement expansion continue to place strain on bulk and reticulation infrastructure, with persistent backlogs in key municipal services and notable risks to water security and environmental quality. Key pressures and constraints referenced include water stress and

deteriorating water quality in the Upper Olifants system, infrastructure deterioration, theft and vandalism, illegal dumping, informal settlement growth, and the municipality's dependency on the mining economy with associated long-term transition risks.

In response, the municipality's planning approach prioritises stabilising and improving core service delivery, strengthening governance and financial viability, and supporting economic diversification while addressing environmental degradation through improved compliance, waste management, air quality interventions, and climate change adaptation measures.

The following priorities, goals and actions are emphasised in the ELM IDP and associated municipal planning instruments:

- Improve access to basic services and address infrastructure backlogs, including water, sanitation, electricity, roads/stormwater and refuse removal, recognising that service delivery deficits are largely driven by ageing and overloaded infrastructure, insufficient maintenance, and rapid growth pressures.
- Strengthen water security and reduce losses, through a combination of augmentation (including mine water reclamation initiatives), refurbishment and upgrades of water treatment works, replacement of ageing pipelines, installation of meters/smart metering and improved operational controls, alongside initiatives to address deteriorating raw water quality and system interruptions.
- Upgrade and expand wastewater and sanitation infrastructure, including planned upgrades to wastewater treatment works and sewer network interventions to reduce spillages, improve effluent quality, and address overloaded systems—recognising the municipality's historical challenges with wastewater treatment performance and downstream water quality risks.
- Improve electricity reliability and reduce losses, focusing on upgrading ageing electricity infrastructure, addressing illegal connections and metering losses, and implementing smart metering and auditing programmes to support improved revenue collection and system stability.
- Address roads and stormwater deterioration, with programmes to reseal and rehabilitate priority road surfaces, patch potholes, maintain extensive gravel road networks, and improve stormwater drainage capacity—recognising road damage pressures from heavy vehicle movements and inadequate drainage.
- Strengthen waste management and environmental health, including improved refuse collection coverage, implementation of the Integrated Waste Management Plan (IWMP), upgrading landfill sites, establishing waste transfer capacity and pursuing recycling and waste minimisation initiatives, in response to illegal dumping and resource constraints.
- Improve environmental governance and compliance, including enforcement of environmental by-laws, air quality and climate response initiatives, and actions to reduce pollution impacts associated with mining, industry and settlement growth. The IDP acknowledges air pollution sources (power generation, industry, mining and domestic fuel burning) and the need for ongoing air quality management interventions.
- Advance spatial transformation and settlement management, including land acquisition, formalisation/upgrading of informal settlements, issuance of title deeds, and strengthened land invasion response capacity, consistent with the municipality's spatial planning objectives and development management functions.
- Support local economic development and diversification, including the strengthening of SMME/cooperative support programmes, development of economic anchor projects and investment readiness initiatives, and longer-term positioning to respond to coal-related economic transition risks.
- Strengthen governance, institutional capability and financial viability, including implementation of the Financial Recovery Plan and revenue enhancement measures, improved audit outcomes and compliance, and digitisation initiatives to improve municipal performance and accountability.

The proposed CharTech VCN project, as an industrial development within an existing operational footprint, will be required to comply with and be assessed against the applicable municipal planning frameworks, including the ELM IDP, the municipal spatial planning tools (SDF and land use management instruments), and relevant environmental management programmes where applicable.

The proposed CharTech VCN project is not anticipated to drive additional municipal service demand beyond current operational requirements, as it is planned within a brownfield industrial setting and will utilise existing authorised service capacity available to CharTech. In this context, the project aligns with municipal planning objectives that promote economic activity within established nodes while limiting the expansion of new impacts into environmentally sensitive or unserviced areas.

4.2.2 EMALAHLENI MUNICIPAL SPATIAL DEVELOPMENT FRAMEWORK (SDF) AND EMALAHLENI LAND USE SCHEME

The Emalahleni Municipal Spatial Development Framework (SDF) and the Emalahleni Land Use Scheme (2020) guide spatial planning, land-use management and development decision-making in accordance with the principles of SPLUMA. The SDF sets out the long-term spatial vision for a sustainable, integrated and efficiently functioning municipal area, with an emphasis on balancing development needs with environmental protection and infrastructure capacity.

The SDF identifies Emalahleni as a heavily transformed, mining-intensive region with significant pressures on land, water resources, biodiversity, and infrastructure. It therefore prioritises directing new development to existing, serviced, and already-transformed areas, while protecting sensitive ecological assets and restricting urban expansion into high-risk or environmentally valuable zones. Relevant strategic objectives contained in the SDF include:

- Promoting compact, efficient, and sustainable settlement patterns and avoiding further sprawl into unserviced or environmentally sensitive areas.
- Concentrating industrial development within existing industrial nodes and designated brownfield areas where bulk services already exist.
- Protecting sensitive ecological features—including wetlands, rivers, endangered grasslands, and biodiversity corridors—by restricting incompatible land uses in high-sensitivity zones.
- Ensuring that development proposals align with infrastructure availability and do not place additional strain on already stressed bulk water, wastewater, and electricity systems unless supported by clear augmentation plans.
- Strengthening land-use enforcement, reducing illegal land occupation, and ensuring that all development follows SPLUMA-compliant land-use approval processes.

The Emalahleni Land Use Scheme (2020) provides the statutory regulatory framework for land-use permissions, zoning controls and development rights. The Scheme seeks to ensure orderly development, regulate industrial land uses appropriately, prevent encroachment into sensitive environments, and maintain alignment with the SDF.

The proposed CharTech VCN project shows a high degree of alignment with the Emalahleni SDF and Land Use Scheme based on the following:

- The project is located within an existing industrial zone, consistent with SDF directives that prioritise industrial activity within established industrial nodes and brownfield sites rather than greenfield expansion. This supports optimal land-use efficiency and aligns with the municipality's spatial transformation agenda.
- The project site falls within an area of low ecological sensitivity, which the SDF identifies as suitable for continued industrial use due to historic transformation, mining disturbance and the absence of natural

habitat requiring protection. Consequently, the proposal avoids conflict with biodiversity conservation priorities.

- The development does not trigger additional bulk infrastructure demands, particularly in relation to water, as it will operate within existing authorised water allocations and established service connections. This is consistent with SDF and Land Use Scheme requirements that development must align with available service capacity and avoid intensifying pressure on already burdened water and wastewater systems.
- The Land Use Scheme permits industrial activities of the type proposed, and the project does not require a departure from existing zoning nor expansion into undeveloped land. As such, the development is compatible with the current lawful land-use rights on the property.
- The project does not encroach into sensitive rivers, wetlands, conservation areas or biodiversity corridors, all of which the SDF explicitly requires to be protected from industrial and incompatible land uses.

Based on the provisions of the Emalahleni SDF and Land Use Scheme, the proposed CharTech VCN development is aligned with the municipality's spatial planning vision and statutory land-use framework. It supports the strategic intent of directing industrial development to appropriate brownfield areas, avoids conflict with ecological sensitivities, complies with existing zoning, and does not impose additional burdens on constrained municipal infrastructure.

5 NEED AND DESIRABILITY OF THE PROPOSED ACTIVITY

This section assesses the need for and desirability of the proposed activity in terms of the National Environmental Management Act (NEMA), relevant policy frameworks, and socio-economic and environmental considerations.

5.1 NEED AND DESIRABILITY STATEMENT

The CharTech VCN Project involves the installation of a VCN furnace within the existing, licensed Char Technology (Pty) Ltd facility, which operates under an approved Atmospheric Emission Licence (AEL) (Ref: NDM/AEL/MP312/13/06). The furnace will be assembled on the existing structural footprint, requiring only minor refurbishment of current infrastructure. As the proposal constitutes a change to approved operational processes and a listed activity under the National Environmental Management: Air Quality Act (NEM: AQA), an amendment to the existing AEL is required.

This statement assesses the need for and desirability of the proposed activity in terms of the National Environmental Management Act (NEMA), relevant policy frameworks, and socio-economic and environmental considerations.

The need and desirability for the proposed VCN furnace is driven by a combination of strategic, economic, and market-related considerations listed below:

- **Strategic beneficiation and value chain development:** The investment in a vanadium carbo-nitride production facility represents a high-impact industrial initiative that supports South Africa's objectives for local beneficiation, downstream processing, and participation in strategic global value chains linked to steel manufacturing.
- **Market opportunity and demand:** Vanadium carbon-nitride is a specialised, high-value alloying material used in sustainable and high-performance steel production. Producing VCN will enable the Applicant to access international demand, including opportunities in the United States market.
- **Product diversification and competitiveness:** The production of VCN will diversify the final product portfolio of Glencore, allowing entry into a new market segment and improving operational versatility. This diversification is critical in mitigating exposure to volatility in traditional vanadium markets.
- **Financial viability and resilience:** Current market conditions indicate the potential for higher profitability in the VCN market compared to other vanadium products. The proposed facility is therefore considered a priority investment to enhance financial stability and support the long-term sustainability and survival of Glencore Rhovan under prevailing market conditions.
- **Technically mature and scalable process:** The proposed VCN furnace is based on a proven, technically mature, and scalable process, supporting efficient implementation within the existing licensed facility.
- **Efficient land use:** The furnace will be installed within an existing industrial footprint, with no requirement for greenfield development or additional land transformation.
- **Policy and planning alignment:** The project aligns with the National Development Plan and broader industrial and beneficiation policies, and is compatible with local and regional spatial planning frameworks that designate the site for industrial use.
- **Socio-economic benefits:** The project supports job retention and may create additional employment opportunities during installation and operation, while contributing to skills development in specialised metallurgical processes.

5.1.1 NEED AND DESIRABILITY ANALYSIS

The needs and desirability analysis component of the "Guideline on need and desirability in terms of the EIA Regulations (Notice 819 of 2014)" includes, but is not limited to, describing the linkages and dependencies

between human well-being, livelihoods and ecosystem services applicable to the area in question, and how the proposed development's ecological impacts will result in socio-economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.). Table 9 presents the needs and desirability analysis undertaken.

Table 9: Needs and desirability analysis for the proposed project

Ref No.	Question	Response
1	Securing ecological sustainable development and use of natural resources	
1.1	How were the ecological integrity considerations taken into account in terms of: Threatened Ecosystems, Sensitive and vulnerable ecosystems, Critical Biodiversity Areas, Ecological Support Systems, Conservation Targets, Ecological drivers of the ecosystem, Environmental Management Framework, Spatial Development Framework (SDF) and global and international responsibilities.	The ecological integrity was considered with respect to the proposed CharTech project. The DFFE screening tool was consulted at project inception to check possible environmental sensitivities where in the sensitivities of ecosystems. During the Site Sensitivity Verification these were investigated by the EAP using desktop and GIS tools and a site sensitivity verification wherein the scope and extent of the proposed project was noted to be limited to an existing industrial facility with limited vegetation for landscaping and no vegetation clearing is planned for this project. As such the proposed project was noted not to pose threats on Threatened Ecosystems, Sensitive and vulnerable ecosystems, Critical Biodiversity Areas, Ecological Support Systems, Conservation Targets, Ecological drivers of the ecosystem. This is reflected in detail on Sections 4.1.2.2, and 8.2. Furthermore, the project being located on a brownfield site, within a property zoned as Industrial, it aligns with the Emalahleni LM IDP 2025/26 and the Emalahleni SDF (refer to Section 4.2)
1.2	How will this project disturb or enhance ecosystems and / or result in the loss or protection of biological diversity? What measures were explored to avoid these negative impacts, and where these negative impacts could not be avoided altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	The proposed project is located on a brownfield site. The proposed project is to be developed at the existing CharTech facility and will constitute addition of a furnace within the existing, licensed, facility. Due to the nature of this development being a brown field development it is not anticipated to cause any significant impacts or harm to biological diversity.
1.3	How will this development pollute and / or degrade the biophysical environment? What measures were explored to either avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	Refer to the alternatives assessment undertaken for this project in Section 6 of this report, ecological information in Section 0 and the impact assessment and mitigation measures in Section 1 of this Basic Assessment.
1.4	What waste will be generated by this development? What measures were explored to avoid waste, and where waste could not be avoided altogether, what measures were explored to minimise, reuse and / or recycle the waste? What measures have been explored to safely treat and/or dispose of unavoidable waste?	Due to the nature of this development being a VCN furnace/plant, it is not anticipated is not anticipated that a large volume of waste will be generated. However, the following waste types are anticipated to be generated during the construction and operation phases of the proposed VCN plant: • General office waste;

Ref No.	Question	Response
		• Industrial Waste; It is understood that the dust collected from the baghouse filters will be packed and transported back to the supplier for reuse. Some construction and decommissioning waste can be expected to be generated during the construction phase of the project. All of the above-mentioned wastes are to be stored in suitable containers and within a designated waste storage area and removed from site by an appropriately qualified waste removal contractor for disposal at a appropriately licensed facilities.
1.5	How will this project disturb or enhance landscapes and / or sites that constitute the nation's cultural heritage? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	The proposed site location is on an operational facility within the Ferrobank Industrial Park. No disturbance to any Heritage or Palaeontological features is thus expected for the proposed development and associated activities. The proposed furnace will be installed into an existing building requiring minor refurbishments, paving and construction of an existing access road.
1.6	How will this project use and / or impact on non-renewable natural resources? What measures were explored to ensure responsible and equitable use of the resources? How have the consequences of the depletion of the non-renewable natural resources been considered? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	The proposed VCN furnace will utilise non-renewable mineral resources in the form of vanadium-bearing feed material as part of an existing metallurgical process. No new mining or extraction activities are proposed, and the project represents downstream beneficiation. The use of non-renewable resources is therefore focused on value addition rather than increased primary resource depletion. Responsible and equitable use of resources is addressed through a technically mature and efficient furnace process that maximises value per unit of raw material consumed. The facility makes use of existing infrastructure and utilities, reducing unnecessary duplication of resource use. Impacts associated with the depletion of non-renewable resources were considered in the context of beneficiation and market efficiency. The project avoids additional land take and minimises impacts through process optimisation and existing environmental management systems. Positive impacts are enhanced through local beneficiation, improved economic resilience, support to sustainable steel production, and the retention of skills and employment within the existing industrial area.
1.7	How will this project use and / or impact on renewable natural resources and the ecosystem of which they are part? Will the use of the resources and / or impacts on the ecosystem jeopardise the integrity of the resource and / or system taking into account carrying capacity restrictions, limits of acceptable change, and thresholds? What measures were explored to firstly avoid the use of resources, or if avoidance is not possible, to minimise the use of resources?	The project will draw required utilities (water and electricity) from existing supply networks within their authorised capacities. No interaction with intact ecosystems is anticipated. Resource use will be minimised through efficient process design, preventative maintenance, and ongoing monitoring implemented under existing management systems, ensuring that operations remain within applicable carrying capacity constraints.

Ref No.	Question	Response
	What measures were taken to ensure responsible and equitable use of the resources? What measures were explored to enhance positive impacts?	
1.7.1	Does the proposed project exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e. de-materialised growth)?	The proposed project does not exacerbate dependency on increased resource consumption to sustain economic growth. Instead, it supports a more de-materialised growth trajectory by utilising existing, authorised utility infrastructure and optimising resource efficiency through improved process design, preventative maintenance, and operational monitoring. As such, economic output is enhanced without a commensurate increase in the consumption of water, electricity, or other natural resources, thereby reducing overall resource intensity per unit of production.
1.7.2	Does the proposed use of natural resources constitute the best use thereof? Is the use justifiable when considering intra- and intergenerational equity, and are there more important priorities for which the resources should be used?	Yes. Local beneficiation to produce a strategic alloy (VCN) is a high-value, nationally aligned use that supports equitable long-term economic benefits without additional primary extraction.
1.7.3	Do the proposed location, type and scale of development promote a reduced dependency on resources?	Yes. The brownfield location, compact scale, and utilisation of existing infrastructure reduce additional land, water, and energy needs. However, this will not necessarily translate to reduced
1.8	How were a risk-averse and cautious approach applied in terms of ecological impacts:	
1.8.1	What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	No direct ecological impacts are expected. However, air quality impacts could indirectly affect the surrounding ecology and human health. In terms of the air quality specialist assessment that was the done, the following limitations were cited: • Meteorological data: Use was made of data from the closest SAWS station for the study area. • Emissions: o The quantification of sources of emission was restricted to the VCN Furnace and current licensed activities at the site. Other background sources were not quantified. o Routine emissions from the project were modelled. Atmospheric releases occurring as a result of start-up or accidents were not accounted for. o Vehicle exhaust emissions were not quantified as the impacts from these sources are expected to be localized (less than 100 m from road) and will not exceed NAAQS offsite. o It was assumed that the VCN Furnace will operate at or below the Subcategory 4.1 and 4.18 MES. o All pollutants as specified in the MES were assumed to be emitted from the VCN Furnace. • Impact assessment:

Ref No.	Question	Response
		○ The construction and closure phases were assessed qualitatively (Section 5.1.9) due to the temporary nature of these operations, whilst the operational phase was assessed quantitatively. As no on-site ambient baseline measurements were available for the assessment; current impacts were assessed assuming the ambient data measured at the closest ambient monitoring station to the site.
1.8.2	What is the level of risk associated with the limits of current knowledge?	The level of risk is low due to the location of the proposed project, within the Ferrobank Industrial Park, and also due to the familiarity that the air quality specialist has with the surroundings of the study area as a result of previous studies done within the same vicinity.
1.8.3	Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	Sufficient information was gathered prior to the onset of this process to indicate that positive impacts will outweigh low risk for the proposed project. The proposed project will positively influence the local economy through limited job creation during construction phase, retention of jobs within the existing facility, as well as the through the provision of sought-after product, VCN. In addition, the location for the proposed activities aligns with that of the EML MSDF.
1.9	How will the ecological impacts resulting from this development impact on people's environmental right in terms following?	
1.9.1	Negative impacts: e.g. access to resources, opportunity costs, loss of amenity (e.g. open space), air and water quality impacts, nuisance (noise, odour, etc.), health impacts, visual impacts, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?	Refer to the identified impacts, their assessment and recommend mitigation measures in section 1 of this BA report. In summary, because of the preferred location alternative, the proposed project will not negatively affect amenity, water quality, case nuisance or have negative visual impacts. The only expected negative impact will be on air quality. According to the specialist air quality impact assessment conducted the project is required to comply with the MES, the AQIA did not make any adverse findings regarding the proposed project.
1.9.2	Positive impacts: e.g. improved access to resources, improved amenity, improved air or water quality, etc. What measures were taken to enhance positive impacts?	Refer to the identified impacts, their assessment and recommended mitigation measures in Section 1 of this BA Report. The only positive impacts relate to the socio-economic benefits (job retention, skills development etc.) which are enhanced by local sourcing.
1.10	Describe the linkages and dependencies between human wellbeing, livelihoods and ecosystem services applicable to the area in question and how the	Given the transformed industrial setting with limited on-site ecosystem services, ecological impacts on livelihoods are negligible. The development supports economic stability and local livelihoods through sustained industrial activity.

Ref No.	Question	Response
	development's ecological impacts will result in socio-economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.)?	
1.11	Based on all of the above, how will this development positively or negatively impact on ecological integrity objectives / targets / considerations of the area?	Refer to the identified impacts, their assessment and recommended mitigation measures in Section 1 of this EIA Report. No material impact on ecological integrity objectives is expected due to the brownfield location utilizing existing infrastructure and limited footprint. The proposed project will only negatively impact on the air quality as it will contribute to the overall emissions within the surrounding area. However, the emissions contribution is not expected to be significant, and will be managed in accordance with an AEL.
1.12	Considering the need to secure ecological integrity and a healthy biophysical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the "best practicable environmental option" in terms of ecological considerations?	Refer to the alternatives considered for this project in Section 6. In summary the selection and of a brownfield site will secure the ecological integrity and a healthy biophysical environment. The selected electric furnace will also result in lower emissions compared to a combustible furnace.
1.13	Describe the positive and negative cumulative ecological / biophysical impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and existing and other planned developments in the area?	Refer to the identified impacts, their assessment and recommended mitigation measures in Section 1 of this BA Report
2	Promoting justifiable economic and social development	
2.1	What is the socio-economic context of the area, based on, amongst other considerations, the following:	
2.1.1	The IDP (and its sector plans' vision, objectives, strategies, indicators and targets) and any other strategic plans, frameworks or policies applicable to the area	The Integrated Development Plan (IDP) and its associated sector plans provide the strategic direction for development within the municipal area, outlining the long-term vision, objectives, strategies, indicators and targets that guide planning and implementation. All relevant strategic frameworks, including the Spatial Development Framework (SDF), Environmental Management Plans, and applicable provincial and national policies, have been considered to ensure alignment with statutory and developmental priorities. The CharTech VCN project aligns with the IDP as follows: • Supports Local Economic Development (LED): The project contributes to job creation, skills development and economic activity within the municipality, in line with IDP objectives for sustainable economic growth.

Ref No.	Question	Response
		• Promotes Sustainable Environmental Management: The project integrates environmentally responsible practices consistent with IDP goals for biodiversity protection, climate resilience and reduced environmental degradation. • Aligns with Spatial Planning Directives**:** The project is situated and designed in accordance with the Spatial Development Framework (SDF), supporting planned land-use patterns and strategic development nodes identified in the IDP. • Contributes to Social Development Priorities: By supporting community upliftment initiatives, directly or indirectly, the project aligns with IDP objectives aimed at improving social well-being and local livelihoods. • Supports Good Governance and Compliance: The project follows relevant planning, environmental and regulatory requirements, complementing the IDP's governance, compliance and risk-management objectives. Enhances Municipal Sustainability Goals: Through resource-efficient operations, the project contributes to IDP targets related to energy efficiency, waste minimisation and responsible natural resource use.
2.1.2	Spatial priorities and desired spatial patterns (e.g. need for integrated of segregated communities, need to upgrade informal settlements, need for densification, etc.),	The spatial priorities outlined in the Municipal Spatial Development Framework (SDF) emphasise the need to promote integrated and efficient settlement patterns, support the upgrading of informal settlements, encourage strategically located densification, and reinforce spatially coherent economic development corridors. These priorities aim to reduce historic spatial fragmentation while guiding future development toward areas best suited for sustainable growth (Refer to Section 4.2).
2.1.3	Spatial characteristics (e.g. existing land uses, planned land uses, cultural landscapes, etc.), and	The preferred location for the CharTech is located within an the Ferrobank Industrial Park, within a property owned by CharTech, zoned as Industrial, with existing Industrial uses. The project is located within an area allocated for industrial use by the Emalahleni SDF. As such, the proposed project aligns with the surrounding land uses as it falls within an industrial park.
2.1.4	Municipal Economic Development Strategy ("LED Strategy").	The proposed CharTech project, located within the Ferrobank Industrial Park, directly supports these LED objectives. Ferrobank is recognised as an established industrial zone forming part of Emalahleni's broader industrial development footprint. By situating the facility within this designated industrial area, the project contributes to municipal economic development by creating employment opportunities for local residents and supporting local SMMEs as far as reasonably possible (Refer to Section 4.2)

Ref No.	Question	Response
2.2	Considering the socio-economic context, what will the socio-economic impacts be of the development (and its separate elements/aspects), and specifically also on the socio-economic objectives of the area?	Given the socio-economic context of Emalahleni, the CharTech project is expected to generate positive socio-economic impacts, including: • Direct and indirect job creation during construction and operation. • Local SMME participation in procurement, services, and subcontracting (where reasonably possible). • Increased economic activity within an existing industrial precinct. • Long-term revenue contributions to the municipal economy through sustained industrial operations. These impacts support the municipality's LED objectives, which include job creation, private-sector-led growth, industrial rejuvenation, and support for SMMEs. Refer to the identified impacts, their assessment and recommended mitigation measures in **Section 9.**
2.2.1	Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programs?	The development complements local LED initiatives, particularly those linked to KPI 3, which emphasises economic diversification, private-sector investment, and creation of decent employment opportunities. The CharTech project supports these initiatives by: • Operating within the Ferrobank Industrial Park, an established and strategically located industrial area. • Creating employment opportunities for local residents. • Supporting local SMMEs through procurement and subcontracting where feasible. Strengthening municipal industrial development goals, which prioritise utilisation and revitalisation of existing industrial areas for economic growth.
2.3	How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities?	Public participation undertaken thus far has aimed to identify the physical, developmental, cultural and social needs of affected communities. Details are provided in 7 and will continue throughout the BA process. The project responds to community needs by: • Creating local employment opportunities, improving household income security.

Ref No.	Question	Response
		• Offering opportunities for skills development and capacity building through industrial work exposure. • Supporting overall community well-being by stimulating economic activity in a designated industrial area. Refer to additional impacts and mitigation measures in Section 9.
2.4	Will the development result in equitable (intra- and inter-generational) impact distribution, in the short- and long-term? Will the impact be socially and economically sustainable in the short- and long-term?	The CharTech project is expected to result in equitable and sustainable socio-economic benefits in both the short and long term. The products and services to be generated by the CharTech facility are expected to remain in steady demand, supporting the long-term viability of the operation. Key sustainability contributions include: • Sustained job creation for local communities over the lifespan of the project. • Potential for future expansion, leading to further employment and SMME opportunities. • Efficient land-use through the utilisation of an existing industrial park (Ferrobank) without impacting agricultural land, residential areas, or environmentally sensitive areas. • Long-term participation in the industrial economy of Emalahleni, reinforcing economic resilience and municipal revenue stability. Overall, the development supports socially and economically sustainable growth for current and future generations.
2.5	In terms of location, describe how the placement of the proposed development will:	
2.5.1	Result in the creation of residential and employment opportunities in close proximity to or integrated with each other.	The proposed project is located approximately 1.2 km from the KwaThomas Mahlanguville area. The refurbishment of existing buildings and civil work to accommodate the VCN furnace will allow for short term contracts for local SMMEs and temporary labor. The CharTech Facility currently employs locals, during the project's operational phase, the project will enable retention of approximately 19 employees currently employed by the applicant.
2.5.2	Reduce the need for transport of people and goods.	The close proximity of the preferred development location to residential areas will reduce the need for transportation of potential local employees. The raw materials are intended to be sourced from Glencore's Ferralloy existing facility for further beneficiation at the VCN plant from where it will be transported to the client's. Transportation of goods/final products depends

Ref No.	Question	Response
		entirely on Glencore Rhovan's client locations. The product is mainly intended for international markets, as such transportation to the ports and eventually client location will be required.
2.5.3	Result in access to public transport or enable non-motorised and pedestrian transport (e.g. will the development result in densification and the achievement of thresholds in terms of public transport),	The proposed project will have no effect on public transport. It is within an existing industrial park.
2.5.4	Compliment other uses in the area,	Numerous industries already exist within the park, with CharTech having the Paste Plant, ACM, ACU, and Tar Dehydration Plant. The proposed VCN plant will thus complement the existing land use.
2.5.5	Be in line with the planning for the area.	Refer to item 2.1.2 of this table (above).
2.5.6	For urban related development, make use of underutilised land available with the urban edge.	Not applicable. The proposed VCN Plant will be situated outside an urban area within an area classified as industrial.
2.5.7	Optimise the use of existing resources and infrastructure,	The proposed use of the existing CharTech facilities allows for effective use of existing infrastructure (warehouses, water, electricity).
2.5.8	Opportunity costs in terms of bulk infrastructure expansions in non-priority areas (e.g. not aligned with the bulk infrastructure planning for the settlement that reflects the spatial reconstruction priorities of the settlement),	No additional bulk infrastructure in non-priority areas is required; opportunity costs are avoided. Refer to Section 3 of this BA report.
2.5.9	Discourage "urban sprawl" and contribute to compaction / densification.	The project discourages "urban sprawl" by intensifying use of existing industrial land. Thus contributing to compaction / densification within the applicant's other approved activities/the industrial park's.
2.5.10	Contribute to the correction of the historically distorted spatial patterns of settlements and to the optimum use of existing infrastructure in excess of current needs,	The proposed project contributes through reinvestment in existing industrial nodes and leveraging excess capacity where available.
2.5.11	Encourage environmentally sustainable land development practices and processes	The proposed land use aligns with the Ferrobank's Industrial area designation. The proposed is a brownfield redevelopment, allowing for efficient resource use, and compliance-driven operations.

Ref No.	Question	Response
2.5.12	Take into account special locational factors that might favour the specific location (e.g. the location of a strategic mineral resource, access to the port, access to rail, etc.),	Refer to Item 1.7.3 of this table (above).
2.5.13	The investment in the settlement or area in question will generate the highest socio-economic returns (i.e. an area with high economic potential).	The area's established industrial base enables higher returns through clustering and existing services. Additionally to the above, the proposed VCN furnace/plant will add to CharTech's products and help maintain current labourer's jobs (19 employees).
2.5.14	Impact on the sense of history, sense of place and heritage of the area and the socio-cultural and cultural-historic characteristics and sensitivities of the area, and	No adverse impact anticipated due to pre-existing industrial character.
2.5.15	In terms of the nature, scale and location of the development promote or act as a catalyst to create a more integrated settlement?	The proposed project will contribute to the allocated land use of the Ferrobank Industrial Park, indirectly supporting an integrated industrial settlement as a whole.
2.6	**How was a risk-averse and cautious approach applied in terms of socio-economic impacts:**	
2.6.1	What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	The location of the proposed plant was chosen as it falls within an industrial area within the EMalahleni LM which is considered a key economic hub and major conduit city. However, global vanadium/steel market volatility is the primary uncertainty; local uptake and export dynamics may fluctuate.
2.6.2	What is the level of risk (note: related to inequality, social fabric, livelihoods, vulnerable communities, critical resources, economic vulnerability and sustainability) associated with the limits of current knowledge?	The level of risk is low as the project is not expected to have far reaching negative impacts on socio-economic conditions should the recommended mitigation and management measures be implemented and adhered to.
2.6.3	Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	As the proposed project will constitute expansion of the existing licensed facilities, an extensive public participation process was undertaken to ensure that the local community and relevant authorities were notified of the proposed project. Ensuring sufficient information is placed, alerting the already known stakeholders in the area as well as the identification of new stakeholder.
2.7	**How will the socio-economic impacts resulting from this development impact on people's environmental right in terms following:**	

Ref No.	Question	Response
2.7.1	Negative impacts: e.g. health (e.g. HIV-Aids), safety, social ills, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?	Refer to the identified impacts, their assessment and recommended mitigation measures in Section 9 of this BA Report. In summary the only negative effects identified will be that on-air quality due to emissions. The risk however to impact on the health of receptors is not considered significant as the proposed development will be situated downwind from sensitive receptors. An amended air emissions license will be applied for and the plant will have to adhere to the limits as set out in the license.
2.7.2	Positive impacts. What measures were taken to enhance positive impacts?	Refer to the identified impacts, their assessment and recommended mitigation measures in Section 9 of this BA Report. Local procurement, training programmes and transparent engagement enhance benefits.
2.8	Considering the linkages and dependencies between human wellbeing, livelihoods and ecosystem services, describe the linkages and dependencies applicable to the area in question and how the development's socioeconomic impacts will result in ecological impacts (e.g. over utilisation of natural resources, etc.)?	Refer to the identified impacts, their assessment and recommended mitigation measures in Section 9 of this BA Report. The proposed development will have a minimal impact on human-wellbeing and ecosystem services due to the location. Human livelihoods could however be positively impacted because of the temporary employment opportunities, SMME appointments and retention of current employees. The anticipated socio-economic gains are achieved without additional ecological pressure due to the brownfield context and use of existing authorised utilities.
2.9	What measures were taken to pursue the selection of the "best practicable environmental option" in terms of socio-economic considerations?	Refer to the identified impacts, their assessment and recommended mitigation measures in Section 9 of this BA Report. Additionally, see item 2.8 of this table (above).
2.10	What measures were taken to pursue environmental justice so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons (who are the beneficiaries and is the development located appropriately)? Considering the need for social equity and justice, do the alternatives identified, allow the "best practicable environmental option" to be selected, or is there a need for other alternatives to be considered?	Refer to the identified impacts, their assessment and recommended mitigation measures in Section 9 of this BA Report. The preferred alternative is considered the best practicable environmental option as it is located within an existing industrial area wherein the applicant already has approved facilities reducing the requirements for uptake of ecologically sensitive area, whilst also protecting employment of their current workforce. The proposed site is located 1.2 km from the closest settlement.
2.11	What measures were taken to pursue equitable access to environmental resources, benefits and services to meet basic human needs and ensure human	By conducting a Basic Assessment process, with adequate Public Participation Process (PPP), the applicant ensures that that equitable access to the environment has been considered. Refer to

Ref No.	Question	Response
	wellbeing, and what special measures were taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination?	the identified impacts, their assessment and recommended mitigation measures in Section 9 of this BA Report. In summary, job retention/creation, skills development, processes that accommodate vulnerable groups.
2.12	What measures were taken to ensure that the responsibility for the environmental health and safety consequences of the development has been addressed throughout the development's life cycle?	Environmental health and safety responsibilities have been integrated into all phases of the CharTech VCN Furnace development through the following measures: • Regulatory Compliance: The project is required to comply with NEMA, NEM:AQA, the Minimum Emission Standards, national ambient air quality standards, and all licence requirements applicable to the facility. • Air Quality Controls: The VCN Furnace includes engineered pollution-control systems such as a baghouse, CO flaring, and controlled off-gas handling to ensure emissions remain within permitted limits. • Monitoring and Verification: Stack emissions will be measured once operational, and ongoing environmental and occupational monitoring will be conducted to ensure continued compliance. • Safety and Risk Management: Formal HSE systems, risk assessments, emergency preparedness and standard operating procedures are implemented and updated throughout the project life cycle. Together, these measures ensure that environmental, health and safety risks are proactively managed from design through to decommissioning.
2.13	**What measures were taken to:**	
2.13.1	Ensure the participation of all interested and affected parties.	Public participation and consultation are key components of the Basic Assessment (BA) process and are essential in informing the assessment of the need and desirability of the proposed project. A public participation process has been undertaken to date, as detailed in Section 7 of this report, and will continue for the duration of the BA process in accordance with relevant legislative requirements.
2.13.2	Provide all people with an opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation,	
2.13.3	Ensure participation by vulnerable and disadvantaged persons,	

Ref No.	Question	Response
2.13.4	Promote community wellbeing and empowerment through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means,	As part of this process, site notices and advertisements were distributed in and around the project area. The notifications were provided in English and IsiZulu to ensure accessibility and understanding by the local community. The notices included sufficient project information as well as contact details of the public participation specialist, allowing members of the public to obtain additional information or register as Interested and Affected Parties (I&APs). The BA Report is made available at a local public place and the EIMS website and all registered I&APs are notified of the report availability.
2.13.5	Ensure openness and transparency, and access to information in terms of the process,	
2.13.6	Ensure that the interests, needs and values of all interested and affected parties were taken into account, and that adequate recognition were given to all forms of knowledge, including traditional and ordinary knowledge,	
2.13.7	Ensure that the vital role of women and youth in environmental management and development were recognised and their full participation therein will be promoted?	
2.14	Considering the interests, needs and values of all the interested and affected parties, describe how the development will allow for opportunities for all the segments of the community (e.g. a mixture of low-, middle-, and high-income housing opportunities) that is consistent with the priority needs of the local area (or that is proportional to the needs of an area)?	While industrial rather than residential, the project supports broader community segments via stable employment and procurement opportunities.
2.15	What measures have been taken to ensure that current and / or future workers will be informed of work that potentially might be harmful to human health or the environment or of dangers associated with the work, and what measures have been taken to ensure that the right of workers to refuse such work will be respected and protected?	Workers at the VCN plant will be educated on a regular basis through toolbox talks on the environmental and health risks that may occur within their work environment, and adequate measures will be taken to ensure that the appropriate personal protective equipment is issued to workers based on the areas that they work in as well as the requirements of their job.
2.16	**Describe how the development will impact on job creation in terms of, amongst other aspects:**	
2.16.1	The number of temporary versus permanent jobs that will be created.	The proposed VCN furnace project is anticipated to create 15 (fifteen) employment opportunities (5 skilled and 10 unskilled) during construction. During the operational phase of the project, the project is anticipated to employ 9 (nine) skilled employees and 13 (thirteen) semi skilled employees. The closest community kwaThomas Mahlanguville is located approximately 3.5 km from the site, by road.
2.16.2	Whether the labour available in the area will be able to take up the job opportunities (i.e. do the required skills match the skills available in the area).	
2.16.3	The distance from where labourers will have to travel.	

Ref No.	Question	Response
2.16.4	The location of jobs opportunities versus the location of impacts.	
2.16.5	The opportunity costs in terms of job creation.	
2.17	**What measures were taken to ensure:**	
2.17.1	That there were intergovernmental coordination and harmonisation of policies, legislation and actions relating to the environment.	The Basic Assessment process requires governmental departments to communicate regarding any application. In addition, notified about the project by the EAP and registered as Interested and Affected Parties who will continue to be notified and engaged with regarding the project throughout the BA process. Coordination through the AEL amendment and environmental authority consultations.
2.17.2	That actual or potential conflicts of interest between organs of state were resolved through conflict resolution procedures.	The BA process requires governmental departments to communicate regarding any application. In addition, all relevant Departments and key stakeholders have been notified about the project by the EAP and registered as Interested and Affected Parties who will continue to be notified and engaged with regarding the project throughout the BA process.
2.18	What measures were taken to ensure that the environment will be held in public trust for the people, that the beneficial use of environmental resources will serve the public interest, and that the environment will be protected as the people's common heritage?	Refer to Section 0 of this BA report for the detailed Public Participation Process undertaken for this application. Furthermore, refer to the identified impacts, their assessment and recommended mitigation measures in Section 9 of the BA. The proposed development is located in a brownfield site allowing for minimal environmental damage, whilst continuing with the intended land use of the Industrial Park, continuing to serve the local socio-economic profile.
2.19	Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?	Refer to the identified impacts, their assessment and recommended mitigation measures in Section 9 of this report.
2.20	What measures were taken to ensure that the costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects will be paid for by those responsible for harming the environment?	Polluter-pays is applied via licensing conditions, performance monitoring, and contractual obligations on operators and contractors.
2.21	Considering the need to secure ecological integrity and a healthy bio-physical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being	The selected option delivers socio-economic benefits while minimising environmental risk by leveraging existing infrastructure and a compact footprint. Refer to Section 6 for details of alternatives considered in this BA Report

Ref No.	Question	Response
	proposed), resulted in the selection of the best practicable environmental option in terms of socio-economic considerations?	
2.22	Describe the positive and negative cumulative socio-economic impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area?	Refer to Section 6 for details of alternatives considered in this BA Report

6 PROJECT ALTERNATIVES

The identification of alternatives is a key aspect of the success of the impact assessment process. All reasonable and feasible alternatives must be identified and screened to determine the most suitable alternatives to consider and assess. There are, however, some significant constraints that have to be taken into account when identifying alternatives for a project of this scope. Such constraints include social, financial and environmental issues, which will be discussed as part of the evaluation of the alternatives for this project. Alternatives can typically be identified according to:

- Location alternatives (including design and layout);
- Scheduling alternatives;
- Process alternatives;
- Technology alternatives; and
- Activity alternatives (including the No-Go option).

For any alternative to be considered feasible, such an alternative must meet the need and purpose of the development proposal without presenting significantly high associated impacts. Section 5 provides an overview of the project need and desirability.

In this section the various alternatives considered are described and their advantages and disadvantages are presented where applicable. Furthermore, the feasibility of the considered alternatives, from both a technical as well as environmental perspective, is determined and the result thereof are the alternatives that will be investigated further in the EIA phase, towards the selection of preferred alternatives. Essentially, alternatives represent different means of meeting the general purpose and need of the proposed project through the identification of the most appropriate and feasible method of development, all of which are discussed below.

Alternatives can further be distinguished into discrete or incremental alternatives. Discrete alternatives are overall development options, which are typically identified during the pre-feasibility, feasibility and or scoping phases of the EIA process. Incremental alternatives typically arise during the EIA process and are usually suggested as a means of addressing identified impacts. These alternatives are closely linked to the identification of mitigation and management measures and are not specifically identified as distinct alternatives. This section provides information on the Project's location, process, technology and activity alternatives considered and assessed.

6.1 LOCATION / PROPERTY ALTERNATIVES

Location alternatives are typically a key consideration when proposing a new industrial development in order to assess the benefits and potential environmental impacts associated with different sites. However, in this instance, the proposed VCN Furnace will be developed within an existing industrial property already designated and suitable for metallurgical and related industrial activities. Char Technology owns Erf Nos. 43 and 44, Ferrobank Township, where the proposed development will be accommodated within existing buildings and available space. The site benefits from established industrial land use rights and existing infrastructure, thereby avoiding the environmental disturbance and additional regulatory processes typically associated with greenfield developments.

The proposed VCN Furnace will be located within Char Technology's existing operational footprint due to the strategic advantages offered by the site, including proximity to associated operations, availability of adequate land and warehouse space, access to existing laboratory facilities, and established electricity and utility supply networks. The use of an already serviced and operational industrial site allows the proposed development to leverage existing approved infrastructure and systems, thereby reducing potential environmental impacts. Based on these considerations, no reasonable or feasible alternative locations were identified, considered, or assessed for the proposed VCN Furnace project.

6.2 SCHEDULING ALTERNATIVES

Scheduling alternatives typically consider different timeframes for construction, commissioning, and operation in order to minimise potential environmental and social impacts. For the proposed VCN Furnace project, the development is planned to be implemented within the existing operational framework of the Char Technology facility. The site is currently on care and maintenance with workforce implications managed in accordance with Section 189 of the LRA. The fact that the site is under care and maintenance allows construction and commissioning activities to be scheduled efficiently without interference from ongoing operations. Based on these circumstances, no reasonable or feasible alternative scheduling options were identified or assessed.

6.3 PROCESS ALTERNATIVES

Process alternatives imply the investigation of alternative processes or methods to achieve the same goal for the proposed Project. This includes using environmentally friendly designs or materials and re-using scarce resources like water and non-renewable energy sources. Process alternatives will be defined and implemented as incremental alternatives during the assessment and incorporated into the EMPr.

6.3.1 PREFERRED PROCESS ALTERNATIVE: SOLID-STATE CARBOTHERMAL REDUCTION AND NITRIDATION (PUSHER FURNACE)- PREFERRED ALTERNATIVE

The preferred process alternative for the proposed project involves the production of VCN through a solid-state carbothermal reduction and nitridation process using a continuous hydraulic pusher furnace operated under a nitrogen-rich atmosphere.

Key characteristics of the preferred process include:

- Briquetting of milled vanadium oxides (V_2O_5 and/or V_2O_3), carbon powder, and minor iron additions to form a consistent feed material.
- Controlled heating through sequential furnace zones (pre-heating, reaction, soaking, and cooling) at temperatures ranging from approximately 300 °C to 1,500 °C.
- Use of nitrogen as both a carrier and reactant gas to facilitate carbonitridation while preventing oxidation.
- Continuous operation with controlled residence time to ensure consistent product quality and process stability.

This process is technically proven, scalable, and suitable for industrial application. It allows for predictable emissions and manageable environmental impacts when supported by appropriate off-gas collection and treatment systems.

6.3.2 ALTERNATIVE PROCESS OPTIONS CONSIDERED

Alternative VCN production routes were considered at a high level and included:

- Batch furnace processing, requiring cyclic heating and cooling.
- Electric arc or induction furnace systems, characterised by higher instantaneous energy demand.
- Direct melting or alloying routes, producing ferrovanadium-type products rather than VCN.

These alternatives were not pursued further due to increased energy intensity, reduced process efficiency, limited control over nitridation and product composition, higher operational complexity, and less favourable emissions profiles. In addition, several alternatives were incompatible with the desired VCN product specification.

Based on these considerations, the solid-state pusher furnace process is regarded as the preferred and most environmentally manageable option.

6.4 TECHNOLOGY ALTERNATIVES

Technology alternatives consider different types of equipment, systems, and pollution control measures that could be used to implement the proposed process while achieving the same production objectives. The assessment focuses on furnace technology and off-gas treatment systems, as these represent the primary sources of energy consumption and atmospheric emissions associated with the proposed VCN Furnace project.

6.4.1 FURNACE TECHNOLOGY ALTERNATIVES

This section considers alternative furnace technologies capable of achieving the temperatures and controlled atmospheres required for the solid-state carbothermal reduction and nitridation of vanadium-bearing briquettes.

6.4.1.1 CONTINUOUS HYDRAULIC PUSHER FURNACE (PREFERRED FURNACE TECHNOLOGY):

A continuous hydraulic pusher furnace operates within zoned temperature control and a sealed nitrogen atmosphere. The pusher furnace provides controlled and sequential heating of briquettes through defined process zones, allowing precise control over temperature profiles, residence time, and gas composition. The enclosed design limits air ingress, supports stable reducing conditions, and is well suited to continuous industrial operation.

6.4.1.2 OTHER FURNACE TECHNOLOGIES (NOT PREFFERED):

The following furnace technologies were considered:

- **Rotary kilns**, which provide continuous processing but offer less precise control over residence time and temperature uniformity.
- **Shaft furnaces**, which rely on gravity-fed material movement and are less flexible in terms of feed composition and operational control.
- **Static batch furnaces**, which operate in discrete cycles and require repeated heating and cooling phases.

These alternatives were not selected due to reduced process control, higher energy consumption per unit of product, increased oxidation risk, and operational inefficiencies. In addition, batch-based systems are less suitable for the proposed production scale and consistent product quality requirements. The pusher furnace technology is therefore considered the most appropriate and environmentally manageable option for the proposed development.

6.4.2 OFF-GAS TREATMENT TECHNOLOGY ALTERNATIVES

This section considers alternative technologies for the capture and treatment of gaseous and particulate emissions generated during furnace operation, particularly those associated with reducing atmospheres and carbon-based reactions.

6.4.2.1 PREFERRED OFF-GAS TREATMENT TECHNOLOGY:

The following off-gas treatment alternatives were considered and deemed feasible:

- **Enclosed off-gas collection system** to prevent fugitive emissions.
- **Carbon monoxide (CO) flaring system** to oxidise CO to CO_2, thereby reducing safety and environmental risks.
- **Baghouse filtration system** for the removal of particulate matter, including carbonaceous particles, metallic oxides, and VCN dust.

This combination of technologies allows for effective containment, treatment, and management of process emissions and is compatible with regulatory requirements for metallurgical operations.

6.4.2.2 OFF-GAS TECHNOLOGY ALTERNATIVES CONSIDERED:

The following off-gas treatment alternatives were considered and were not deemed feasible:

- **Direct venting without flaring**, which would result in unacceptable safety risks associated with untreated CO emissions.
- **Wet scrubbing systems**, which can remove particulate matter but require significant water input and generate secondary liquid waste streams requiring treatment and disposal.

These alternatives were not pursued further due to increased water consumption, higher operational complexity, and the generation of additional waste streams. The selected off-gas treatment configuration is consistent with best-practice emission management for reducing furnace atmospheres and minimises overall environmental risk.

6.5 ACTIVITY ALTERNATIVES

These are sometimes referred to as project alternatives, although the term activity can be used in a broad sense to embrace policies, plans and programmes as well as projects. Consideration of such alternatives requires a change in the nature of the proposed activity. This would entail a process where a different project is proposed instead of the VCN plant. This alternative was not interrogated in the Basic Assessment as the application for authorisation stems from a business decision within the holding company to diversify and fill in market opportunity that has been identified.

6.6 NO GO ALTERNATIVE

The “No Go” or “No Action” alternative refers to the alternative of not embarking on the proposed project at all. It assumes that the activity does not go ahead, implying a continuation of the current situation or the status quo. It is important to note that the No Go alternative is the baseline against which all other alternatives and the development proposal are assessed. When considering the No Go alternative, the impacts (both positive and negative) associated with any other specific alternative, or the current project proposal would not occur and in effect the impacts of the No Go alternative are therefore inadvertently assessed by assessing the other alternatives. In addition to the direct implications of retaining the status quo, there are certain other indirect impacts, which may occur should the No Go alternative be followed. The ‘no-go’ alternative provides the means to compare the impacts of project alternatives with the scenario of a project not going ahead. In evaluating the ‘no-go’ alternative it is important to take into account the implications of foregoing the benefits of the proposed project.

The No-Go alternative, thus assumes, not proceeding with the proposed VCN production facility. Under this scenario, the site would remain under its current operational status, with no expansion or diversification of vanadium processing activities. The implications of the No-Go alternative include, the loss of an opportunity to diversify the product portfolio, and the inability to access higher-value domestic and export markets. While the No-Go alternative would avoid additional project-related environmental impacts, it would also forego associated socio-economic benefits, including job creation, improved economic resilience, and downstream industrial development. From a strategic, economic, and developmental perspective, the No-Go alternative is therefore considered undesirable.

7 STAKEHOLDER ENGAGEMENT

The PPP is a requirement of several pieces of South African Legislation and aims to ensure that all relevant I&APs are consulted, involved and their opinions are taken into account and a record included in the reports submitted to Authorities. The process ensures that all stakeholders are provided this opportunity as part of a transparent process which allows for a robust and comprehensive environmental study. The PPP for the necessary authorisation required for the project needs to be managed sensitively and according to best practices.

7.1 IDENTIFICATION OF INTERESTED AND AFFECTED PARTIES (I&APS)

An initial I&AP database has been compiled from existing stakeholder database(provided by applicant), historic projects in the area, and Windeed searches were conducted to obtain the contact details of the surrounding landowners. The I&APs referred to in the PPR include:

- Pre-identified and registered landowners and surrounding landowners;
- Pre-identified and registered key stakeholders;
- Regulatory authorities;
- Specialist interest groups; and
- All I&APs who responded to the initial notifications and requested to be registered.

Efforts to pre-identify key I&APs involved various avenues such as consultation with the proponent and known landowners within the study area, review of related previously conducted studies, and identification of key interest groups and authorities within the vicinity of the study area and municipality. Refer to Appendix D for the PPR.

7.1.1 LIST OF ORGANS OF STATE IDENTIFIED AND NOTIFIED

The following key I&APs, but not limited to, were notified of the proposed project and invited to participate in the public participation process:

- Emalahleni Local Municipality
- Eskom
- Mpumalanga Department of Agriculture, Rural Development, and Environmental Affairs
- Mpumalanga Department of Co-operative Governance and Traditional Affairs
- Mpumalanga Department of Economic Development and Tourism (MPDEDT)
- Mpumalanga Department of Health
- Mpumalanga Tourism and Parks Agency (MPTA)
- National Energy Regulators of South Africa (NERSA)
- National Department of Agriculture
- National Department of Co-operative Governance
- National Department of Forestry, Fisheries, and the Environment (DFFE)
- National Department of Health
- National Department of Human Settlements
- National Department of Mineral Resources and Energy (DMRE)
- National Department of Tourism
- National Department of Traditional affairs
- National Department of Water and Sanitation (DWS)
- National House if Traditional Leaders
- Nkangala District Municipality
- South African Civil Aviation Authority (SACAA)
- South African Heritage Resources Agency (SAHRA)
- South African National Roads Agency (SANRAL)
- Transnet

7.1.2 LIST OF OTHER KEY I&APS IDENTIFIED AND NOTIFIED

- Pre-identified and registered landowners and surrounding landowners.
- BirdLife South Africa
- Bushveld Vanchem
- Centre for Environmental Rights (CER)
- Council for Geoscience
- CULISA Umphakathi
- EarthLife Africa

- ECUFE Business Hub
- Endangered Wildlife Trust (EWT)
- Federation for a Sustainable Environment (FSE)
- GroundWork South Africa
- Mining Affected Communities United in Action (MACUA)
- Mpumatech Stainless Tube (Pty) Ltd
- National Union of Metalworkers of South Africa (NUMSA)
- Natural Justice
- Nzalo Yelanga
- Rise and Shine
- South Durban Community Environmental Alliance
- the Green Connection
- Tracks of Africa
- Wetlands and Environmental Society South Africa (WESSA)

7.2 NOTIFICATION OF INTERESTED AND AFFECTED PARTIES

This section provides details on the notifications that were distributed as part of the consultation process to date.

7.2.1 INITIAL NOTIFICATION OF KEY I&APS

The PPP commenced on the 9th of December 2025 with an initial call to register notification. Notification during this initial consultation was given in the manner described below.

7.2.2 FAXES, REGISTERED MAIL AND EMAILS

Notification letters (in English and Isizulu) were distributed to pre-identified I&APS through either faxes, SMSs, registered mail, and/or emails on the 12th of December 2025.

The notification documents included the following information:

- Authorisations required;
- Sufficient detail of the proposed development to enable I&APs to assess/surmise what impact the development will have on them or the use of their land;
- The purpose of the proposed project;
- Details of the application processes associated with proposed activities;
- Details of the affected properties;
- Relevant EIMS contact person for the project.

Please refer to Appendix D for the detailed PPR.

7.2.3 NEWSPAPER ADVERTISEMENTS

Advertisements (in English and Isizulu) describing the proposed project and Basic Assessment (BA) process were placed in the Witbank News Newspaper with circulation in the vicinity of the study area on the 12th of December 2025. Please refer to Appendix D for proof of the advert placed.

7.2.4 SITE NOTICE PLACEMENT

Six (6) A1 Correx site notices (in English and Isizulu) were placed at 6 locations around the proposed project study area on the 9th of December 2025. The on-site notices included the following information:

- Project name;
- Applicant name;
- Project location;

- Map of proposed project area;
- Project description;
- Legislative requirements; and
- Relevant EIMS contact person for the project.

Please refer to Appendix D for proof of site notice and site notice distribution.

7.2.5 NOTIFICATION OF INTERESTED AND AFFECTED PARTIES OF BASIC ASSESSMENT REPORT AVAILABILITY

Notification (in English and Isizulu) regarding the availability of the Basic Assessment Report for public review and comment will be provided to pre-identified and registered I&APs. The notifications will be distributed through either email, registered mail, fax, and/or SMS, where contact details are available.

Contact details will be provided to I&APs should they require assistance accessing the information or require copies of the reports.

A hard copy of the Basic Assessment Report will be placed at the Lynnville Library for a period of 30 days. An electronic copy of the Basic Assessment Report will be made available on the EIMS Public Participation Website

7.3 RECORD OF ISSUES RAISED

Comments on the proposed project were solicited from pre-identified and registered I&APs and key stakeholders. To date, the following comments have been received:

- I&AP registration.
- SANRAL stated that they had no objections to the proposed project.
- Transnet Properties has no objections to the proposed project.
- I&APs raised interest on the measures to be taken to ensure environmental protection.
- I&APs enquired about how the community will benefit from the proposed project.

All comments and/or queries received to date are included in this report and presented in Appendix D of this report.

8 ENVIRONMENTAL ATTRIBUTES AND BASELINE ENVIRONMENT

This section of the BA Report provides a description of the environment that may be affected by the proposed project. Aspects of the biophysical, social and economic environment that could be directly or indirectly affected by, or could affect, the proposed development have been described. This information has been sourced from existing information available for the area and where relevant specialist assessments.

8.1 PHYSICAL ENVIRONMENT

8.1.1 CURRENT CLIMATE AND WEATHER

Climate plays an important role in air quality dispersion modelling, therefore, the information in this section is mainly based on the air quality specialist assessment undertaken for the propose VCN furnace project.

8.1.1.1 **AMBIENT TEMPERATURE**

Air temperature is important, both for determining the effect of plume buoyancy (the larger the temperature difference between the emission plume and the ambient air, the higher the plume is able to rise), and determining the development of the mixing and inversion layers.

Monthly mean, maximum and minimum temperatures are given in Table 10. Diurnal temperature variability is presented in Figure 8: Diurnal temperature profile (eMalahleni SAWS data, January 2022 to December 2024) cited in Airshed (2026). Average monthly temperatures ranged between 13°C in July and 23.5°C in December. During the day, temperatures increase to reach maximum at around 15:00 in the afternoon. Ambient air temperature decreases to reach a minimum at around 06:00 i.e. just before sunrise.

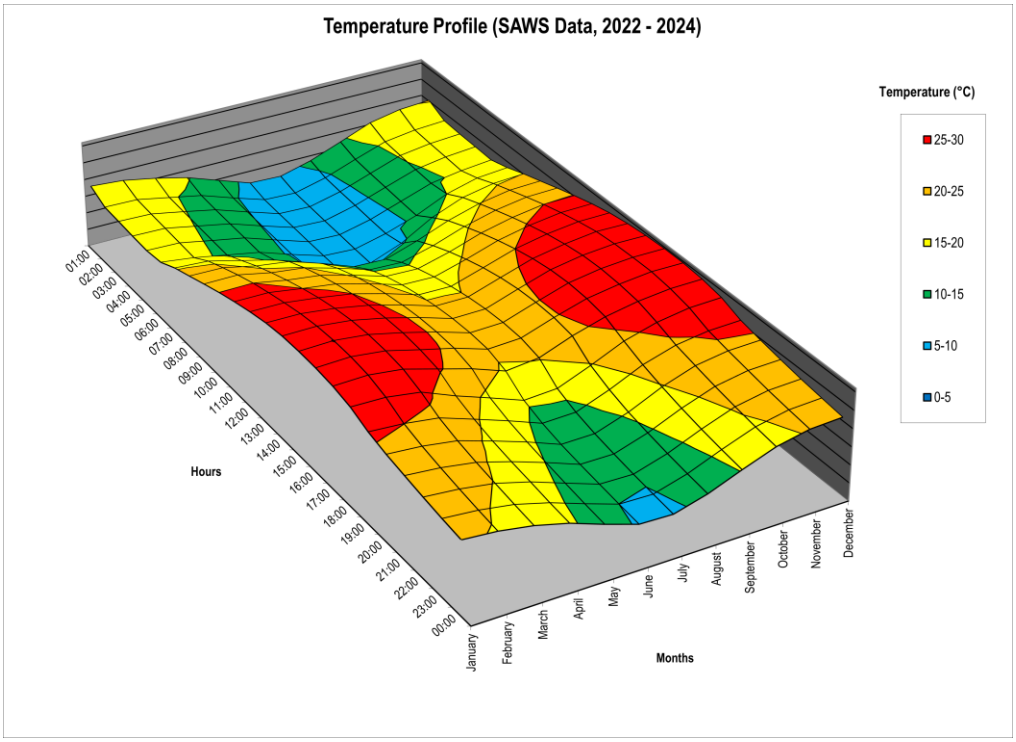


Figure 8: Diurnal temperature profile (eMalahleni SAWS data, January 2022 to December 2024) cited in Airshed (2026)

Table 10: Monthly temperature summary (eMalahleni SAWS data, January 2022 to December 2024) cited in Airshed (2026)

Monthly Minimum, Maximum and Average Temperatures (°C)												
Parameter	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**

Monthly Minimum, Maximum and Average Temperatures (°C)												
Minimum	16.6	16.0	14.2	12.5	9.3	6.2	5.6	8.0	11.0	14.4	15.8	16.7
Average	23.4	23.0	21.5	19.3	16.3	13.2	13.0	15.8	19.2	21.8	23.2	23.5
Maximum	29.8	30.0	29.0	26.8	24.3	21.4	21.6	24.7	27.5	29.0	29.6	29.6

8.1.1.2 LOCAL WIND FIELD

The dispersion of pollution is largely a function of the wind field. The wind speed determines both the distance of downward transport and the rate of dilution of pollutants. The generation of mechanical turbulence is similarly a function of the wind speed, in combination with the surface roughness (Tiwary and Colls, 2010).

The wind roses comprise 16 spokes, which represent the directions from which winds blew during a specific period. The colours used in the wind roses below, reflect the different categories of wind speeds; the yellow area, for example, representing winds in between 4 and 5 m/s. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories. The frequency with which calms occurred, i.e. periods during which the wind speed was below 1 m/s are also indicated.

The period wind field and diurnal variability in the wind field are shown in Figure 9: Period, day-, and night-time wind roses (eMalahleni SAWS station, January 2022 to December 2024) cited in Airshed (2026). During the 2022 to 2024 period, the wind field was dominated by winds from the north and east, with less frequent winds from the southwestern sector. During the day, the prevailing wind direction is from the north and from the east during night-time.

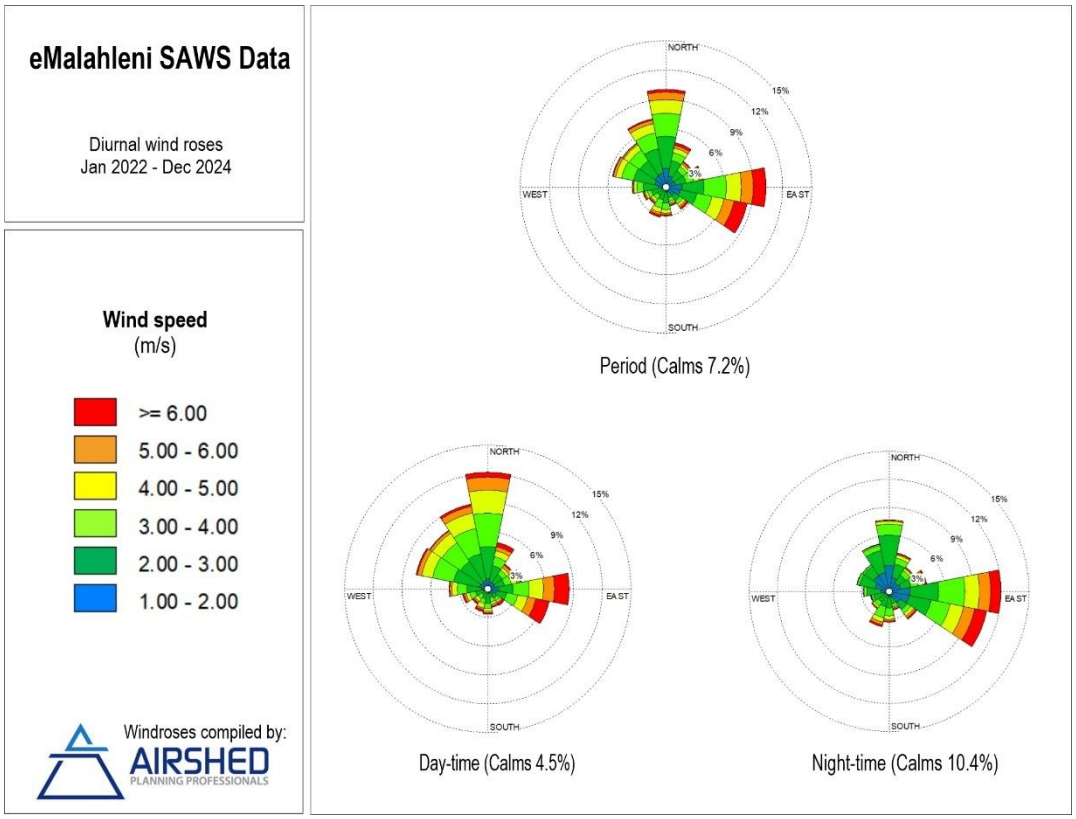


Figure 9: Period, day-, and night-time wind roses (eMalahleni SAWS station, January 2022 to December 2024) cited in Airshed (2026)

8.1.2 PREDICTED FUTURE CLIMATE

The GreenBook (CSIR, GreenBook 2025) provides downscaled (±8×8 km) climate projections for South Africa to the 2050s and models hydro-meteorological hazards (drought, heat, wildfire, flooding) together with socio-economic exposure and vulnerability at municipal and settlement scales. Table 11 provides a summary of the climate change metrics applicable to the municipality. The Rossby Centre regional model (RCA4) is used in

the predictions for climate change. Two trajectories are included based on the four Representative Concentration Pathways (RCPs) discussed in the IPCC's assessment report. RCPs are defined by their influence on atmospheric radiative forcing in the year 2100. RCP4.5 represents an addition to the radiation budget of 4.5 W/m2 as a result of an increase in GHGs. The two RCPs selected were RCP4.5 representing the medium-to-low pathway and RCP8.5 representing the high pathway. RCP4.5 is based on a CO_2 concentration of 560 ppm and RCP8.5 on 950 ppm by 2100. RCP4.5 is based on if current interventions to reduce GHG emissions being sustained (after 2100 the concentration is expected to stabilise or even decrease). RCP8.5 is based on if no interventions to reduce GHG emissions being implemented (after 2100 the concentration is expected to continue to increase).

Table 11: Climate change predictions (CSIR, GreenBook 2025)

Aspect	Baseline (1961-1990)	Predicted Change (2021-2050)	
		RCP4.5	RCP8.5
Average temperature	Min: 8.86°C Avg: 15.77°C Max: 22.59°C	+2.18°C — 2.79°C	+ 2.60°C — 3.08°C
# very Hot Daysa		+ 1.10 days — 17.64 days (average of 5.6)	+ 1.36 days — 22.58 days
Average annual rainfall	902.43mm	-43.01mm — 57.61mm (ave -15.5)	-2.25mm — 125.27mm (ave 10.8)
# extreme annual rainfall daysb		-2.46 days — -0.30 days (ave -0.7)	-1.38 days — 1.06 days (ave -0.6)

Climate change hazards identified for the municipality include:

- Predicted fire danger days increase to 22.
- The likelihood of wildfires occurring in the wildland-urban interface is regarded as likely.
- Residential settlements have a slight to moderate potential for increased flooding due to the predicted rainfall changes.
- There is a predicted increase in drought tendencies of 1.06 per 10 years (more frequent than baseline), with the communities in the area having a very low expected increase in drought exposure.
- The surrounding settlements are predicted to have a high risk of encountering increasing heat stresses (heat waves and extreme heat days).

Predicted climate changes should be integrated into design and risk assessment considerations.

8.1.3 GEOLOGY, SOILS, AND LAND CAPABILITY

8.1.3.1 **GEOLOGY**

The Karoo Supergroup in the CharTech VCN study area is represented by the Vryheid Formation of the Ecca Group, comprising mudstone, siltstone, and fine- to coarse-grained sandstone (refer to Figure 12 for a simplified geological map of the site). These sediments were deposited in a landlocked basin with deltaic and fluvial cycles, capped by coal beds formed in swampy environments. Dolerite intrusions are common and form impermeable layers that influence groundwater flow. The underlying Dwyka Formation, composed mainly of diamictite, acts

[a] *where temperatures exceed 35°C.*

[b] *more than 20 mm in 24 hours.*

as an aquiclude, separating the upper Karoo aquifer from deeper systems. The Cleantream (2006) EIA report undetaken for the facility confirmed that the Ferrobank is an industrial area situated adjacent to the abandoned Transvaal and Delagoa Bay (T&DB) mine along its western boundary, where ongoing land subsidence has been recorded. Despite this proximity, the CharTech, ACU, ACM and ACP sites themselves are located outside the undermined zone and have not been affected by subsidence.

The Vryheid formation is rated as having a very high paleontological sensitivity (see Figure 10) according to the South African Heritage Resources Information System (SAHRIS) 'PalaeoSensitivity Map' as well as the DEA Screening Tool Report. Although a very high paleontological rating is given to the formations underlying the proposed project area, no deep excavations will be done during construction as the project consists mainly of refurbishment of existing building and paving of existing roads, and thus it is not anticipated that possible paleontological resources will be negatively impacted.

MAP OF RELATIVE PALEONTOLOGY THEME SENSITIVITY

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
x			

Sensitivity Features:

Sensitivity	Feature(s)
Medium	Features with a Medium paleontological sensitivity
Very High	Features with a Very High paleontological sensitivity

Figure 10: DFFE Screening Tool map of relative palaeontology theme sensitivity

8.1.3.2 **SOILS**

The proposed project area is underlain by the Ach- Haplic Acrisol (Ferric, Abru, Arenic) soil type according to the International Soil Reference and Information System (ISRIC 2008/06) and Global Assessment of Land Degradation (GLADA 2008/03) reports and spatial data. The Acrisols soil group (ISRIC, 2020) can be characterised consisting of low activity clays in an argic subsurface horizon and has low base saturation levels. This soil type within the project area has a mean gradient of less than 10% and a relief intensity of less than 50 m/km2. This soil type puts severe restrictions on arable land uses. See Figure 13 for a soil map of the project area. The DEA

Screening Tool spatial data identified the proposed project as having a high agricultural sensitivity. The above-mentioned restrictions on arable land, the site visit conducted, and the industrial zoning of the proposed project area all negate the need for an agricultural impact assessment. Refer to Figure 13 for the simplified soils map.

8.1.4 SURFACE WATER AND DRAINAGE

The proposed CharTech VCN project is located within the Upper Olifants River catchment, which forms part of the wider Olifants–Letaba Water Management Area. In terms of quaternary catchments, the project falls within the B11K quaternary catchment (see Figure 14). Artificial wetlands are noted approximately 500m (showing as NFEPA wetlands on the map) however, further analysis shows that these are artificial wetland due to mining activities east of the Ferrobank Industrial site. The closest drainage feature is noted to be the non-perrenial tributary of the Brugspruit located at least 1.5 km at its closest point to the VCN plant.

The Emalahleni municipal planning baseline recognises that the Upper Olifants system is highly utilised and environmentally stressed, with cumulative pressures linked to mining, energy generation, industry, settlement growth and wastewater management constraints. Key water-resource concerns identified for the municipal area include water stress (demand pressure), deteriorating water quality, and constraints associated with historic and ongoing mining activities (including limitations on groundwater utilisation due to mining-related impacts).

The proposed VCN infrastructure will be developed within an existing brownfield industrial footprint associated with CharTech's current operations. As a result, stormwater from the operational area will be managed through existing site stormwater controls and/or municipal stormwater infrastructure, with appropriate pollution-prevention measures to limit any risk of contaminated runoff leaving the site, consistent with the stressed catchment context.

As such, the proposed CharTech VCN project is not anticipated to place additional pressure on natural water resources, because it will be developed within a brownfield industrial site, will not require additional water allocation beyond CharTech's existing authorised supply, and is located within an area of low environmental sensitivity. Accordingly, the project is unlikely to exacerbate existing catchment pressures within B11K and the broader Upper Olifants system, provided standard stormwater management and pollution-prevention measures are implemented.

8.1.5 AIR QUALITY

Ambient Air Quality Monitoring Stations (AQMS) within the study area include the eMalahleni AQMS managed by the SAWS is located approximately 2 km southeast of the VCN Furnace (see Figure 11)

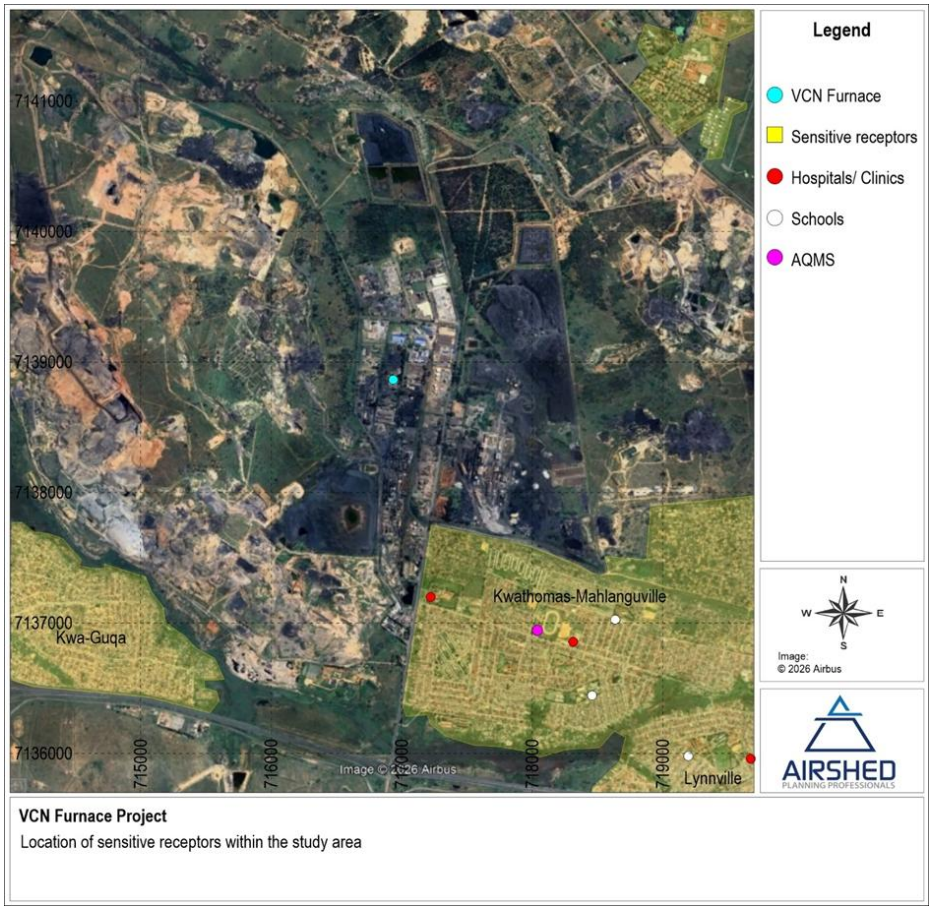


Figure 11: Location of sensitive receptors and Air Quality Monitoring Station (AQMS)

A summary of the measured ambient air quality data for the period 2023-2025 from the eMalahleni AQMS is provided in Table 5-8. Data availability for the pollutants measured at eMalahleni AQMS was very poor with no ambient measurements available for 2025.

Table 12: Summary of the ambient measurements at the AQMS within the study area for the period 2023-2025(a)(b)

Year	Data Availability	Hourly			Daily			Annual Average	No of recorded hourly exceedances	No of recorded daily exceedances
		Maximum	99th Percentile	50th Percentile	Maximum	99th Percentile	50th Percentile			
SO_2 (µg/m³)										
Criteria		*350 µg/m³*			*125 µg/m³*			*50 µg/m³*	*88 hours per year*	*4 days per year*
2023	72%	959.6	200.9	14.5	167.6	113.6	21.7	28.9	20	2
2024	10%	429.4	188.6	19.5	96.9	91.0	28.4	31.8	2	0
2025	0%									
NO_2 (µg/m³)										
Criteria		*200 µg/m³*						*50 µg/m³*	*88 hours per year*	
2023	63%	128.6	90.9	17.0				23.8	0	
2024	10%	111.2	89.1	16.9				23.7	0	
2025	0%									
PM_{10} (µg/m³)										

Year	Data Availability	Hourly			Daily			Annual Average	No of recorded hourly exceedances	No of recorded daily exceedances
		Maximum	99th Percentile	50th Percentile	Maximum	99th Percentile	50th Percentile			
Criteria					*75 µg/m³*			*40 µg/m³*		*4 days per year*
2023	65%				155.1	131.7	39.3	**48.1**		**71**
2024	11%				43.5	43.4	22.0	26.0		0
2025	0%									
$PM_{2.5}$ (µg/m³)										
Criteria					*40 µg/m³*			*20 µg/m³*		*4 days per year*
2023	60%				84.8	61.9	20.6	**23.4**		**48**
2024	11%				30.1	29.0	12.1	13.1		0
2025	0%									

Notes:

(a) Red text denotes less than 80% data availability

(b) Bold text denotes exceedance of the NAAQS

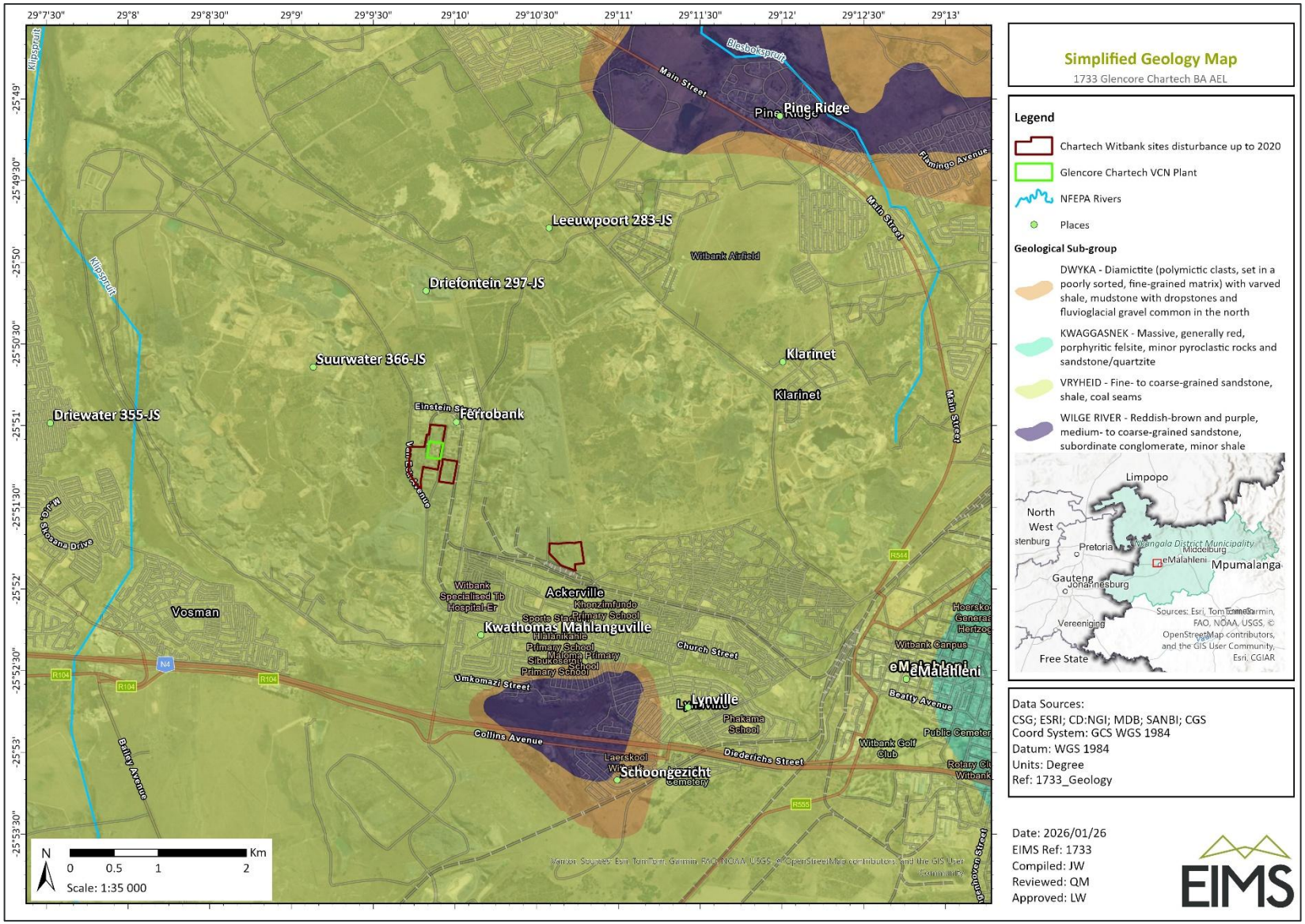


Figure 12: Simplified geologic map of the proposed VCN Plant

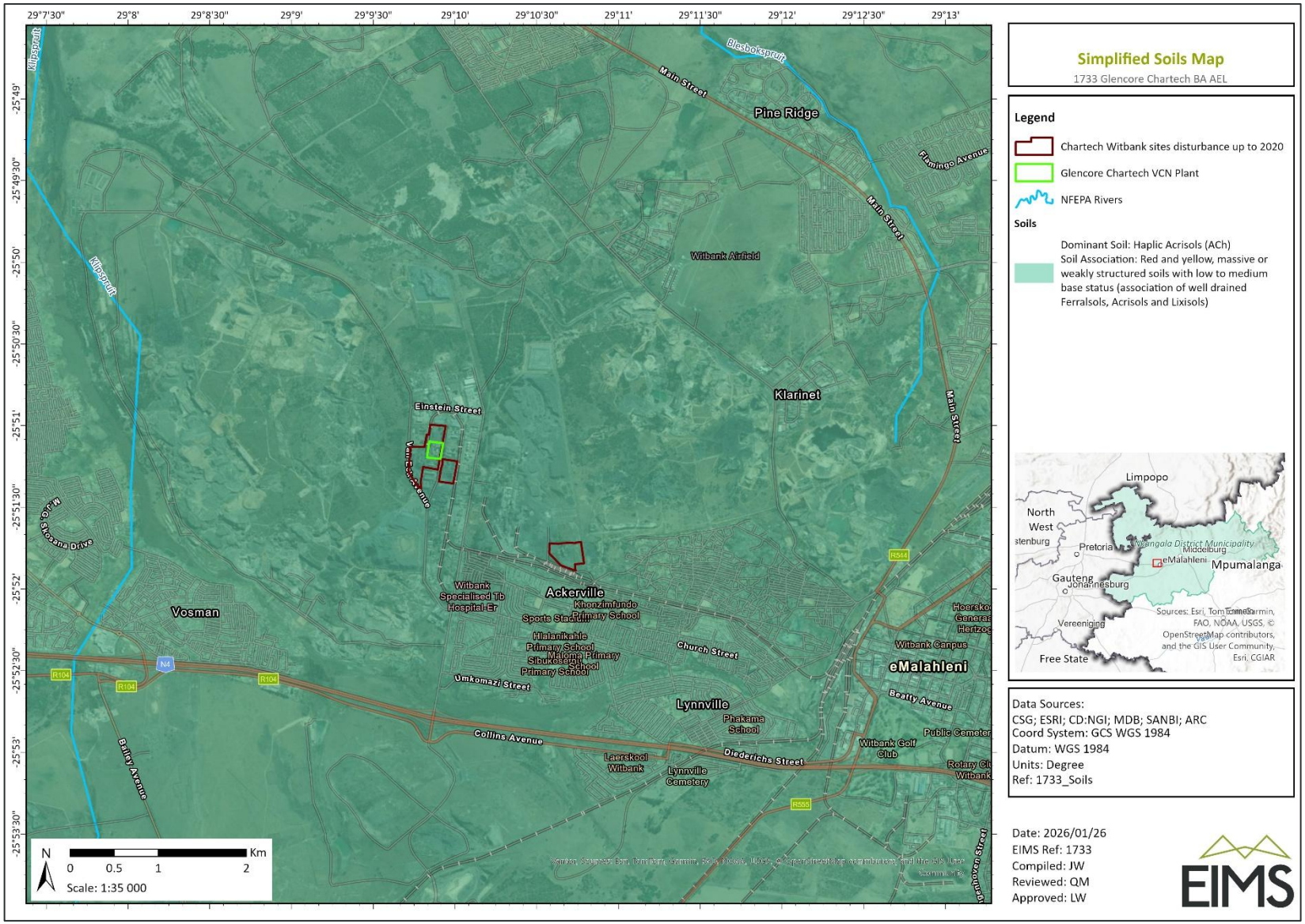


Figure 13: Simplified soils map of the proposed VCN Plant

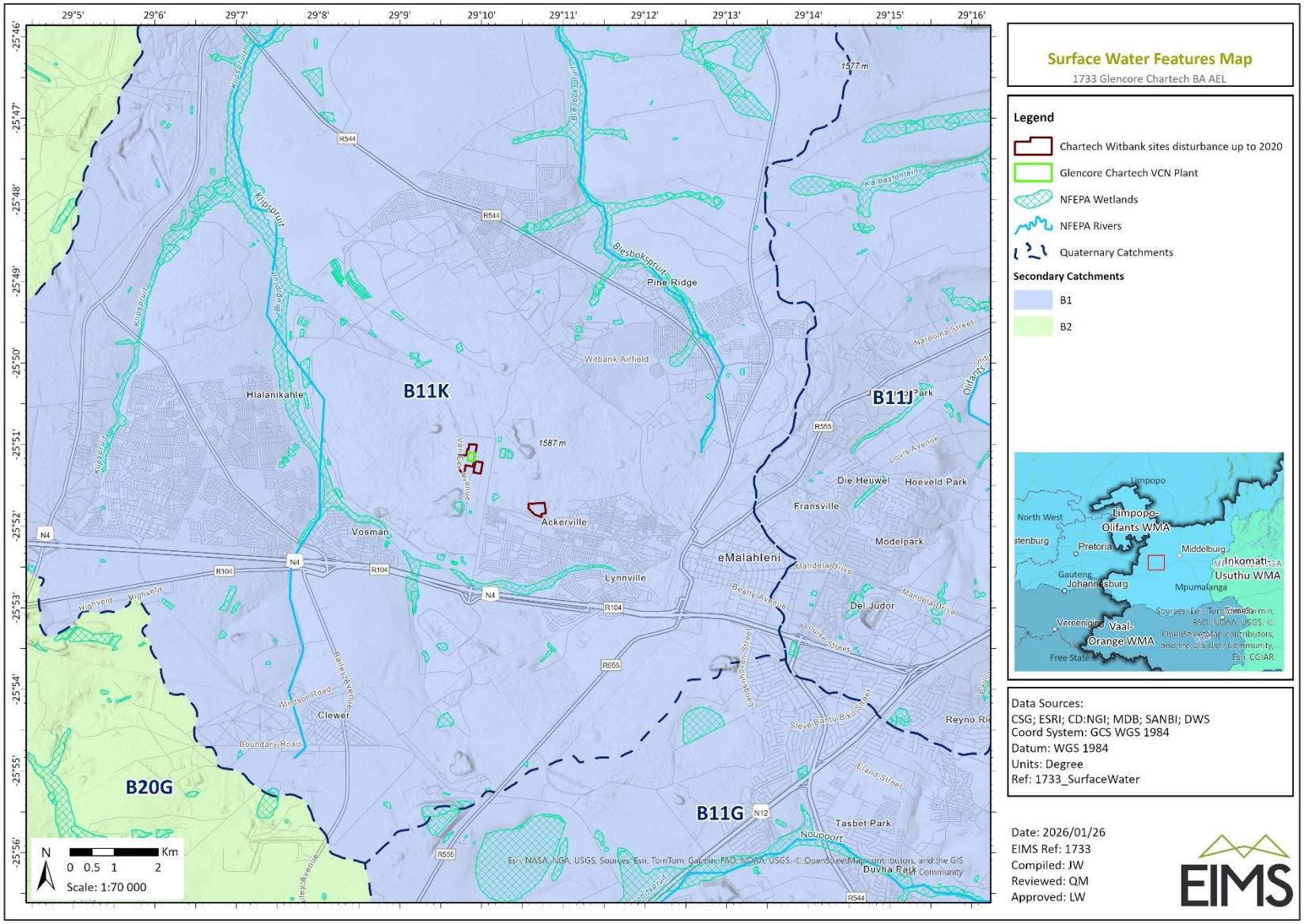


Figure 14: Surface water features map

8.2 BIOLOGICAL ENVIRONMENT

8.2.1 VEGETATION

According to spatial data from Mucina and Rutherford, 2006, the project area falls within Gm 12, Eastern Highveld Grassland (Figure 15). According to the National Biodiversity Assessment (SANBI, 2018) this vegetation type is poorly protected and is listed as Endangered on the Revised National List Red List of Ecosystems (RLE) Revised National list of Ecosystems that are Threatened or in need of Protection (GN 2747). After investigation of google imagery and a site visit, the area can be described as cleared, and no vegetation exist on the proposed VCN plant site. The proposed site is a brownfield site within the Ferrobank Industrial Park and no negative impacts on vegetation is expected due to the proposed activity.

8.2.2 FAUNA

According to the DFFE Screening Report (Appendix B) there are three (3) sensitive animal species within the proposed VCN plant area (refer to Table 13). The site is located within the within the Ferrobank industrial area, surrounded by mining areas. The likelihood of occurrence of Red Data species on the industrial sites is extremely low (Clean Stream Environmental Services, 2006). After further investigation of google imagery and a site visit, it is maintained that there is an extremely low likelihood of occurrence of any Red Data species within the site as the site is modified with no natural areas located within the proposed site.

Table 13: Threatened animal species that are expected in the project area and surrounding areas (DFFE, 2025).

Scientific name	Common Name	Treat Status	Screening Tool Sensitivity	Likelihood of occurrence in project area
Mammalia-Chrysospalax villosus	Rough-haired Golden Mole	VU IUCN Red List of Threatened Species	Medium	Very low, as the site lacks any suitable habitat and is fully developed as an industrial park with existing buildings and road infrastructure
Mammalia-Crocidura maquassiensis	Makwassie musk shrew	LC IUCN Red List of Threatened Species	Medium	Very low, as the site lacks any suitable habitat and is fully developed as an industrial park with existing buildings and road infrastructure
Mammalia-Dasymys robertsii	Robert's shaggy rat	DD[c] IUCN Red List of Threatened Species	Medium	Very low, as the site lacks any suitable habitat and is fully developed as an industrial park with existing buildings and road infrastructure

[c] DD – Data deficient

8.2.3 HABITATS

The grassland biome is highly vulnerable to both land-use and climate change, being ranked the second-most vulnerable (endangered), with low protection of this biome nationally. Due to the high-altitude location of the biome and its susceptibility to warming impacts, substantial change and loss of habitat is projected for the grasslands (DEA, 2013a; Driver et al., 2011). Further, the grassland biome faces threats from the encroachment of tree cover as a result of CO2 fertilisation and longer growing periods (DEA, 2013a). The loss of the grassland biome is likely to have adverse impacts on ecosystem goods and services, such as water delivery from the highland catchments and grazing, as well as adverse impacts on conservation and ecosystem delivery and ecosystem processes such as wildfires. The grassland biome should ideally be not disturbed further.

According to the Mpumalanga Biodiversity Sector Plan (MBSP) (Lötter, 2015), the proposed project falls entirely within a heavily modified terrestrial area (the Ferrobank Industrial Park), see Figure 16. The MBSP was created with a mission to adequately represent the natural environment and biodiversity within the Mpumalanga province. This is to assist in conservation, sustainable management and prevention of degradation and fragmentation of natural ecosystems and biodiversity. As the proposed CharTech VCN project is located within a heavily modified, industrialised area, it is unlikely that the proposed project will negatively affect natural ecosystems or biodiversity.

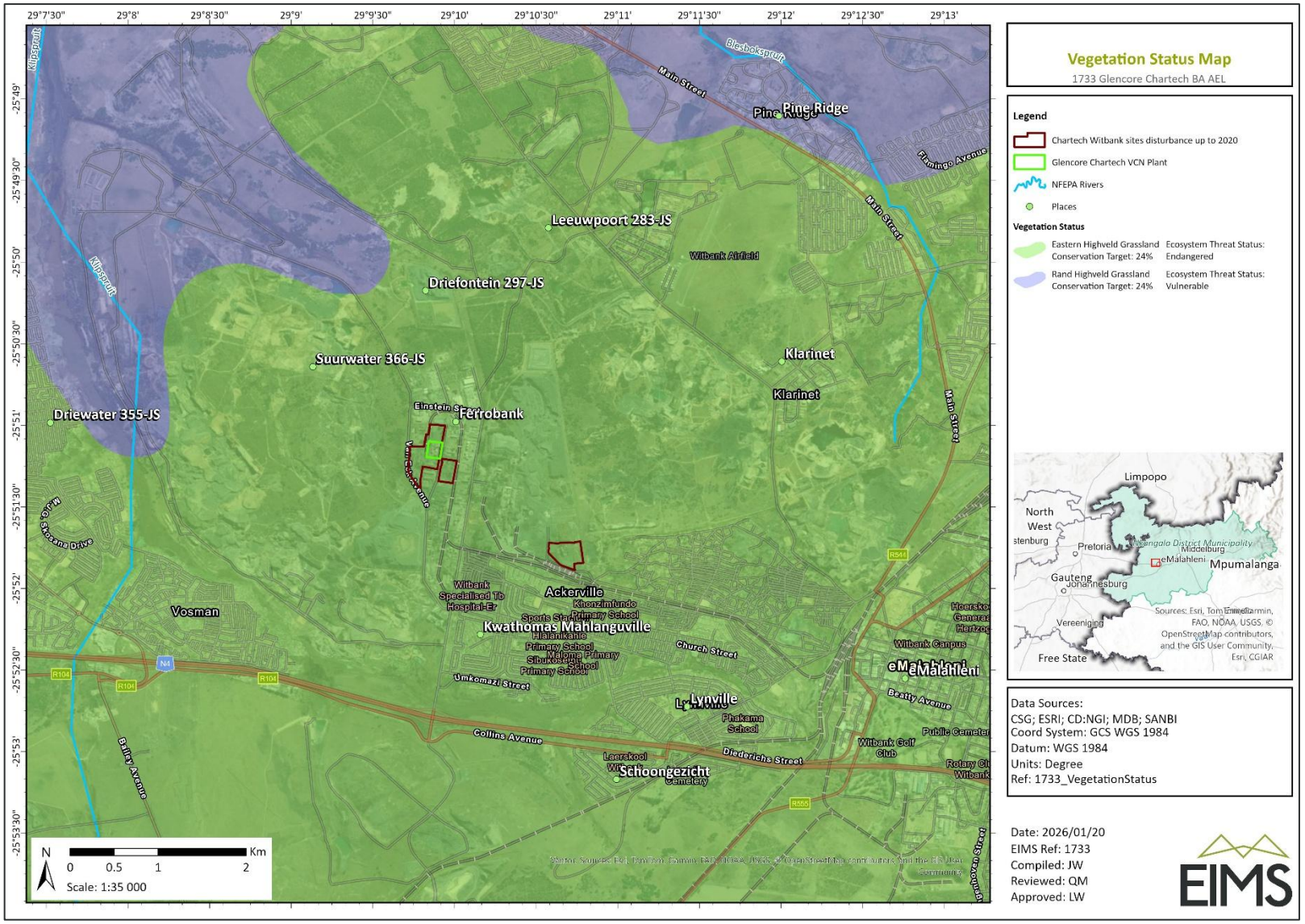


Figure 15: Vegetation Map

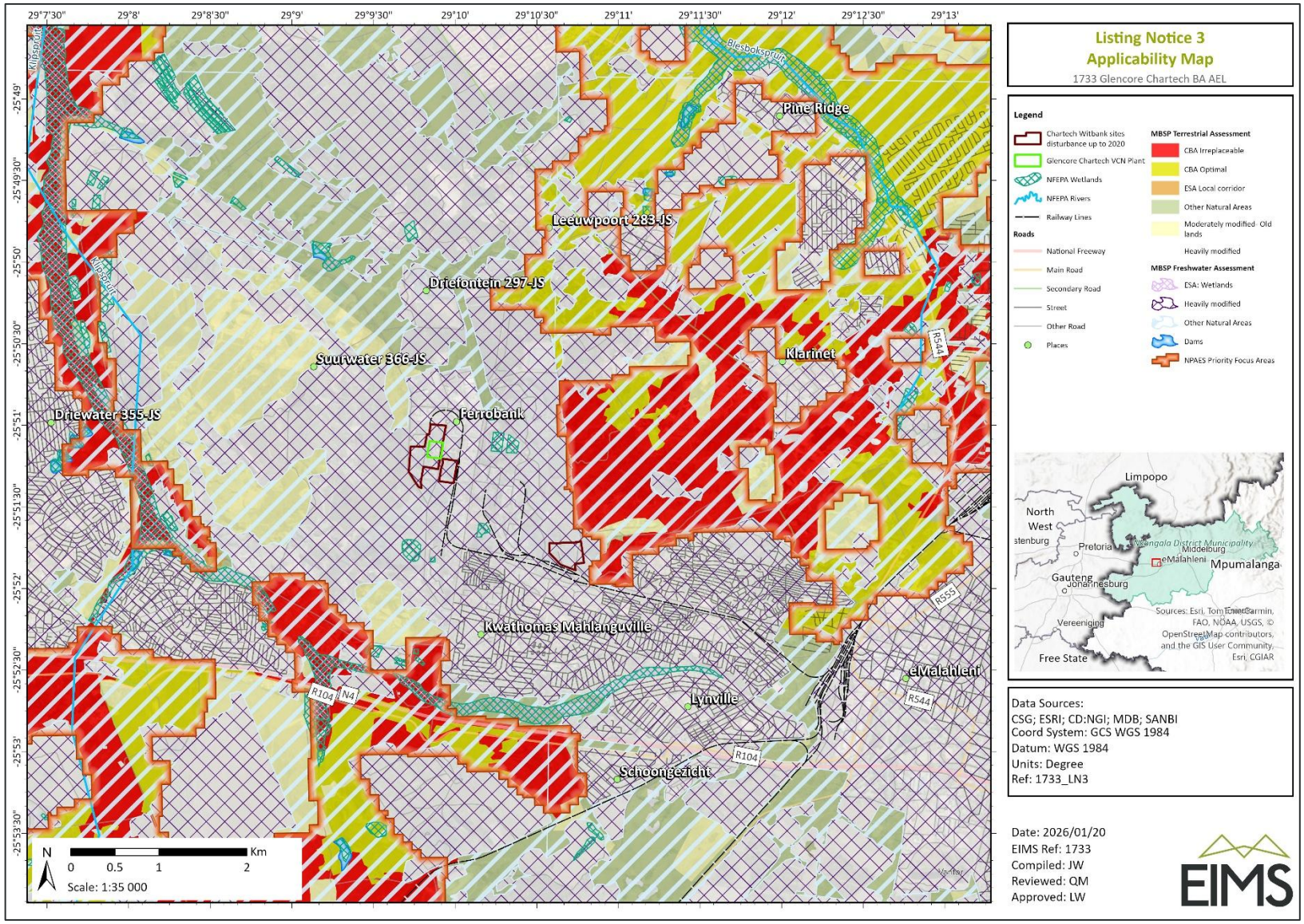


Figure 16: Listing notice 3 applicability map with project area overlain on to the MBSP

8.3 SOCIO-ECONOMIC ENVIRONMENT

According to the National Environmental Management Act (NEMA, 1998), environment refers to the surroundings in which humans exist. When viewing the environment from a socio-economic perspective the question can be asked what exactly the social environment is. Different definitions for social environment exist, but a clear and comprehensive definition that is widely accepted remains elusive. Barnett & Casper (2001) offers the following definition of human social environment:

"*Human social environments encompass the immediate physical surroundings, social relationships, and cultural milieus within which defined groups of people function and interact. Components of the social environment include built infrastructure; industrial and occupational structure; labour markets; social and economic processes; wealth; social, human, and health services; power relations; government; race relations; social inequality; cultural practices; the arts; religious institutions and practices; and beliefs about place and community. The social environment subsumes many aspects of the physical environment, given that contemporary landscapes, water resources, and other natural resources have been at least partially configured by human social processes. Embedded within contemporary social environments are historical social and power relations that have become institutionalized over time. Social environments can be experienced at multiple scales, often simultaneously, including households, kin networks, neighbourhoods, towns and cities, and regions. Social environments are dynamic and change over time as the result of both internal and external forces. There are relationships of dependency among the social environments of different local areas, because these areas are connected through larger regional, national, and international social and economic processes and power relations.*"

Environment-behaviour relationships are interrelationships (Bell et al., 1996). The environment influences and constrains the behaviour of people, but behaviour also leads to changes in the environment. The impacts of a project on people can only be truly understood if their environmental context is understood. The baseline description of the social environment includes a description of the area within a provincial, district and local context that will focus on the identity and history of the area as well as a description of the population of the area based on a number of demographic, social and economic variables.

8.3.1 DISTRICT MUNICIPALITY

The Nkangala DM is a Category C municipality in the Mpumalanga Province. It is one of the three districts in the province, making up 22% of its geographical area. It is comprised of six local municipalities: Victor Khanye, Emalahleni, Steve Tshwete, Emakhazeni, Thembisile Hani, and Dr JS Moroka. The district's headquarters are in Middelburg. Nkangala DM is at the economic hub of Mpumalanga and is rich in minerals and natural resources. The district is host to the Maputo corridor which brings increased potential for economic growth and tourism development. Nkangala district neighbours' provinces like Limpopo (north), Gauteng (west), Free State and KwaZulu-Natal (south). The proximity to Gauteng opens up opportunities to a larger market, which is of benefit to the district's agricultural and manufacturing sectors. The district's economy is dominated by electricity, manufacturing and mining. These sectors are followed by community services, trade, finance, transport, agriculture and construction. Nkangala DM is not exempt from the difficulties facing all municipalities in South Africa as poverty and unemployment in the rural areas are a major threat to socioeconomic growth.

8.3.2 DEMOGRAPHICS

The baseline description of the population will take place on two levels, namely, district and local municipality level. Impacts can only truly be comprehended by understanding the differences and similarities between the different levels. The baseline description will focus on the Emalahleni and Victor Khanye Local Municipalities and Nkangala District Municipality in Mpumalanga Province (referred to in the text as the study area), as these are the areas that will be most affected by the proposed project. The data used for the socio-economic description was sourced from Census 2022. Census 2022 was a de facto census (a census in which people are enumerated according to where they stay on census night). The results should be viewed as indicative of the population characteristics in the area and should not be interpreted as absolute.

According to the Community Survey 2022, the population of South Africa was approximately 62 million and has shown an increase of about 16.5% since 2011. Based on the same data, Nkangala DM had a population of 1 588 684. Emalahleni LM on the other hand, had a population of 434 238 people, which was about one-third of the figure in Nkangala DM and about 10 percent of the figure in the province. Population density refers to the number of people per square kilometre and the population density on a national level has increased from 42.45 people per km^2 in 2011 to 51.42 people per km^2 in 2022. In the study area the population density has increased since 2011 on all levels with Emalahleni LM showing the highest density numbers. Refer to **Table 14** for the population dynamics of the area.

Table 14: Population density and growth estimates (sources: Census 2011, Community Survey 2016)

Area	Size in km^2	Population 2011	Population 2022	Population density 2011	Population density 2022	Population Growth (%)
Nkangala DM	16 899.2	1 308 129	1 588 968	7.74	9.4	21.5
Emalahleni LM	2 682.7	395 466	434 522	147.41	161.97	9.88

2.4.1. Employment

South Africa's official unemployment rate has averaged approximately 26.5% between 2008 and late 2025, reflecting a persistent upward trajectory in labour market distress over the period. After reaching a low of 21.5% in 2008, unemployment rose steadily, peaking at over 35% in late 2021 amid compounded economic pressures. Although this peak has moderated somewhat, joblessness remains structurally high: by Q3 2025, the official rate stood at 31.9%, while the broader expanded unemployment rate—which accounts for discouraged job seekers unable to access the labour market—remained significantly elevated at 42.4%.

The Emalahleni Integrated Development Plan (IDP 2025/26) highlights several socio-economic pressures facing the Municipality, most notably persistently high unemployment levels. As of the latest reporting period, Emalahleni recorded a strict (official) unemployment rate of 28.6%, while the expanded unemployment rate, which includes discouraged work-seekers, stood significantly higher at 37.6%. Poverty indicators further reflect growing vulnerability: 32.4% of the population lived below the Lower-Bound Poverty Line (LBPL) in 2022, representing the second lowest proportion in the province, yet translating to 158,267 individuals, the fifth-highest number in absolute terms. This marks a deterioration from 149,819 people in 2019, pointing to worsening socio-economic conditions despite relative provincial ranking. The Human Development Index (HDI) for Emalahleni was 0.68 in 2022, the second highest in the province, indicating comparatively stronger human development outcomes. However, the Municipality continues to face mounting pressure on basic services and infrastructure, largely driven by population growth consistently outpacing economic growth, resulting in increased demand on already strained municipal systems.

2.4.2. Service Delivery

Service delivery performance in Emalahleni Local Municipality continues to be shaped by rapid population growth, infrastructure backlogs, ageing systems, and constrained financial resources. Between 2011 and 2022, the municipal population increased to 434,522 residents, with households rising from 119,873 to 164,573, growing at 3.1% annually, significantly faster than the economy (0.5% per year). This disproportional growth has placed sustained pressure on water, sanitation, electricity, roads, stormwater and waste-management systems. Refer to Figure 17 for a summary of service backlogs between 2011 and 2022.

Water services remain one of the municipality's most critical challenges. By 2022, 18,713 households (11.4%) still lacked access to piped water, reflecting rising demand and infrastructure stress. Chronic issues include water scarcity, deteriorating raw water quality, intermittent supply, high losses (±42%), ageing asbestos pipelines, and persistent vandalism. The municipality operates three internal supply schemes supported by mine-water reclamation and modular package plants, but capacity gaps remain. Short-, medium- and long-term interventions include the refurbishment of Witbank and Ga-Nala treatment works, commissioning additional

modular plants and a proposed 30Ml/d future WTP and WWTP, alongside extensive pipe replacement programmes (see Figure 17).

Sanitation services face similar strain. In 2022, 33,283 households (20.3%) lacked access to flush or chemical toilets. Wastewater Treatment Works (WWTWs) are overloaded and outdated, with eight plants operating at or beyond design capacity, and a 1,700km sewer network requiring major upgrades. Planned interventions include the upgrading of Klipspruit, Ferrobank and Naauwpoort WWTWs (from 10–30Ml/d each), construction of new outfall lines, and emergency modular treatment units to alleviate immediate pressure (see Figure 17).

Electricity provision has improved over the past decade, with access rising to 84.1% of households, yet 26,147 households (15.9%) remain unconnected. Old and overloaded infrastructure, illegal connections, recurring equipment explosions and high technical and non-technical losses undermine reliability. Interventions include network audits, meter installations, kiosk upgrades, mini-substation replacements and collaboration with NERSA through cost-reflective tariffs (see Figure 17).

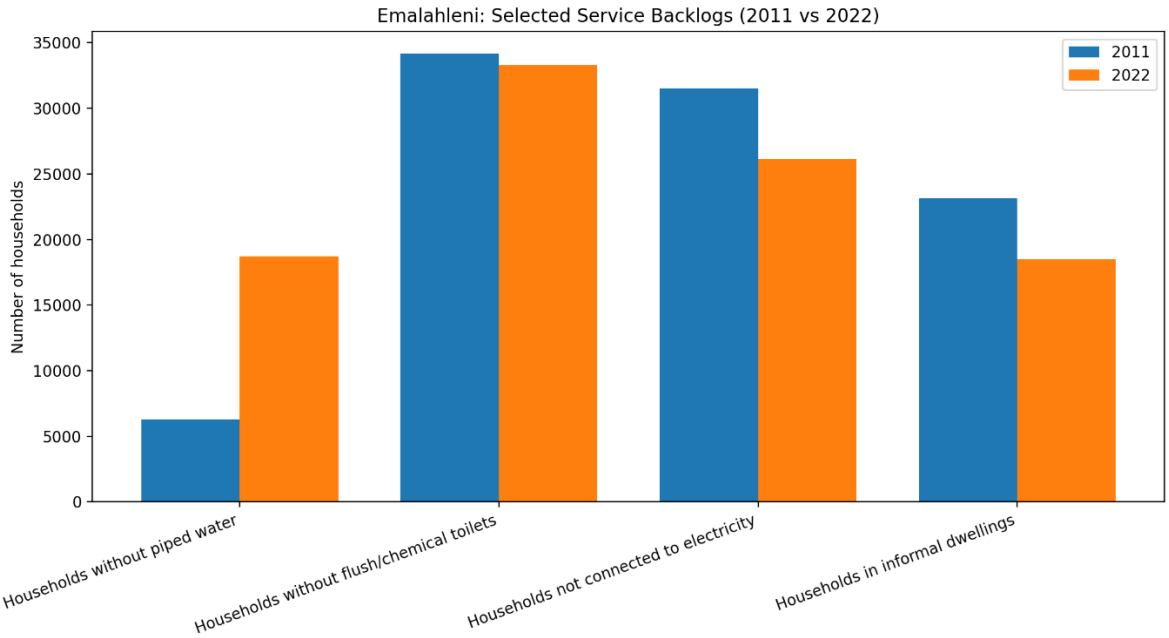


Figure 17: Selected service backlogs (households) show mixed trends between 2011 and 2022, with improvements in electricity connections and informal dwellings, but increased households without piped water

Roads and stormwater systems reflect severe deterioration. The municipal network spans 1,400 km, but approximately 90% of streets are damaged and require full rehabilitation due to ageing pavements, insufficient drainage and heavy-vehicle pressure from mining logistics. Flooding hotspots and gravel road erosion require increased maintenance. The municipality continues patching, grading and stormwater upgrades, but limited capital funding and fleet shortages hinder progress.

Waste management services reach 68.1% of households, with the remainder dependent on communal collection. Challenges include inadequate fleet, illegal dumping, declining landfill capacity and limited recycling infrastructure. The Integrated Waste Management Plan (IWMP) and Section 78 study guide interventions, with expansion of transfer stations, landfill upgrades and community clean-up programmes forming part of the response.

Housing and informal settlement pressures remain substantial, with 72 informal settlements identified. Although 14 upgrading plans have been approved and 13 settlements formalised, growth in unplanned settlements continues, driven by in-migration and unemployment. Only 11.2% of households remain in informal dwellings (down from 19.3% in 2011), but service backlogs and land invasion persist. The municipality is implementing the Informal Settlements Upgrading Policy, acquiring land, formalising townships and rolling out bulk infrastructure.

Social service delivery—spanning emergency services, waste management, public safety, youth development and community facilities—continues to operate under resource constraints. However, programmes such as the EPWP (creating 489 work opportunities) and CWP (1,071 participants) help strengthen community-based service delivery.

Financial constraints remain a cross-cutting driver of service delivery performance. Limited revenue collection (±60%), high distribution losses, Eskom and DWS arrears, and an unfunded budget position have necessitated a revised Financial Recovery Plan (FRP), focusing on revenue enhancement, cost containment, infrastructure rehabilitation and improved governance.

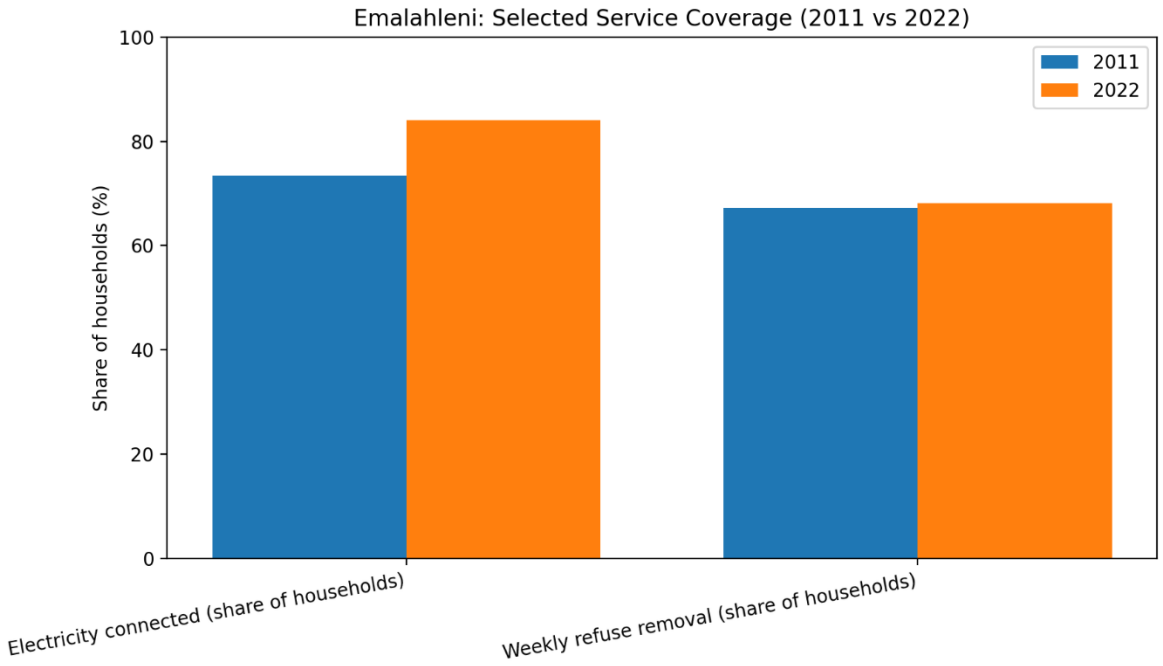


Figure 18: Service coverage indicates improved electricity access (2011–2022), while refuse removal coverage remains largely stagnant, implying operational constraints and settlement growth

Overall, while progress has been made in improving access to basic services—particularly electricity and formal housing—the municipality continues to face systemic challenges. Water scarcity, ageing infrastructure, financial instability, informal settlement growth and environmental degradation require coordinated, long-term investment and intergovernmental support. The IDP and FRP outline a clear roadmap that, if implemented effectively, will stabilise and gradually improve service delivery outcomes across Emalahleni.

8.3.3 ARCHAEOLOGICAL, CULTURAL HERITAGE AND PALAEONTOLOGY

Emalahleni possesses a rich and diverse cultural heritage landscape, shaped by its mining, industrial and military history. The municipality contains numerous heritage resources protected under the NHRA, including structures older than 60 years, the NZASM Station at Clewer, and a range of listed heritage sites, such as the Battle of Bakenlaagte site, Steenkoolspuit Bridge, Balmoral Concentration Camp, Eensaamheid site, and several archaeological and military grave locations (Emalahleni IDP, 2025) These features reflect the socio-economic evolution of the region—from early transport routes and Anglo-Boer War activities to 20th-century industrial development driven by coal mining. To safeguard these assets, Emalahleni has adopted a Heritage By-Law that empowers the municipality to identify, manage and protect heritage sites in alignment with national legislation (Emalahleni IDP, 2025). The DFFE screening tool (2025) has shown that the CharTech VCN site maintains a Low Sensitivity for Archaeological and Cultural Heritage Theme (refer to Figure 7). During the Site Sensitivity Verification, the EAP's findings (refer to Table 5) concluded that project is located within an industrial site, on an existing industrial building and will not change the character of the site. Minor refurbishments of an existing industrial building, including installation of a stack and baghouse. The building on which the furnace will be installed is approximately 35 years old. As such, it does not qualify as a heritage resource and is not considered

a heritage feature. All works will be confined to the existing building footprint, and no deep excavations or ground disturbances are planned. The project is therefore excluded from the Chance Finds Protocol.

Section **8.1.2** sufficiently addresses the paleontological context of the study area, as the geological formations underlying the site directly inform its fossil sensitivity. The area is underlain by the Vryheid Formation of the Ecca Group, comprising mudstone, siltstone and sandstone deposited in deltaic and fluvial environments, with overlying coal beds formed in palaeo-swamps. Dolerite intrusions and the underlying Dwyka diamictite influence groundwater behaviour and form distinct stratigraphic boundaries. The Vryheid Formation is classified as having very high paleontological sensitivity according to the SAHRIS PalaeoSensitivity Map and the DEA Screening Tool Report; however, because the proposed activities involve only the refurbishment of existing buildings and the paving of existing roads (with no deep excavations planned), the likelihood of disturbing fossil-bearing strata is extremely low.

9 ENVIRONMENTAL IMPACT ASSESSMENT

9.1 IMPACTS IDENTIFIED

This Section presents the impacts that have been identified and assessed for the BA. Potential environmental impacts were identified by the EAP, the appointed specialists (where applicable), as well as the preliminary input from the public. The impacts are included in Table 15below.

When considering cumulative impacts, it is important to bear in mind the scale at which different impacts occur. The identification of impacts is an objective iterative process of considering the project components and activities and how these may interact with the different environmental components. An activity/ environmental component matrix is presented in Table 15 below. The matrix represents which environmental components are likely to be impacted upon by the project activities. Table 16 provides a list of the identified impacts associated with each environmental component Table 16.

In interpreting Table 15, it is important to recognise that the activities identified and their associated environmental interactions are considered within the broader context of the project's planned activities. The matrix functions as a screening tool, guiding the EAP in identifying potential points of interaction between project activities and valued environmental components, and highlighting any activities that may warrant further examination due to their potential to result in impacts. However, for an environmental change to constitute an assessable impact, there must be a clear and quantifiable linkage between an impact source (activity), an impact pathway, and a receptor. Where this linkage cannot be established with sufficient clarity or does not result in a measurable or predictable outcome, the impact may not be deemed assessable. In such cases, although the impact cannot be assessed in a formal significance rating, good industry practice management measures are nonetheless included in the EMPr to avoid or minimise potential risks. As such, the environmental components identified in Table 15 are considered to be adequately addressed and safeguarded through the impacts listed in Table 16, together with the comprehensive mitigation measures proposed in the EMPr, which collectively ensure protection against deterioration.

Table 15: Impact identification matrix.

Phase	Activity	Environmental Component												
		Climate and Air Quality (AQ)	Geology and soils (G)	Groundwater (GW)	Surface water/ wetlands (W)	Noise (N)	Topography (T)	Visual/ Landscape (V)	Flora (FL)	Fauna (FA)	Ecosystems/ habitats (EH)	Social (S)	Cultural Heritage (C)	Economic (E)
Planning and Design	Project planning, design development, procurement and contracting activities											+		+
Construction (incl pre construction and post construction rehab)	Site establishment and preparation	-	-			-						+		+
	Movement of construction vehicles, equipment and machinery	-	-	-		-						+		-
	Paving, resurfacing, upgrading or refurbishing of existing services	-	-	-	-	-						+		-
	Utility relocation or temporary service interruptions (e.g., water/electricity)											-		-
	Construction-related activities generating dust, noise, and vibrations	-				-						-		
Operations	Operation of industrial facilities, equipment, and associated infrastructure	-				-			-	-				+

Key:
+ = Potential positive interaction
– = Potential negative interaction
(blank) = No meaningful interaction anticipated

Table 16: Potential impacts Identified and Assessed during the BA.

#	Impact	Activity/ Aspect	Phase
9.3.1.1	Impacts due to inefficient communication (employment, procurement of goods and/or services etc)	Project planning, design development, procurement and contracting activities; Utility relocation or temporary service interruptions (e.g., water/electricity)	Planning; Construction
9.3.2.1	Impacts on existing infrastructure and services (servitudes)	Surface service infrastructure/servitudes, including access restrictions and potential disturbance	Construction
9.3.2.2	Creation of employment opportunities	Construction/refurbishments	Construction
9.3.2.3	Ambient Air Quality	Movement of construction vehicles, equipment and machinery; Paving, resurfacing, upgrading or refurbishing of existing services;	Construction
9.3.2.4	Impact on Health and Safety	General construction activities	Construction
9.3.2.6	Waste Management Impacts	Construction waste generation, handling & disposal	Construction
9.3.3.1	Ambient Air Quality	Facility operations (vehicular movement, emissions, dust)	Operation
9.3.3.2	Impact on Health and Safety	Operational activities / workforce & public interface	Operation
9.3.3.3	Waste Management Impacts	Operational waste generation & disposal	Operation
9.3.3.4	Job Creation	Operations	Operation
9.3.3.5	Climate change impact	Normal operations or events	Operation
9.3.3.5	Climate Change Vulnerability	Abnormal or unplanned events	Operation
9.3.4.1	Ambient Air Quality	Decommissioning activities (demolition, dust emissions)	Decommissioning

#	Impact	Activity/ Aspect	Phase
9.3.4.2	Job-losses	Decommissioning (End of operational life / workforce reduction)	Decommissioning
9.3.4.3	Waste Management Impacts	Decommissioning rubble and waste handling	Decommissioning

9.2 IMPACT ASSESSMENT METHODOLOGY

The broad approach to the significance rating methodology is to determine the significance (S) of an environmental risk or impact by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relating this to the probability/ likelihood (P) of the impact occurring. The S is determined for the pre- and post-mitigation scenario. In addition, other factors, including cumulative impacts and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the S to determine the overall final significance rating (FS).

9.2.1 DETERMINATION OF SIGNIFICANCE

The final significance (FS) of an impact or risk is determined by applying a prioritisation factor (PF) to the post-mitigation environmental significance. The significance is dependent on the consequence (C) of the particular impact and the probability (P) of the impact occurring. Consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and Reversibility (R) applicable to the specific impact.

For the purpose of this methodology the consequence of the impact is represented by:

$$\boldsymbol{C = \frac{(E + D + M + R) * N}{4}}$$

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in Table 17 below.

Table 17: Criteria for Determining Impact Consequence

Aspect	Score	Definition
Nature	- 1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. Highly localised, limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property or site boundary, or the area within a few hundred meters of the site)
	3	Local (i.e. beyond the site boundary within the Local administrative boundary (e.g. Local Municipality) or within consistent local geographical features, or the area within 5 km of the site)
	4	Regional (i.e. Far beyond the site boundary, beyond the Local administrative boundaries within the Regional administrative boundaries (e.g. District Municipality), or extends into different distinct geographical features, or extends between 5 and 50 km from the site).
	5	Provincial / National / International (i.e. extends into numerous distinct geographical features, or extends beyond 50 km from the site).

Aspect	Score	Definition
Duration	1	Immediate (<1 year, quickly reversible)
	2	Short term (1-5 years, less than project lifespan)
	3	Medium term (6-15 years)
	4	Long term (15-65 years, the impact will cease after the operational life span of the project)
	5	Permanent (>65 years, no mitigation measure of natural process will reduce the impact after construction/ operation/ decommissioning).
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected)
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected, or affected environmental components are already degraded)
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way; moderate improvement for +ve impacts; or where change affects area of potential conservation or other value, or use of resources).
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease; high improvement for +ve impacts; or where change affects high conservation value areas or species of conservation concern)
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease, substantial improvement for +ve impacts; or disturbance to pristine areas of critical conservation value or critically endangered species)
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring very high time and cost.
	5	Irreversible Impact.

Once the C has been determined, the significance is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/ scored as per Table 18.

It is noted that both environmental risks as well as environmental impacts should be identified and assessed. Environmental Risk can be regarded as the potential for something harmful to happen to the environment, and in many instances is not regarded as something that is expected to occur during normal operations or events (e.g. unplanned fuel or oil spills at a construction site). Probability and likelihood are key determinants or variables of environmental risk. Environmental Impact can be regarded as the actual effect or change that happens to the environment because of an activity and is typically an effect that is expected from normal operations or events (e.g. vegetation clearance from site development results in loss of species of concern). Typically, the probability of an unmitigated environmental impact is regarded as highly likely or certain

(management and mitigation measures would ideally aim to reduce this likelihood where possible). In summary, environmental risk is about what could happen, while environmental impact is about what does happen.

Table 18: Probability/ Likelihood Scoring

Probability	1	Improbable (Rare, the event may occur only in exceptional circumstances, the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <5% chance).
	2	Low probability (Unlikely, impact could occur but not realistically expected; >5% and <20% chance).
	3	Medium probability (Possible, the impact may occur; >20% and <50% chance).
	4	High probability (Likely, it is most probable that the impact will occur- > 50 and <90% chance).
	5	Definite (Almost certain, the impact is expected to, or will, occur, >90% chance).

The result is a qualitative representation of relative significance associated with the impact. Significance is therefore calculated as follows:

$$S = C \, x \, P$$

Table 19: Determination of Significance

Consequence	5- Very High[d]	5	10	15	20	25
	4- High	4	8	12	16	20
	3- Medium	3	6	9	12	15
	2- Low	2	4	6	8	10
	1- Very low	1	2	3	4	5
		1- Improbable	2- Low	3- Medium/ Possible	4- High/ Probable	5- Highly likely/ Definite
	Probability					

The outcome of the significance assessment will result in a range of scores, ranging from 1 through to 25. These significance scores are then grouped into respective classes as described in Table 20.

Table 20: Significance Scores

S Score	Description
≤4.25	Low (i.e. where this impact is unlikely to be a significant environmental risk/ reward).
>4,25, ≤8.5	Low-Medium (i.e. where the impact could have a significant environmental risk/ reward).
>8.5, ≤13.75	High-Medium (i.e. where the impact could have a significant environmental risk/ reward).

[d] In the event that an impact or risk has very high or catastrophic consequences, but the likelihood/ probability is low, then the resultant significance would be Low-medium. This does in certain instances detract from the relative important of this impact or risk and must consequently be flagged for further specific consideration, management, mitigation, or contingency planning.

S Score	Description
>13.75	High (i.e. where the impact will have a significant environmental risk/ reward).

The impact significance will be determined for each impact without relevant management and mitigation measures (pre-mitigation significance), as well as post implementation of relevant management and mitigation measures (post-mitigation significance). This allows for a prediction in the degree to which the impact can be managed/mitigated.

9.2.2 IMPACT PRIORITIZATION

Further to the assessment criteria presented in the section above, it is necessary to consider each potentially significant impact in terms of:

1. Cumulative impacts; and
2. The degree to which the impact may cause irreplaceable loss of resources.

To ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impacts' post-mitigation significance (post-mitigation). This prioritisation factor does not aim to detract from the significance ratings but rather to focus the attention of the decision-making authority on the higher priority/significance issues and impacts. The PF will be applied to the post-mitigation significance based on the assumption that relevant suggested management/mitigation impacts are implemented.

Table 21: Criteria for Determining Prioritisation

Cumulative Impact (CI)	Low (1)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/ definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable Loss of Resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.
	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

The value for the final impact priority is represented as a single consolidated priority, determined as the sum of each individual criteria represented in Table 21. The impact priority is therefore determined as follows:

$$\boldsymbol{Priority = CI + LR}$$

The result is a priority score which ranges from 2 to 6 and a consequent PF ranging from 1 to 1.5 (Refer to Table 22).

Table 22: Determination of Prioritisation Factor

Priority	Prioritisation Factor
2	1
3	1.125
4	1.25
5	1.375
6	1.5

In order to determine the final impact significance (FS), the PF is multiplied by the post-mitigation significance scoring. The ultimate aim of the PF is an attempt to increase the post mitigation environmental risk rating by a factor of 0.5, if all the priority attributes are high (i.e. if an impact comes out with a high medium environmental risk after the conventional impact rating, but there is significant cumulative impact potential and significant potential for irreplaceable loss of resources, then the net result would be to upscale the impact to a higher significance).

Table 23: Final Environmental Significance Rating

Significance Rating	Description
<-25	**Very High (Impacts in this class are extremely significant and pose a very high environmental risk. In certain instances these may represent a fatal flaw. They are likely to have a major influence on the decision and may be difficult or impossible to mitigate. Offset's may be necessary.**
<-13.75 to -25	High negative (These impacts are significant and must be carefully considered in the decision-making process. They have a high environmental risk or impact and require extensive mitigation measures).
-8.5 to -13.75	Medium-High negative (i.e. Impacts in this class are more substantial and could have a significant environmental risk. They may influence the decision to develop in the area and require more robust mitigation measures).
<-4.25 to <-8.5	Medium- Low negative (i.e. These impacts are slightly more significant than low impacts but still do not pose a major environmental risk. They might require some mitigation measures but are generally manageable).
-1 to -4.25	Low negative (i.e. Impacts in this class are minor and unlikely to have a significant environmental risk. They do not influence the decision to develop in the area and are typically easily mitigated.
0	No impact
1 to 4.25	Low positive
>4.25 to <8.5	Medium-Low positive
8.5 to 13.75	Medium-High positive

Significance Rating	Description
>13.75	High positive

The significance ratings and additional considerations applied to each impact will be used to provide a quantitative comparative assessment of the alternatives being considered. In addition, professional expertise and opinion of the specialists and the environmental consultants will be applied to provide a qualitative comparison of the alternatives under consideration. This process will identify the best alternative for the proposed project. Refer to Appendix F for the Impact Assessment Matrix.

9.3 DESCRIPTION AND ASSESSMENT OF IMPACTS

This section explains each identified environmental impact, considering the related activity and aspect, and clarifies why specific ratings were assigned to impact assessment attributes. It lists the relevant project and site-specific management and mitigation measures for each impact. When mitigation and impact management actions represent accepted industry standards (i.e., generic good practice), they are included automatically in the EMPr. References to relevant good industry practices incorporated into the EMPr are provided where applicable.

9.3.1 PLANNING PHASE IMPACTS

During the planning phase, impacts due to inefficient communication have been identified.

9.3.1.1 IMPACTS DUE TO INEFFICIENT COMMUNICATION

Effective communication is essential to ensure I&APs understand the proposed activity, anticipated benefits (e.g., employment/procurement), potential disruptions, and how they may be affected. Inefficient or non-transparent communication can result in misinformation, distrust, and an incomplete PPP, which may lead to poor decision-making, community dissatisfaction, delays, and potential refusal or withdrawal of EA and/or AEL if minimum legal requirements are not met.

Given these considerations, the impact of inefficient communication is assessed as medium-high negative before mitigation, as it poses reputational, social, and procedural risks. However, by implementing appropriate mitigation measures such as structured engagement processes, clear documentation of issues raised, and consistent feedback, the impact can be reduced to medium-low negative. This highlights the importance of a robust and inclusive communication strategy throughout the project lifecycle.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Impacts due to inefficient communication	Planning	Medium to high negative	Medium to low negative	Medium to low negative
Potential cumulative/ confounding effects	Cumulative and confounding effects of ineffective communication relate to the combined social and procedural risks that arise when stakeholders are not adequately informed during the planning phase. Poor communication, when combined with existing community-level pressures (e.g. unemployment, service-delivery concerns, prior negative experiences with industry or authorities), can result in elevated community dissatisfaction, misinformation, and reduced trust in the process. This may escalate into objections, delayed approvals, or conflict, thereby compounding the risk to project timelines and stakeholder relationships. Considering that the project is located within an established industrial area and that a formal stakeholder engagement framework is being implemented, the cumulative socio-economic effects of ineffective communication are expected to remain Medium to low negative. No additional			

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
	cumulative-specific mitigation measures are proposed beyond the standard communication and engagement measures already incorporated into the BAR.			
Alternatives	N/A			
Mitigation Measures				
• Clear and transparent communication with the authorities and all affected and surrounding I&APs about the proposed project and activities as well as possible vacancies/procurement opportunities. • Refer to the *EMPr Section 10.5 Item GS1 – GS8* attached as **Appendix G** of this report for detailed mitigation measures proposed to manage impacts relating to inefficient communication.				

9.3.2 CONSTRUCTION PHASE IMPACTS

During the construction phase, the following potential impacts were identified and are discussed in detail in the subsequent sub-sections:

- Impacts on existing infrastructure and services;
- Creation of employment opportunities;
- Impacts on ambient air quality;
- Health and safety impacts; and
- Waste management–related impacts.

9.3.2.1 IMPACTS ON EXISTING INFRASTRUCTURE AND SERVICES

Construction plant movement and compaction over service corridors (water, sewer, stormwater, power or communications) can lead to accidental damage, service interruptions, restricted access to servitudes, or disruptions to onsite operations and neighbouring users. Even minor disturbances can cause delays, repair costs, and safety hazards (e.g., damaged electrical cables or ruptured water lines).

Given these considerations, the pre-mitigation rating for impacts exiting infrastructure and services is medium to low negative with a post mitigation score of low negative.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Impacts on existing infrastructure and services	Construction	Medium to low negative	Low negative	Low negative
Potential cumulative/ confounding effects	Cumulative and confounding effects may arise from the in-combination risk of service disturbances when refurbishment/paving activities occur over or near existing service corridors (water, sewer, stormwater, power, communications) in an already serviced industrial area. When added to background network constraints, legacy mapping inaccuracies, and concurrent works by third parties. However, Given the brownfield setting, the limited scope (refurbishment and paving), and the commitment to service detection, demarcation, permit-to-dig controls, and coordinated access with service owners, the cumulative/confounding effects on existing infrastructure and services are expected to be low.			

Alternatives	N/A
Mitigation Measures	
• As-built and existing services drawings shall be obtained, verified, and supplemented by appropriate service detection and scanning prior to the commencement of construction activities. • Identified service corridors shall be clearly marked and barricaded where necessary, and no-go zones for heavy plant and machinery shall be enforced as required. • An emergency response procedure for accidental service strikes shall be in place, including immediate isolation, reporting to the relevant authority or service owner, and repair arrangements. • Access to, and works within proximity of, existing services shall be coordinated with the relevant service owners and/or the local municipality, where applicable. • Where service interruptions are planned as a result of construction activities, affected users, property owners, and/or neighbouring landowners shall be notified in advance. Records of such notifications shall be retained as part of the stakeholder engagement register.	

9.3.2.2 CREATION OF EMPLOYMENT OPPORTUNITIES

The socio-economic considerations for this project relate primarily to short-term employment and local procurement opportunities that arise during the refurbishment and installation activities. Based on the information provided by the applicant, the project is expected to generate five (5) skilled and ten (10) unskilled employment opportunities for local residents. These opportunities include minor civil and paving works, building refurbishments, logistics support, and other labour-intensive tasks that can be undertaken by local labour and SMMEs. In addition to providing temporary income for households, such opportunities contribute to broader local economic benefits through procurement spending and associated multiplier effects. Given these employment contributions and their positive socio-economic implications, the pre-mitigation significance rating is low-medium positive whilst the and post-mitigation and final significance ratings are low positive, resulting in an overall medium-to-high positive final significance.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Creation of employment opportunities	Construction	Low-to-medium Positive	Low positive	Low positive
Potential cumulative/ confounding effects	Positive cumulative effects may arise through localised multiplier benefits (household spending, SMME activity), albeit limited by the short duration of construction. Confounding risks (inflated expectations) are managed through clear vacancy/procurement notices and transparent criteria			
Alternatives	• Local-first recruitment (targeted adverts via ward reps; local databases). • Procurement alternative: unbundle scopes to enable SMME participation.			
Mitigation Measures				
• Local suppliers and service providers shall be prioritised where feasible and in accordance with applicable procurement policies and legislation. • Prioritise local employment and procurement during all project phases. Ensure recruitment of local labour (particularly youth and women) for unskilled and semi-skilled positions. • Refer to the *EMPr Section 10.5 Item GS02 and GS04* attached as **Appendix G** of this report for detailed mitigation measures proposed to manage impacts relating to inefficient communication.				

9.3.2.3 AMBIENT AIR QUALITY

During the construction phase, dust emissions and vehicle exhaust generated by site clearing, material handling, and short-haul construction traffic may result in a temporary nuisance and minor, localised deterioration in ambient air quality within and in the immediate vicinity of the industrial site. These impacts are expected to be short-term, intermittent, and limited to the duration of construction activities.

Based on the nature, scale, and duration of the impact, the pre-mitigation significance is rated as medium-to-low negative. With the implementation of standard dust suppression and vehicle management measures, the post-mitigation significance is assessed as low negative, resulting in a low negative final significance.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Ambient air quality	Construction	Medium-to-low negative	Low negative	Low negative
Potential cumulative/ confounding effects	Minor fugitive dust can combine with background industrial sources, but given the small footprint and duration, cumulative effects are low where suppression and housekeeping are applied.			
Alternatives	N/A			
Mitigation Measures				
• Refer to the *EMPr Section 10.1 Item GA1 – GA17* attached as **Appendix G** of this report for detailed mitigation measures proposed to manage impacts relating to Air Quality during construction.				

9.3.2.4 IMPACTS ON HEALTH AND SAFETY

Construction activities involving moving plant, lifting operations, electrical works, and work at heights present inherent health and safety risks that may result in injury to personnel or damage to property if not adequately managed.

Given the nature of construction activities, the pre-mitigation significance is assessed as medium-to-low negative. With the application of standard occupational health and safety controls, the post-mitigation significance is reduced to low negative, resulting in a low negative residual impact.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Impact on health and safety	Construction	Medium-to-low negative	Low negative	Low negative
Potential cumulative/ confounding effects	Where multiple contractors operate concurrently, uncoordinated activities may compound safety risks. Implementation of site-wide permit-to-work systems and interface management measures will ensure cumulative risks remain low.			
Alternatives	Deconfliction of work fronts, particularly between hot works, electrical activities, and work at height.			
Mitigation Measures				
• Permit-to-work systems shall be implemented for high-risk activities (e.g. hot works, work at heights, lock-out/tag-out). • Refer to the *EMPr Section 10.3 Item GHS1 – GHS13 and SHS1* attached as **Appendix G** of this report for detailed mitigation measures proposed to manage impacts relating to Health and safety during construction.				

9.3.2.5 WASTE MANAGEMENT IMPACTS

Construction and refurbishment activities will generate general and potentially hazardous waste streams. Inadequate storage, handling, or disposal may result in littering, pollution, and regulatory non-compliance.

The pre-mitigation significance is rated as medium-to-low negative. With appropriate waste management controls in place, the post-mitigation significance is low negative, resulting in a low negative final significance.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Waste management impacts	Construction	Medium-to-low negative	Low negative	Low negative
Potential cumulative/ confounding effects	Multiple small waste streams may cumulatively result in nuisance conditions if not managed daily. With effective segregation, housekeeping, and licensed removal, cumulative impacts will remain low.			
Alternatives	Scheduled waste collection to minimise on-site storage durations.			
Mitigation Measures				
Refer to the *EMPr Section 10.2* attached as **Appendix G** of this report for detailed mitigation measures proposed to manage impacts relating to Waste Management during construction.				

9.3.3 OPERATIONAL PHASE IMPACTS

During the operational phase, the proposed facility will function within an established industrial environment and will involve ongoing process activities, routine maintenance, and associated vehicle movements. The impacts identified for this phase primarily relate to ambient air quality, occupational health and safety, and waste management. These impacts are generally predictable and continuous in nature, and are in large part managed through existing operational controls, licensing requirements, and management systems. Where mitigation measures are implemented and maintained, operational phase impacts are expected to remain localised, and compliant with applicable legislation.

9.3.3.1 AMBIENT AIR QUALITY

At the time of the AQIA, the existing licensed operations were under care and maintenance; however, this status may change in the future. Consequently, the potential impacts of the proposed VCN Furnace were evaluated independently of the existing activities. The impacts of the proposed VCN Furnace were assessed in isolation from the existing activities (Refer to Figure 19 - Figure 23 for the AQIA pollutant models) and cumulatively with consideration of the other licensed facilities and baseline conditions from the AQMS (these are discussed in the table below under potential cumulative/ confounding effects (a map showing the concentration due to cumulative impacts from licensed activities and the proposed VCN furnace is presented in Figure 24). The AQIA made the following findings regarding the VCN furnace:

- The PM_{10} and $PM_{2.5}$ ground level concentrations for highest daily (99^{th} percentile) and annual averaging periods, is well below the NAAQS at all identified off-site sensitive receptors;
- The SO_2 and NO_2 ground level concentrations are well below the NAAQS for all averaging periods at all off-site identified sensitive receptors;
- The acute and chronic NH_3 ground level concentrations are well below the inhalation screening criteria at all potential sensitive receptors within the study area;

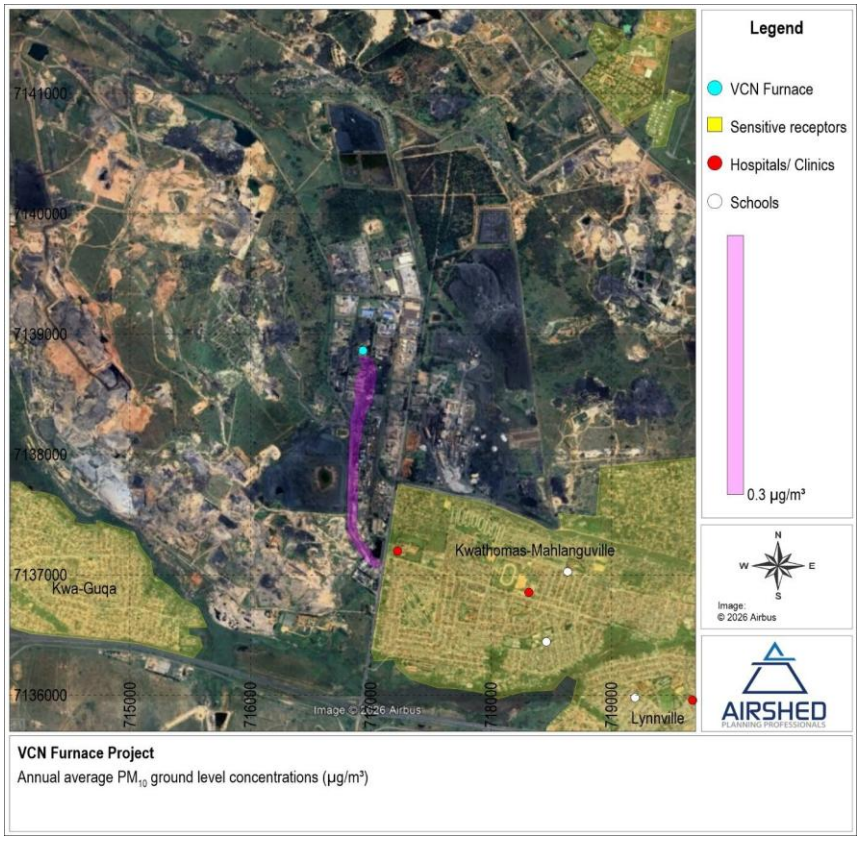


Figure 19: Annual average PM_{10} ground level concentrations due to the VCN Furnace operations

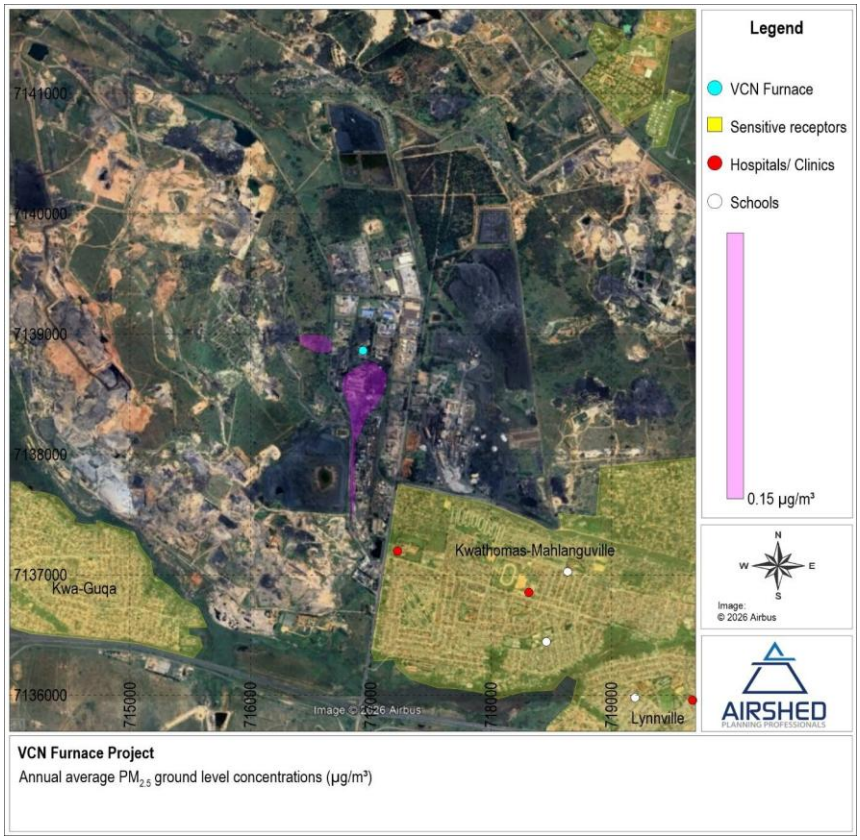


Figure 20: Annual average $PM_{2.5}$ ground level concentrations due to the VCN Furnace operations

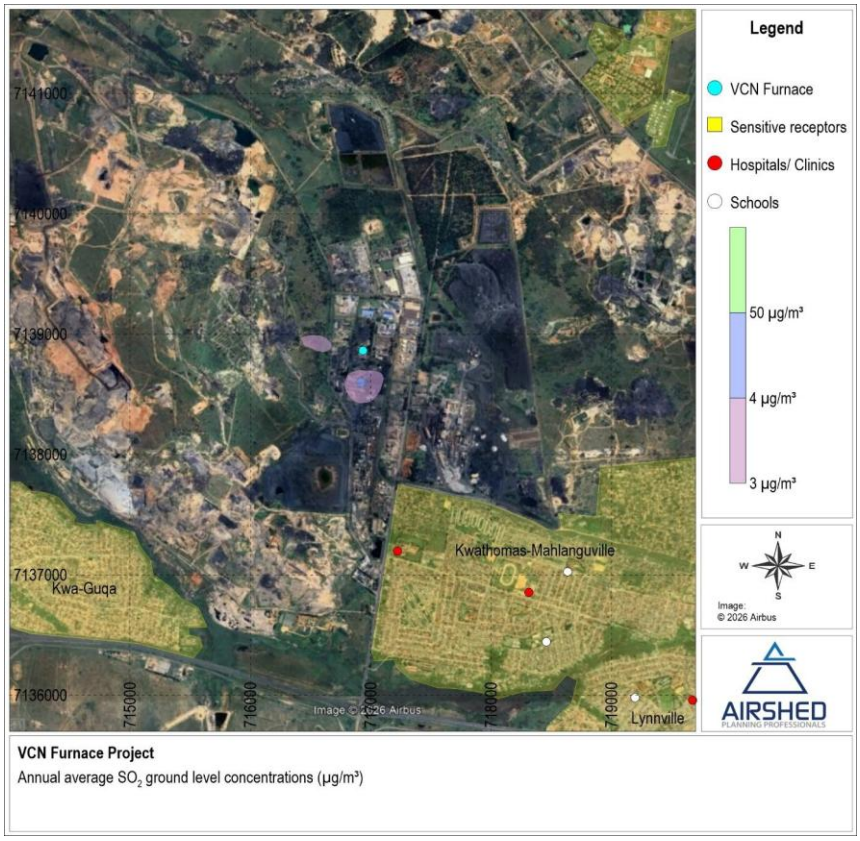


Figure 21: Annual average SO_2 ground level concentrations due to the VCN Furnace operations

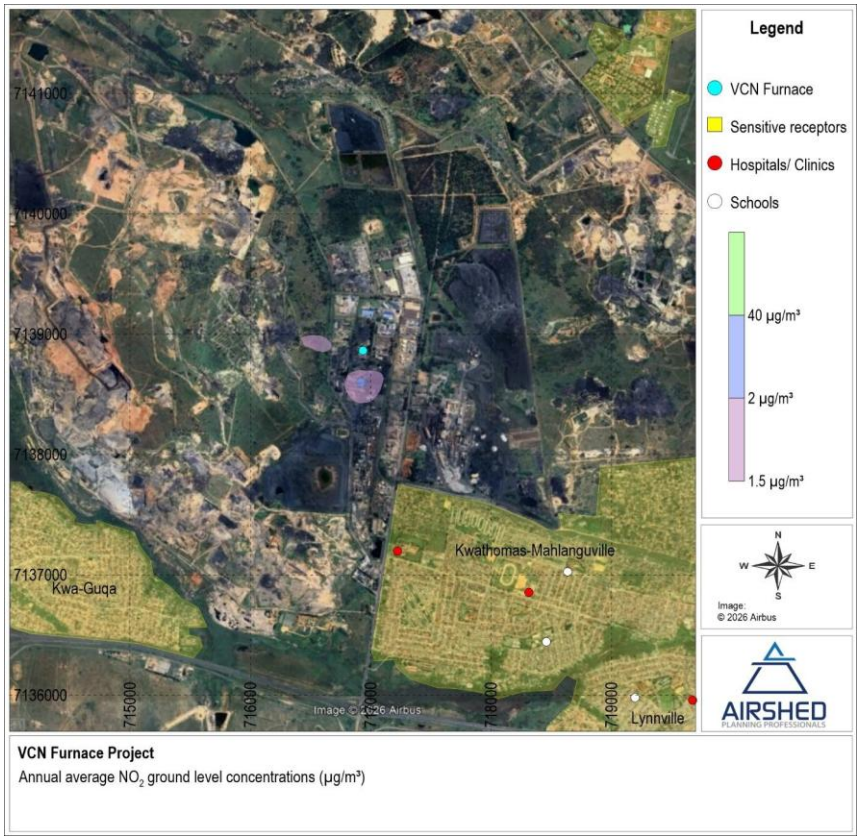


Figure 22: Annual average NO_2 ground level concentrations due to the VCN Furnace operations

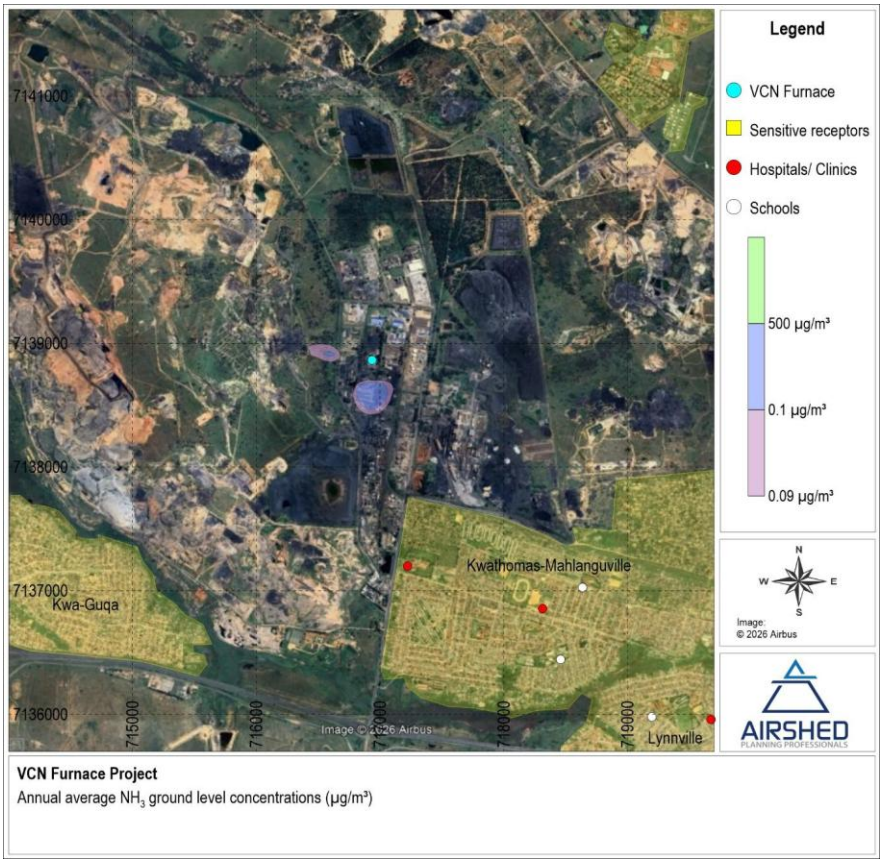


Figure 23: Annual average NH_3 ground level concentrations due to the VCN Furnace operations

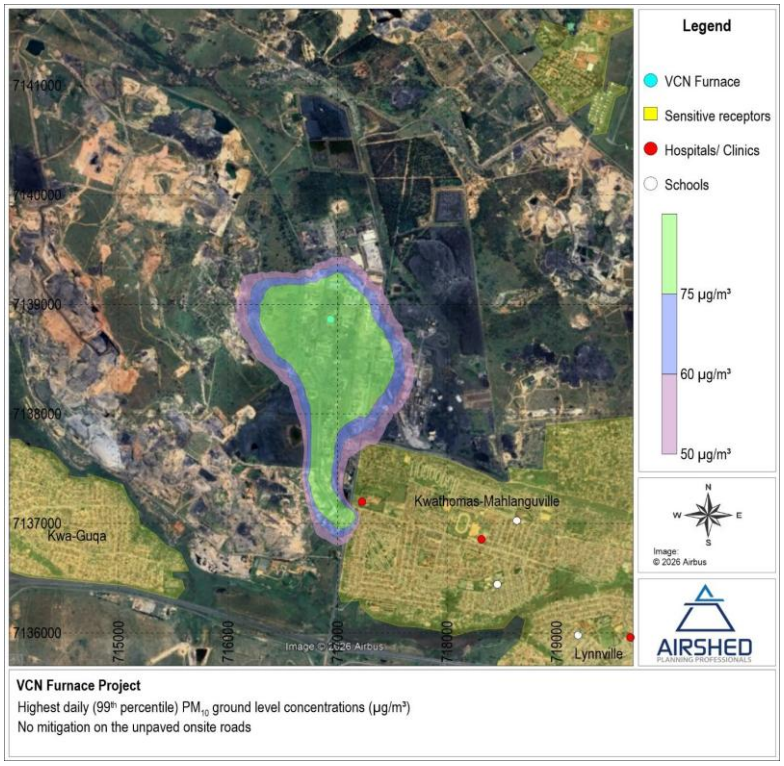


Figure 24: Highest daily (99th percentile) PM10 ground level concentrations due to existing licensed operations and the VCN Furnace operations (cumulative)

As emissions are regulated and controlled, both pre- and post-mitigation significance ratings remain medium-to-low negative, with a medium-to-low negative final significance.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Ambient air quality	Operation	Medium-to-low negative	Medium-to-low negative	Medium-to-low negative
Potential cumulative/ confounding effects	Cumulative impacts arise from in-combination emissions with existing industrial sources. Compliance with Atmospheric Emission Licence (AEL) conditions and ongoing monitoring will maintain residual cumulative impacts at a medium-to-low level. The AQIA (attached as Appendix E of this report) Section 5.1.8 cumulative impacts were assessed using recognised industry guidance. Literature indicates that simply adding peak modelled concentrations to measured background levels can significantly overestimate cumulative impacts. A more representative approach is to add twice the annual mean background concentration to the peak (or 99.9th percentile) model result (Ministry for the Environment, 2004). Within the study area, ambient levels of sulfur dioxide (SO_2), nitrogen dioxide (NO_2), PM_{10} and $PM_{2.5}$ have been continuously monitored at the eMalahleni Air Quality Monitoring Station (AQMS). Using measured annual average concentrations for the year 2023 (which offers the highest data availability for the 2023–2025 period) the cumulative impact assessment was undertaken. When compared to the assumed baseline concentrations, the modelled annual average contribution of the VCN Furnace represents 1.6% of existing ambient levels for SO_2, 1% of existing ambient levels for NO_2, and less than 0.1% for PM_{10} and $PM_{2.5}$. These increments are negligible and do not materially influence ambient air quality or NAAQS compliance. The detailed results are provided in Table 5-16 of the AQIA. Furthermore, the AQIA concluded that PM_{10} and $PM_{2.5}$ impacts due to existing licensed operations are similar in magnitude and spatial distribution to the PM_{10} and $PM_{2.5}$ impacts for existing licensed operations and VCN Furnace combined.			
Alternatives	N/A			
Mitigation Measures				
• Compliance with AEL requirements shall be maintained, including abatement system operation, maintenance, and periodic stack testing. • Refer to the *EMPr Section 10.1 Item GA1 – GA17 and SA01 – SA08* attached as **Appendix G** of this report for detailed mitigation measures proposed to manage impacts relating to Air Quality during operational phase.				

9.3.3.2 IMPACTS ON HEALTH AND SAFETY

Operational activities involving hot surfaces, moving equipment, electrical systems, and vehicle movements present ongoing health and safety risks if controls are not consistently applied.

The pre-mitigation significance is assessed as medium-to-low negative. With operational controls in place, the post-mitigation and final significance is low negative.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Impacts on operational health and safety	Operation	Medium-to-low negative	low negative	low negative
Potential cumulative/ confounding effects	Multiple workstreams can cumulatively elevate exposure; SOPs, permits and supervision maintain cumulative risk low.			
Alternatives	N/A			
Mitigation Measures				
• Refer to the *EMPr Section 10.3 Item GHS1 – GHS13* attached as **Appendix G** of this report for detailed mitigation measures proposed to manage impacts relating to Health and safety during operation.				

9.3.3.3 WASTE MANAGEMENT RELATED IMPACTS

Operational activities will generate general, recyclable, and maintenance-related waste streams. Poor management may result in pollution and non-compliance.

Pre- and post-mitigation significance remains medium-to-low negative, with a medium-to-low negative final significance.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Waste management related impacts	Operation	Medium-to-low negative	Medium-to-low negative	Medium-to-low negative
Potential cumulative/ confounding effects	Routine wastes plus occasional maintenance peaks can cumulatively stress storage; with segregation, licensed removal and record-keeping, cumulative risk stays medium-low			
Alternatives	N/A			
Mitigation Measures				
• Any material losses arising during handling or transfer shall be collected and re-fed into the process where technically feasible, to minimise waste generation. • A baghouse dust collection system shall be installed, operated, and maintained to capture any particulate matter generated during furnace operation. Captured dust shall be bagged, stored in designated waste storage areas, and transported to the supplier for reprocessing in accordance with applicable waste management and transport requirements. (refer to SW01 -SW03 in *Section 10.2 of EMPr* attached as Appendix G of this report for detailed mitigations) • *Good industry practice mitigations are included in Section 10.2 Item GW01 – GW15 of EMPr* attached as Appendix G of this report.				

9.3.3.4 CREATION OF EMPLOYMENT OPPORTUNITIES

During the operational phase, the project will create 9 skilled and 13 semi-skilled employment opportunities (It is noteworthy that no unskilled employment is created during the operational phase). These positions will provide meaningful job creation for local labour, contributing to improved household incomes and enhanced economic stability within the surrounding communities. The VCN furnace' created during the operational phase

will support the retention of existing jobs that might otherwise be at risk due to other site activities being placed under care and maintenance.

Given the direct and sustained socio-economic benefits associated with both job creation and job retention, the significance of this impact is assessed as low-to-medium positive before and after mitigation, resulting in a final significance rating of low-to-medium positive.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Creation of employment opportunities	Construction	low-to-medium positive	low-to-medium positive	low-to-medium positive
Potential cumulative/ confounding effects	Employment effects during the operational phase are expected to be largely stable and confined to the facility's workforce.			
Alternatives	N/A			
Mitigation Measures				
• Local suppliers and service providers shall be prioritised where feasible and in accordance with applicable procurement policies and legislation. • Prioritise local employment and procurement during all project phases. Ensure recruitment of local labour (particularly youth and women) for unskilled and semi-skilled positions. • Refer to the *EMPr Section 10.5 Item GS2 and GS4* attached as **Appendix G** of this report for detailed mitigation measures proposed to manage impacts relating to inefficient communication.				

9.3.3.5 CLIMATE CHANGE IMPACT AND VULNERABILITY

Section 8.1.2 presents the high-level climate change predicted to occur in the project area in the future. These changes are relevant over the operational life of the proposed VCN Furnace and must be considered in design, operation, and environmental management. Further it is important to consider the extent to which the proposed project is likely to contribute significantly to climate change through emission of greenhouse gases (GHG) either directly or indirectly.

9.3.3.5.1 CLIMATE VULNERABILITY

A changing climate may expose the project to vulnerabilities and risks in the future. The following should be considered:

- Rising ambient temperatures may increase thermal stress on plant, equipment, and electrical systems, potentially reducing operational efficiency and increasing maintenance requirements. Higher temperatures also elevate the risk of heat stress for workers during construction, operation, and maintenance activities.
- Projected increases in the intensity of rainfall events may place additional pressure on stormwater management infrastructure, with a risk of localized flooding, erosion, or uncontrolled runoff if systems are not adequately designed or maintained. Increased fire danger days also introduce an elevated risk of fire affecting site infrastructure, particularly during dry periods and in peripheral or buffer areas.
- Increased drought frequency and regional water stress may affect the reliability of water supply for cooling, dust suppression, and general operational use. Heatwaves may further contribute to electricity supply instability due to increased regional demand. This is somewhat mitigated due to the fact that the proposed VCN project does not require significant volumes of input water and where possible water will be recycled in a closed system.

In order to proactively address these potential vulnerabilities management and mitigation measures have been included in the assessment below.

9.3.3.5.2 GHG EMISSIONS

Increased greenhouse gas (GHG) emissions intensify climate change by trapping more heat in the Earth's atmosphere and disrupting the planet's natural energy balance. As concentrations of gases such as carbon dioxide, methane, and nitrous oxide rise, global temperatures increase, leading to more frequent and severe climate-related impacts. These changes include shifting weather patterns, rising sea levels, and increased risks to ecosystems, human health, and economic stability.

In an effort to screen the potential impact that the proposed VCN Project may have on climate change through the direct and indirect emissions, a high level GHG emissions calculation have been conducted. The high level GHG emissions are calculated as follows:

- Scope 1 (direct) emissions: A maximum of 3.24 tonnes of carbon per day is expected to be released via the off-gas system. Assuming 348 days of operations this will equate to a GHG emission of ~4 134.6 t CO_2 per annum.
- Scope 2 (indirect) emissions: Scope 2 accounts for GHG emissions from the generation of purchased electricity consumed by the company. Purchased electricity is defined as electricity that is purchased or otherwise brought into the organizational boundary of the company. Scope 2 emissions physically occur at the facility where electricity is generated (and are considered scope 1 emissions for the generating facility). CharTech estimates an electricity consumption of 12528 MWh/ annum (assuming 348 day operations). This equates to a Scope 2 GHG emission of 11 664t CO_2e (Eskom emission factor of 0.931t CO2e per MWh).

The total estimated GHG emissions from the operation of the VCN Furnace will be in the order of 15 798.6 t CO_2e per annum. As a comparison or significance metric, South Africa's current Nationally Determined Contribution (NDC) pathway frames total national emissions at 350–420 Mt CO_2e in 2030. Against that reference, ~15.9 kt CO_2-e/yr is ~0.003–0.004 % of national emissions in 2030. Further the IFC EHS Guidelines stipulate a GHG emission reporting threshold of 15 000t CO_2e/year. The estimated Scope 1 and Scope 2 GHG emissions form the proposed VCN furnace are well below this.

Because the climatic effects of well-mixed, long-lived greenhouse gases (e.g., CO_2) occur at international scale, the 'Extent' sub-criterion used in determining significance is fixed at 5 for this impact across all scenarios regardless of the size of a project and the magnitude of the GHG emissions. 'Extent' therefore is not useful for differentiating alternatives or direct comparisons with other impacts. Conclusions should focus on Magnitude (tCO_2e/yr and intensity per t product) and on verified mitigation. Also please note that the significance assessment assumes that in the medium to long term (i.e. 6-15 years) the electricity supplying the operations will most likely move away from fossil fuel based sources to renewable low carbon sources, in line with the National GHG Emissions reduction strategy.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Climate change vulnerability	Operations	Medium-to-low Negative	Low Negative	Low Negative
Climate Change Impact	Operations	High Negative	Medium-to-High Negative	Medium-to-High Negative
Potential cumulative/ confounding effects	As noted in Section 8.1.2 the area around the proposed site is exposed to a number of climate change impacts and hazards. Any further contribution to the global GHG emissions will increase these risks.			

Alternatives	The current design includes the use of a flare to convert CO emissions to CO_2. Flaring CO is a better environmental option than venting because it converts toxic CO into CO_2, which significantly reduces human health and safety risks and eliminates acute air-quality impacts. In addition, flaring avoids the indirect climate effects of CO (such as prolonging methane lifetime), making it environmentally preferable and consistent with best-practice emission management.
Mitigation Measures	
• Review existing **stormwater systems** design **and equipment to** considered and **withstand extreme weather and temperature conditions.** • A **heat-stress management plan should be implemented, including work-rest cycles, provision of shaded rest areas, hydration protocols, and the use of temperature-based early warning triggers. High-risk or labour-intensive activities should, where feasible, be scheduled outside peak heat periods.** • **Implement integrated water conservation, fire prevention, and emergency response measures to address climate-related risks.** • Investigate longer term options for alternative renewable low carbon electricity sources.	

The proposed CharTech VCN Furnace Project is moderately vulnerable to projected climate change impacts, particularly those associated with increased temperatures, rainfall variability, fire risk, and water security. Given the brownfield nature of the site, enclosed process design, and limited development footprint, climate-related risks are considered manageable. Provided that the mitigation and adaptation measures outlined above are implemented and maintained, climate change is not expected to pose a fatal flaw to the project.

9.3.4 DECOMMISSIONING PHASE IMPACTS

The decommissioning phase will involve the cessation of operations, dismantling and removal of infrastructure, and site clean-up activities at the end of the facility's operational life. Potential impacts during this phase are generally short-term and localised, and may include dust and noise generation, increased waste volumes, health and safety risks, and socio-economic effects such as job losses. With appropriate planning and the implementation of decommissioning-specific management and mitigation measures, these impacts can be managed to ensure regulatory compliance, minimise environmental disturbance, and facilitate effective site rehabilitation and closure.

9.3.4.1 **AMBIENT AIR QUALITY**

Demolition/dismantling and haulage may generate dust and vehicle emissions, causing temporary nuisance.

Since these considerations apply, the pre-mitigation rating is medium-to-low negative; post-mitigation is low negative; final significance is low negative.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Waste management related impacts	Decommissioning	Medium-to-low negative	Low negative	Medium-to-low negative
Potential cumulative/ confounding effects	Short-term demolition peak may coincide with other site works, but with suppression and scheduling, cumulative effects are low.			
Alternatives	N/A			
Mitigation Measures				
• Refer to the *EMPr Section 10.1 Item GA1 – GA17* attached as Appendix G of this report for detailed mitigation measures proposed to manage impacts relating to Air Quality during decommissioning.				

9.3.4.2 JOB-LOSSES

The cessation of operations at end-of-life may result in job losses, with associated socio-economic implications for affected employees and households.

Due to the nature of decommissioning, pre- and post-mitigation significance remains high negative, with a high negative final significance.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Job-losses	Decommissioning	high negative	high negative	high negative
Potential cumulative/ confounding effects	Early closure planning and transition support can soften (but not remove) this effect.			
Alternatives	N/A			
Mitigation Measures				
• A Closure and Transition Plan shall be developed, including skills development, employment referrals, and CV support. • Transparent engagement with labour representatives/affected employees shall be undertaken, with realistic timelines communicated.				

9.3.4.3 WASTE MANAGEMENT IMPACTS

Demolition waste, scrap and potentially contaminated materials may cause pollution and non-compliance if poorly controlled.

Since these considerations apply, the pre- and post-mitigation ratings are medium-to-low negative, with final significance medium-to-low negative.

Impact	Phase	Pre-mitigation Impact	Post-mitigation Impact	Final Significance
Job-losses	Decommissioning	medium-to-low negative	medium-to-low negative	medium-to-low negative
Potential cumulative/ confounding effects	If various waste streams peak together, onsite storage pressure can rise; with segregation, scheduling and licensed disposal, cumulative risk remains medium-low.			
Alternatives	N/A			
Mitigation Measures				
• Compile a Decommissioning Waste Management Plan (DWMP) prior to works, detailing waste streams, handling methods, storage locations, transporters, and disposal sites. • Conduct a pre-decommissioning waste inventory to identify general, recyclable, hazardous, and potentially contaminated waste sources. • Refer to the *EMPr Section 10.2* attached as **Appendix G** of this report for detailed mitigation measures proposed to manage impacts relating to Waste Management during decommissioning.				

10 CONCLUSIONS AND RECOMMENDATIONS

The BA process identified potential issues and impacts associated with the proposed project. The BA addresses those identified potential environmental impacts and benefits (direct, indirect and cumulative impacts)

associated with applicable phases and activities of the project and recommends appropriate mitigation measures for potentially significant environmental impacts. The BA report provides sufficient information regarding the potential impacts and the acceptability of these impacts in order for the Competent Authority to make an informed decision regarding the proposed project. The release of a draft BA Report for public review and comment provides stakeholders with an opportunity to verify that the issues they have raised throughout the process to date has been captured and adequately considered. All issues raised throughout the public participation process have been captured and responded to as far as possible.

The BA report aims to achieve the following:

- Provide an overall assessment of the social and biophysical environments affected by the proposed project.
- Assess potentially significant impacts (direct, indirect and cumulative, where required) associated with the proposed project.
- Identify and recommend appropriate mitigation measures for potentially significant environmental impacts; and
- Undertake a fully inclusive public involvement process to ensure that I&APs are afforded the opportunity to participate, and that their issues and concerns are recorded.

10.1 CONCLUSIONS FROM SPECIALIST STUDIES

The conclusions and recommendations of this BA are the result of the assessment of identified impacts by specialists where applicable, and the parallel process of public participation. The main findings and conclusions from the Air quality specialist study area:

- The wind regime for the area largely reflects the synoptic scale circulation with dominant northerly and easterly flow fields.
- Ambient ground level concentrations were available for the eMalahleni AQMS managed by the SAWS for the period 2023 and 2024:
    - Ambient SO_2 concentrations were compliant with NAAQS;
    - Ambient NO_2 concentrations were compliant with NAAQS;
    - Ambient PM_{10} and $PM_{2.5}$ concentrations were non-compliant with NAAQS.
- The ground level concentrations due to the VCN Furnace operations (assuming maximum allowable emissions according to the MES) were well within NAAQS and health effect screening levels at the closest sensitive receptors for all averaging periods.
- The ground level concentrations due to the current licensed activities were within NAAQS and health effect screening levels at the closest sensitive receptors for all averaging periods.
- The ground level concentrations due to the current licensed activities and proposed VCN Furnace operations were within NAAQS and health effect screening levels at the closest sensitive receptors for all averaging periods.
- The PM_{10} and $PM_{2.5}$ impacts due to existing licensed operations are similar in magnitude and spatial distribution to the PM_{10} and $PM_{2.5}$ impacts for existing licensed operations and VCN Furnace combined.
- The significance rating due to VCN Furnace operations was low negative for construction, and low-medium negative for operation and decommissioning phases.

The Air Quality Specialist's conclusion and recommendation is that, from an air quality perspective, the proposed VCN Furnace is acceptable and should be authorised. The specialist further recommends that stack emissions be monitored once the facility is operational to verify the actual pollutants and emission concentrations generated by the process.

10.2 SENSITIVITY MAP

Environmental sensitivity mapping provides a strategic overview of the environmental, cultural and social assets in a region. The sensitivity mapping technique integrates numerous datasets (base maps and shapefiles) into a single consolidated layer making use of Geographic Information System (GIS) software and analysis tools. Environmental sensitivity mapping is a rapid and objective method applied to identify areas which may be particularly sensitive to development based on environmental, cultural and social sensitivity weightings – which is refined by specialists' input within each respective specialist field based on aerial or ground-surveys. Therefore, the sensitivity mapping exercise assists in the identification of sensitive areas within and surrounding the proposed application area

A final environmental sensitivity map was developed using the Mpumalanga Biodiversity Sector Plan (BSP), the National Freshwater Ecosystem Priority Areas (NFEPA) datasets, and the quantitative results of the air quality dispersion modelling. The map reflects a tiered sensitivity rating for the project area, identifying High Sensitivity features including NFEPA wetlands, ESA wetlands, CBA Irreplaceable zones, and the air quality receptors (both point and polygon). Medium Sensitivity areas include CBA Optimal, terrestrial ESAs, and other remaining natural areas, while Low Sensitivity areas are those classified as heavily modified or transformed. The map also includes the boundary for the VCN Furnace and the cumulative PM_{10} NAAQS modelled plume. The cumulative PM_{10} daily concentration boundary (shown in purple) represents the worst-case cumulative scenario, as it is the plume with the widest spatial extent. Modelling indicates that cumulative impacts (driven largely by existing CharTech licensed operations) are similar in magnitude and distribution to the combined impacts of existing operations plus the proposed VCN Furnace. Importantly, these cumulative concentrations remain within the applicable NAAQS, regardless of whether the VCN Furnace proceeds.

Figure 25 superimposes the proposed activity and its associated structures and infrastructure on the combined environmental sensitivities of the preferred site indicating that the site is located within an area of least concern.

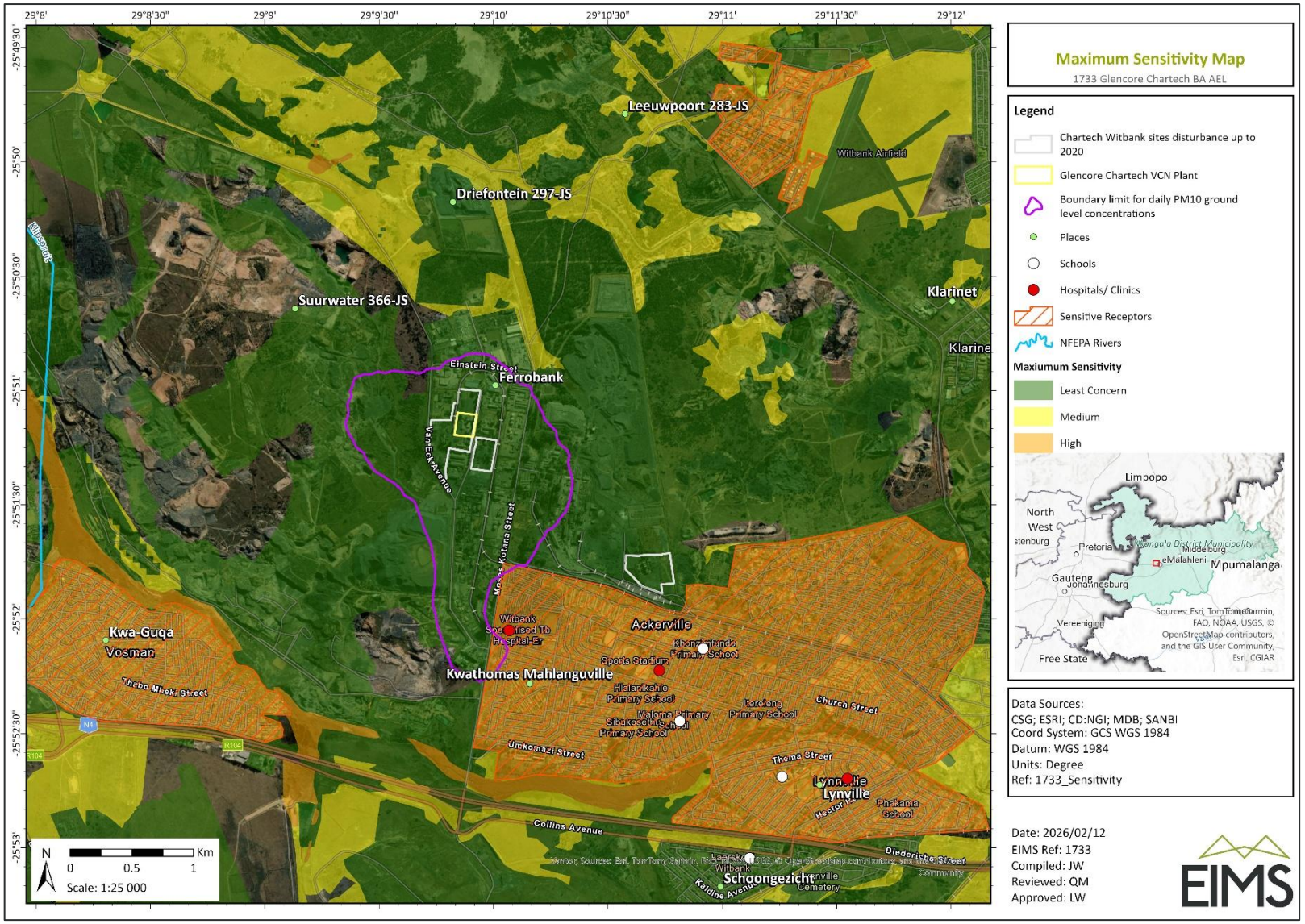


Figure 25: Composite sensitivity map.

10.3 ASSESSMENT OF ALTERNATIVES

Only one (1) feasible/preferred alternative was identified in Section 6 and thus assessed in Section 9. this section summarises the alternatives assessments undertaken as part of this BAR.

Various alternatives were considered during the alternatives-identification process, as detailed in Section 6 of this report. The nature of the proposed activity, being an installation within an existing industrial building, significantly limited the range of reasonable alternatives. Location alternatives were explored but found not to offer any environmental or operational benefits. The preferred location, within the existing CharTech industrial footprint, was selected as it avoids greenfield disturbance and relies on existing authorised infrastructure, including electricity supply, stormwater management systems, and an existing Atmospheric Emission Licence framework. No meaningful environmental sensitivities were identified within or adjacent to the proposed footprint, and no alternative site presented any environmental advantage over the preferred location.

Process alternatives were considered at a high level, including various furnace and metallurgical processing approaches. The solid-state carbothermal reduction and nitridation process using a continuous hydraulic pusher furnace was identified as the most viable option due to its controlled temperature profile, reduced oxidation risk, stable nitrogen-rich atmosphere, and ability to produce a consistent VCN product. Other options, such as batch furnaces or rotary kilns, were less efficient, more energy-intensive, or technically incompatible with the required product quality. As such, only the preferred process was taken forward for assessment.

Similarly, technology alternatives were screened during the BA process. The preferred technology, an enclosed continuous pusher furnace equipped with off-gas capture, carbon-monoxide flaring, and baghouse filtration, was chosen due to its emissions-control capability and operational efficiency. Other furnace technologies were not assessed further because they involve less effective process control, greater energy demand, and potentially higher emissions. These were therefore excluded from detailed assessment.

The No-Go alternative, which assumes that the proposed VCN furnace is not installed and the site remains under care-and-maintenance conditions, was also considered. While this option would avoid construction-related and operational impacts, it would also forgo the socio-economic gains associated with the project, including job retention, limited new employment opportunities, and improved utilisation of an already transformed industrial site. Given that the site has no ecological or heritage sensitivities, the No-Go alternative does not offer significant environmental benefit and is therefore not preferred. The assessment concludes that the selected alternatives represent the best practicable environmental option.

10.4 ENVIRONMENTAL IMPACT STATEMENT

The findings of the assessment and associated specialist study conclude that there are no environmental fatal flaws that should prevent the proposed CharTech project from proceeding, provided that the recommended mitigation and management measures are implemented. The proposed furnace will be established within an existing, highly transformed industrial footprint, thereby avoiding disturbance to natural habitat, biodiversity features, water resources, or heritage resources. No vegetation clearing is required, and all work occurs within an existing building and existing roads and operational Industrial sites, resulting in minimal direct biophysical impacts.

The primary environmental risk associated with the project relates to air quality, as emissions will contribute incrementally to cumulative atmospheric pollution within the Highveld Priority Area. However, the AQIA confirms that expected emissions from the proposed furnace, when controlled through the enclosed off-gas system, carbon-monoxide flaring, and baghouse filtration, will comply with the National Minimum Emission Standards, with no exceedances predicted at sensitive receptor locations due to the proposed project or cumulatively (VCN together with existing licenced processes). The project's atmospheric impacts are therefore considered manageable and acceptable under normal operating conditions.

From a socio-economic perspective, the proposed project will support job retention at the existing facility and contribute to local economic stability through continued industrial activity within an appropriate industrial zone.

No significant negative socio-economic impacts were identified, and the project aligns with municipal planning frameworks that promote industrial activity in established industrial nodes.

Overall, the assessment concludes that the preferred alternative represents the best practicable environmental option, and that the project can proceed without causing unacceptable environmental or social harm, subject to strict adherence to mitigation and monitoring measures outlined in this report and the associated EMPr. It is the EAP's opinion that the activity should be authorised, subject to the recommendations made in this BAR and the implementation of the management and mitigation measures presented in the EMPr.

10.5 RECOMMENDATIONS FOR INCLUSION IN ENVIRONMENTAL AUTHORIZATION

This section contains recommendations from the EAP and various specialist's for inclusion in the EA.

10.5.1 EAP

Based on the findings of the BA process, the following recommendations should be incorporated as conditions of the Environmental Authorisation:

- All mitigation measures, monitoring requirements and operational controls contained in the Environmental Management Programme (EMPr) must be implemented throughout construction, operation, and decommissioning.
- Waste generated during construction and operations, including baghouse dust, must be handled, stored, disposed of in accordance with NEMWA. Waste minimisation and recycling must be prioritised.
- The operator must maintain adequate occupational health and safety systems, including emergency response measures, hazardous materials handling, and worker training as required under OHSA.

10.5.2 AIR QUALITY

The Air Quality Impact Assessment Report (Appendix E) recommends that the proposed VCN Furnace be authorised and that stack emissions be measured in accordance with the specified AEL conditions, once the facility is operational in order to verify pollutants and emission concentrations from the process.

11 ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations relating to this assessment should be considered in evaluating and decision-making on this assessment:

- Unless specifically noted, the environmental attributes for the receiving environment have been obtained from best available spatial and scientific data sources. Whilst reasonable effort has been taken to obtain the most recent and relevant data, there may be gaps in baseline data, leading to uncertainties in impact predictions. Where uncertainty exists efforts are made to indicate this in the assessment.
- This study is based on activity information provided by the applicant (including engineering designs, specifications, etc). The accuracy of this information has not been verified, and it is assumed that no significant changes or deviations to the final designs will occur. Should such occur the significance of the potential impacts may require reassessment and where relevant formal amendment processes.
- The information presented in this report is based on the information available at the time of compilation of the report.
- Whilst reasonable effort has been made to identify all potential environmental impacts, some impacts may not be reasonably foreseeable or may emerge only after project implementation.

- In determining the significance of impacts, with mitigation, it is assumed that mitigation measures proposed in the report are correctly and effectively implemented and managed throughout the life of the project.

The remaining sub-sections present the assumptions and limitations applicable to the respective specialist assessment.

11.1 AIR QUALITY

The main assumptions, exclusions and limitations related to the AQIA are summarised below:

- Meteorological data: Use was made of data from the closest SAWS station for the study area.
- Emissions:
    - The quantification of sources of emission was restricted to the VCN Furnace and current licensed activities at the site. Other background sources were not quantified.
    - Routine emissions from the project were modelled. Atmospheric releases occurring as a result of start-up or accidents were not accounted for.
    - Vehicle exhaust emissions were not quantified as the impacts from these sources are expected to be localized (less than 100 m from road) and will not exceed NAAQS offsite.
    - It was assumed that the VCN Furnace will operate at or below the Subcategory 4.1 and 4.18 MES.
    - All pollutants as specified in the MES were assumed to be emitted from the VCN Furnace.
- Impact assessment:
    - The construction and closure phases were assessed qualitatively (Appendix E) due to the temporary nature of these operations, whilst the operational phase was assessed quantitatively.
    - As no on-site ambient baseline measurements were available for the assessment; current impacts were assessed assuming the ambient data measured at the closest ambient monitoring station to the site.

12 AFFIRMATION REGARDING CORRECTNESS OF INFORMATION

I **Qaphela Magaqa** declare that:

General declaration:

- 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 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 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;
- I 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 48 and is punishable in terms of section 24F of the Act.

Disclosure of Vested Interest (delete whichever is not applicable)

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, 2014.

Signature of the EAP

Environmental Impact Management Services (Pty) Ltd

Name of company:

2026/02/11

Date:

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14 APPENDICES

Appendix A: EAP CV

Appendix B: Screening Tool Report and SSVR

Appendix C: Application Form

Appendix F: Impact Assessment Matrix

Appendix I: Maps